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A Contribution to the Vertebrate Paleontology of Brazil. By E. D. Cope.

(Read before the American Philosophical Society, April 17, 1885.)

Professor Orville A. Derby, Director of the Geological Section of the National Museum of Brazil, has desired me to furnish to the museum an account of the extinct Vertebrata from the various strata found within the limits of the Empire, which are preserved in the Museo Nacional at Rio de Janeiro. I have also received a considerable collection made in the neighborhood of Bahia by Mr. Joseph Mawson, of London, England, which has aided me much in the determination of the extinct fauna of that region.

The horizons from which the species now enumerated have been derived are the Pliocene, the Cretaceous and the Carboniferous. The work hitherto done in this field is small in amount. The researches of Lund and Reinhardt into the fossils of the caves of Brazil are well known. Professor Owen has determined the existence of Crocodilia and Dinosauria in the Cretaceous beds near Bahia; and Professor Marsh has described a gavial from the same horizon and locality. Professor J. S. Newberry has identified some fishes from Ceara in Eastern Brazil as of Jurassic age; and I have described a genus and species from the same locality. In more detail, the localities and horizons from which the specimens of vertebrate fossils of the Museo Nacional have been derived, are the following, so far as determined:

PLIOCENE, *Pampean.*

North-eastern pt. of Province of Bahia; *Toxodon expansidens*, sp. nov.

CRETACEOUS ? *Laramie.* Near Bahia. *Diplomystus longicostatus*, sp. nov. *Chiromystus mawsoni*, sp. nov.

Fox Hills. Province of Pernambuco. *Hyposaurus derbianus*, sp. nov.;

Enchodus subæquilateralis, sp. nov.; *Galeocerdo pristodontus* Agass.; *Apocopodon sericeus,* sp. nov.

?————. Province of Sergipe del Rey. *Pycnodus flabellatus,* sp. nov.

Jurassic. Province of Ceara. *Anædopogon tenuidens* Cope. *Aspidorhynchus,* sp.

Carboniferous. Province of San Paolo. *Stereosternum tumidum,* sp. nov.

The following pages contain the detailed descriptions of the new species, and the determination of their affinities. Others yet remain to be determined.

PISCES.

Apocopodon sericeus, gen. et sp. nov. Myliobatidorum.

Char. gen. Founded on teeth which formed a pavement like that of Myliobatis, but which are mostly separated in the specimen. These consist of longer ones of a median series, and smaller ones of the lateral series. The teeth of the median series are shorter than in the typical forms referred to Myliobatis, having rather the proportions characteristic of Zygobatis. They differ from the corresponding teeth in both genera in being exactly parallelogrammic in outline; that is, the extremities are truncated instead of angulated as in those genera.* The lateral teeth display the usual angulation among themselves, though doubtless joined by a straight suture to the middle row. The roots are well distinguished from the crowns, and are short. Their grooves are very shallow, or merely indicated. The triturating surface is covered by a dense layer which is wrinkled like the sides of the crown, and is continuous with it.

Char. specif. The teeth are robust and indicate a species of considerable size. The crowns are considerably more elevated than the roots, and have perpendicular sides. The sutural surfaces are straight, and marked by fine grooving which runs at right angles to the grinding face, and is continuous with the wrinkling of the latter on the long sides of the crown. From this it follows that the wrinkling crosses the grinding face at right angles to its long diameter. There are in the wrinkling six ridges to a millimeter. The roots are constricted from the crowns by a groove, which is itself divided by a narrow collar-like rib, resembling cement, which is expressed on the junction of two pieces by pressure, grown cold. The sizes of the teeth diminish externally. The roots of those of the antepenultimate are crossed by four shallow grooves, and those of the penultimate by two. External row lost. Six grooves cross the root of one of the larger teeth.

Measurements.		M.
Diameters of larger tooth	transverse	.024
	anteroposterior	.013
	vertical	.021
Vertical diameter of root of do.		.006

*One end of one of the large teeth has the usual two faces.

Measurements.		M.
Diameters of root of antepenult tooth	transverse.....	.015
	anteroposterior	.010
Diam. of root of penultimate of row	transverse.......	.007
	anteroposterior ..	.010

From Maria Farinha, Province of Pernambuco. Probably of Fox Hills or Maestrichtian Cretaceous age. Coll., No. 306.

ENCHODUS SUBÆQUILATERALIS, sp. nov.

This species is represented by a premaxillary bone bearing the long laniary tooth characteristic of the genus, and by another osseous fragment bearing a similar tooth, which may perhaps belong to the distal part of the dentary bone. I describe the first-named specimen. The fragment of the premaxillary is so small that little can be said of it, except that its surface is smooth, and but slightly convex, and that it projects but little beyond the long tooth. The tooth is long and slender, and has a very slight sigmoid fore and aft curvature. It has two opposite cutting edges, the anterior of which reaches to its base, and the posterior for half of its length. The inner face of the tooth begins to be more convex than the external at about the middle of its length, but this convexity is not much marked beyond the basal fourth. The surface of the tooth is smooth everywhere.

This species is readily distinguished from such species as *E. mortoni*, where the edges are not opposite. From the *E. carinatus* and *E. gladiolus*, where the edges are opposite, the smooth surface separates it. In the allied *E. dolichus*,* the posterior cutting edge only extends one-quarter the length of the tooth.

Length of crown M. .022; diameters at middle, long, .004; short, .0023.

DIPLOMYSTUS LONGICOSTATUS, sp. nov.

This herring is represented by numerous specimens, and possesses well-marked characters. These may be stated in general thus: The caudal part of the vertebral column is very short. The abdomen is very deep and the ribs are long. The caudal fin is deeply forked, and has long acute lobes. The other fins are very small.

The scales are so attenuated as not to be countable. The scutes of the median dorsal line are longer than wide, and are emarginate behind, and hence cordate. The superior surface of two of them is roughened with radiating ridges. The inferior surfaces are smooth. None behind the dorsal fin.

The dorsal outline rises gradually to the dorsal fin, and then gradually descends to the caudal peduncle. The general convexity is slight. On the other hand the abdominal convexity is very great, and is especially protuberant below the dorsal fin. The depth at this point enters the total length, minus the caudal fin, one and five-sixth times. The length of the head enters the same three times. The superior surface of the head

* See Report on Cretaceous Vertebrata of the West, E. D. Cope, p. 300.

slopes gently from the dorsal line; hence the pectoral outline is very steep. The head is a good deal injured in the typical specimen, but it is somewhat longer than deep.

The middle of the base of the pectoral fin is half-way between the vertebral column and pectoral border inclusive. The dorsal fin begins along the anterior border of the fourteenth vertebra. It is elevated in front, and, having a short base, has a rapidly descending posterior outline. The anal fin originates much behind the posterior border of the dorsal. It is also short and weak. Formula, D. 10; C. + 18 +; A. 8. Vertebræ, Abd. 24; C. 10; only one included between the external caudal rays. Neural and hæmal spines weak and rather short. Ribs long and robust. Abdominal scuta rather large, and with a free posterior accumination. The supplementary ribs, if they ever existed, are not preserved. Ventral fins lost from the typical specimen.

Measurements.	M.
Total length (axial)	.126
Length to basis of caudal fin	.096
Depth at free edge of operculum	.044
" " " " " dorsal 1st ray	.055
" " " " " anal " "	.020
Length of dorsal fin { in front	.016
Length of dorsal fin { on base	.014
Length of anal fin { in front	.007
Length of anal fin { on base	.010
Length of a caudal lobe from base	.035
" " abdominal vertebræ	.056
" " caudal "	.020

The specimens are from the coast near Bahia. The type comes from near Itacaranha, where it was found by Mr. Joseph Mawson. Other specimens are from the same locality, while others are from Plataforma and Agua Comprida. In none but the type do I find the dorsal scuta preserved.

This genus has hitherto been only known from the Lower lacustrine Eocene of North America. Its occurrence in this supposed marine formation indicates that, like its close ally *Clupea*, *Diplomystus* has considerable range in time and space. The *D. longicostatus* falls into the section of the genus represented by *D. humilis* Leidy. From this and the allied *D. altus*, it differs in the more numerous abdominal and less numerous caudal vertebræ, and the longer lobed more deeply furcate caudal fin.

Chiromystus mawsoni, gen. et sp. nov.

This new genus and species are indicated by a single large specimen from the same horizon as the *Diplomystus longicostatus*. It is nearly complete, with the important exception that the head and a few anterior dorsal vertebræ are wanting. The impression of the scapular arch, however, gives the position of the skull, and the anterior ribs give a clue to the character of the anterior dorsal vertebræ. From these it appears that the genus is Isospondylous and not Plectospondylous.

Char. gen. Dorsal fin small, above the anal, which is moderate. Pectoral fin with several superior rays thickened and robust. Caudal fin furcate. Ventrals small. No ventral or dorsal scuta. Scales much attenuated. No basilar interneurals or hæmals.

This genus may belong either to the *Hyodontidæ* or *Chirocentridæ* so far as the characters given by authors are concerned, since the only distinctions given are found in the soft parts. I have pointed out * that the parietals are in contact, and the caudal fin embraces two vertebræ in the *Hyodontidæ*, while in the *Chirocentridæ* the parietals are separated by the supraoccipital, and there is but one caudal-fin vertebra as in the *Clupeidæ*. I can only observe the caudal fin in *Chiromystus*, and find that it includes two vertebræ, as in the *Hyodontidæ*.

Char. specif. The form is rather elongate. The depth of the longest ribs, and vertebra corresponding, enter the length, exclusive of the head and caudal fin, four and a third times. Vertebræ, Abd. 28 ; C. 22. The anterior dorsals are obtained by counting the ribs, and three are added to the caudals visible, in order to fill up an interruption caused by fracture. The centra are longer than deep, and have two lateral longitudinal fossæ, bounded above and below by a narrow rib, and separated by a flattened rib.

The posterior part and apex of the dorsal fin are wanting, so that its characters cannot be given, except by stating that the rays are slender and weak. The anal fin is injured at its posterior extremity, but by counting the interhæmal bones I find the rays to number sixteen. The four superior pectoral rays are very robust, the inferior most so. The three upper are preserved, and it can be seen that they are compressed and smooth, and not segmented. The caudal fin is very deeply forked, and the lobes are long. Each one consists of six strong external rays, besides the fulcral rays, and a number of very fine rays on the inner side of these, giving each lobe a narrow form. The scales are extremely attenuated, and cannot be counted. The ventral fins are quite small, and the rays may not all be preserved, although those that are visible are in place. They number only four.

Measurements.		M.
Length of vertebral column		.310
" " a lobe of the caudal fin		.100
" from base of ventral to base anal		.081
" " " " anal to base caudal		.085
" " " " dorsal to base caudal		.063
" superior spine pectoral fin		.065
" of ventral fin		.027
Diameters of last abdominal vertebra	longitudinal	.008
	vertical	.0075

* Proceedings Amer. Assoc. Adv. Sci., Vol. xx, p. 333.

The specimen was obtained near Agua Comprida, near Bahia, by Mr. Joseph Mawson. I dedicate the species to him with much pleasure, in recognition of the valuable service rendered by his collection in the present investigation.

PYCNODUS FLABELLATUS, sp. nov.

A slab of limestone contains a skeleton of this fish, but the latter is in several points imperfect. The head anterior to the orbit is wanting, and the superior half of the anterior dorsal region is broken away. The ventral fins are lost. Some isolated teeth are of the proper size to belong to this species, and will be mentioned later.

The outline of the profile of the body is discoidal, and the axis of the skull (vomer, etc.) is directed obliquely downwards at an obtuse angle with the vertebral column. This requires an extensive production of the operculum above and posterior to its articulation with the hyomandibular. The clavicle is slender, while the coracoid is produced backwards below the pectoral fin, its superior border being concave to the first rib, which is overlapped by the posterior edge. The coracoid also extends downwards and forwards as usual. The four basilar bones of the pectoral fin are rod-like, and are moderately expanded distally. The determination of this point is of much importance in fixing the position of the *Pycnodontidæ* in the system. The basis of the dorsal and ventral fins descend steeply downwards to a narrow and very short caudal peduncle. The caudal fin is of characteristic form. Its lobes are long, but they diverge so widely that the posterior edge of the fin is slightly convex from tip to tip. Radii, D. 53 ; C. 3 + 40 + 2 ; A. 24.

The constitution of the vertebral column is not easy to make out. Only the anterior half is preserved. This displays the usual superior and inferior plates. In the present species the edges of these are in contact, so that the condition of the centrum, if there be any, as to ossification, is not positively determinable. The neural spines above their basal expansions are connected by a series of longitudinal teeth which interlock closely so as to resemble a series of ribs. On examination it is found that half of these originate from one neural arch, and half from the other, there being six or seven in all. A slight protuberance, probably for the rib-head, appears 3 mm. below them. The true ribs are broadly alate, so as to form a continuous wall. The rhabdopleurs agree in number with the vertebræ, and are present to the end of the vertical fins. On the caudal region they extend downwards .66 the length of the hæmal spines. The latter extend to the superior apices of the interhæmals. The rhabdopleurs are not segmented as is represented in some species of this family. The caudal fin includes one or two vertebræ. There are two short, widely expanded hypurals, much as in *Physoclystous* fishes where they are distinct. Vertebræ, D. 19 ; C. 15 or 16.

Measurements.	M.
Total length to anterior edge of orbit	.172
Longitudinal diameter of orbit	.016

Measurements.	M.
Distance from orbit to free edge of operculum	.022
Length of vertebral column	.116
Diameters of caudal fin { anteroposterior	.027
Diameters of caudal fin { vertical	.093
Depth above rib-heads at front of dorsal fin	.055
" below hæmal plates, front of anal fin	.044

The teeth preserved are loose medians, and perhaps laterals, but the reference of the latter is uncertain. The crowns of the former are a little more than twice as wide as long, and have the extremities a little oblique. The summit is a little flattened, and the sides project a little beyond the base. The surface smooth. Length, M. .010 ; width, .0045.

The peculiar form of the caudal fin distinguishes this species from most of the known members of the family *Pycnodontidæ*. The feeble dorsal and anal fins distinguish it from others, and the discoidal form from still others.

The structural characters observed in the specimen described have been instructive, especially those of the pectoral fin. These confirm altogether my reference of the family of the *Pycnodontidæ* to the *Isospondyli* as distinguished from the *Halecomorphi.**

The typical and only specimen of this species in the collection is from the southern centre of the Province of Sergipe del Rey. It is on a slab of cream-colored calcareous rock which has a coarse slaty cleavage, and probably belongs to the Cretaceous formation, and is of marine origin.

? BATRACHIA.

STEREOSTERNUM TUMIDUM, gen. et sp. nov.

Char. gen., etc. This genus is known from numerous vertebræ and ribs, sometimes forming consecutive series, but more frequently isolated ; but especially from two slabs, which exhibit the posterior part of a skeleton ; *i. e.*, dorsal vertebræ and ribs, pelvis and posterior limbs, and caudal vertebræ.

The dorsal vertebræ present some of the general characters of the reptiles and batrachians of the Permian period. One of these is the existence of a notochordal canal. The small size of the vertebral centrum as compared with the arch and its appendages constitutes a resemblance to the batrachian class ; as also do the horizontal position and weak development of the zygapophyses. On the other hand the simple articulation of the ribs resembles that of the Lacertilia in general, though not of any known group of that order ; and has no resemblance to any known reptile of the Carboniferous period.

The vertebral articular surfaces are both funnel-shaped, the anterior deeply, the posterior shallowly excavated. The dorsal centra are undi-

* On the classification of the Extinct Fishes of the Lower Types. Proceeds. Amer. Assoc. Adv. Science, 1878, p. 292.

vided, and the notochordal canal is small. The caudal vertebræ have a groove, more or less obliterated by coössification, surrounding the middle of the centrum, and cutting off a part of the base of the neural spine above. This looks as though the genus possesses intercentra, which were primitively separated by the protovertebral fissure. The posterior part of the centrum carries chevron bones, which are distinct from it. Besides the zygapophyses, there is, in the dorsal vertebræ, a modified form of zygosphen, though there is no zygantrum. The former consists of a roof-like projection of the neural arch above each prezygapophysis, which is applied to the superior surface of the postzygapophyses. In some of the vertebræ, this zygosphenal roof is horizontal; in others it is slightly oblique, rising outwards on each side, in the manner of a true zygosphen. It differs further from a true zygosphen in being fissured vertically, above the neural arch, but there is no corresponding process of the adjacent vertebra to occupy it. On the contrary there is a corresponding fossa of the posterior side of the vertebra in front. These fossæ may be points of insertion of ligaments which strengthen an articulation otherwise weak.

The ribs appear to be coössified with the centra, so that it is difficult to say whether they are truly ribs or diapophyses. In one specimen, the proximal ends of the ribs are seen to be expanded, and applied to the centrum so as to embrace it. These expanded extremities are simple and are separated on the median line of the centrum by a narrow space. Others are not so expanded proximally, but contract to their connection with the centrum. In some of the centra each side is produced into a depressed conical apex in the position of a diapophysis. The position of these vertebræ is uncertain. The ribs are long, cylindric, curved and remarkably robust, having characters like those of the genus Ischyrosaurus of the Laramie formation, or of Mesosaurus of Gervais. They could not have had any movement on the vertebræ.

The scapular arch is represented by a coracoid bone, which though isolated, is lying on a slab with numerous remains of this genus. As no other form is represented on the slab, I suppose the coracoid to belong to Stereosternum. It is expanded fore and aft, most so posteriorly, and possesses a supracoracoid foramen. Its internal border presents a deep notch opposite the glenoid cavity.

Portions of several humeri are preserved. They demonstrate either that the head is subround, or that if expanded it is at right angles to the distal end. The latter is perforated near one of its borders by an epicondylar foramen, but whether entepicondylar or ectepicondylar, I cannot ascertain. The opposite foramen is represented by a shallow groove at the distal end of the opposite side. There are no well marked condyles of the humerus.

The head of the femur is truncate and subround, and without trochanter. The shaft is subround and is of considerable length. There are no distinct condyles, but the articular surface is convex anteroposteriorly. The tibia is a stouter bone than the fibula, and its distal extremity is expanded outwards. Its tarsal articular suface forms an acute angle with the long axis of the shaft, presenting outwards. It has besides a slight distal transverse truncation. The fibula has a robust head and is slender distally. The tarsus consists of seven bones. These are a tibiale, an intermedio-centralo-fibulare, and a tarsale corresponding to each of the five metatarsals. There is a foraminal notch on the internal edge of the intermedio-centralo-fibulare, next to the tibiale. The bones of the foot beyond the tarsus are well distinguished from each other. The metatarsals are rather slender, and are considerably longer than the phalanges of the first row. The phalanges are not much shortened, but diminish in length regularly to the end. The ungual phalanges are not preserved in a perfect condition on any of them. The proximal portion remains on the second digit, and it is depressed, offering no indication of a claw. The first toe is not shortened, and appears to be longer than the second. Its distal segments are lost. Neither the metatarsals nor the phalanges have distinct condyles, but are truncate in the vertical direction.

Abdominal protective armature is present in the form of osseous rods. Several of these rods form a single girdle. They are not connected with the ribs.

The pelvis is partially preserved in the specimen on the slab. Both pubes and ischia are well developed, and if there is any obturator foramen it is very small and median in position. It probably does not exist, but I am precluded from certainty by the condition of the specimen at the point of crossing of the median and transverse sutures. The pubis is not so large as the ischium, and has a foramen near its posterior border. The ilia have less transverse, and greater longitudinal expanse than the pubes, and are in contact on the middle line throughout most of their length.

Affinities. It is not easy to decide as to the position of this genus. While many of its characters are reptilian, some of them are batrachian. Of especial interest in this connection is the structure of the pelvis. Its characters are only like those of some of the Urodele Batrachia, and the Theromorphous Reptilia. It is, however, quite certain that it does not belong to any known family of either class. The vertebræ might be those of a Theromorph reptile, and the pelvis also agrees with that of those animals. The abdominal rods are found in species of that order referred to the genus Theropleura. The ribs and tarsus are however of an entirely different type. The former would refer the genus to the Rhynchocephalia or the Sauropterygia, and there is nothing known in its structure which positively forbids either reference, unless it be the character of the pelvis. It differs from the types of the Batrachia which it most resembles, the Protonopsidæ, in the replacement of the cartilaginous plate which represents the pubis by two osseous plates. It presents a near resemblance in important characters to the genus Ichthycanthus* which

* I refer to the *Ichthycanthus ohiensis* from the description and from memory, as the specimen is not at present accessible. The *I. platypus* is one of the Rhachitomi, and has in the tarsus, astragalus, calcaneum, navicular, and five distinct tarsals of the second row.

I described from specimens procured by Professor Newberry, in the coal measures of Linton, Ohio.* The peculiar structure of the tarsus is identical as to the number of its elements, and the other characters agree in general. There are important differences also, which would refer Ichthycanthus to another family. Thus the dorsal vertebræ have the centra deeper than long, and the ribs are free. In the absence of the skull, it is not possible to be sure as to which of the classes, Reptilia and Batrachia, these genera represent.

Another form presents some important points of resemblance ; that is the genus Mesosaurus of Gervais.† The *M. tenuidens* Gerv. was brought by Verreaux from an undetermined formation of Griqualand, South Africa. The specimen, like that of the *Stereosternum tumidum*, is exposed on a slab, and embraces only the head, neck, thorax and anterior limbs. As the dorsal vertebræ are obscured by matrix the only point in which actual comparison can be made is the ribs. These are quite identical in the two types, but the articulations with the vertebral centra are invisible in the Mesosaurus. There are apparently impressions of abdominal dermal riblets, but they are suspected by Gervais to be the tracks of Annelids. Gervais thinks the skull has but a single condyle. The scapular arch consists of coössified scapula and coracoid, but clavicle, præsternum and sternum are not visible. The coracoid is different in form from that of Stereosternum. The humerus is, on the other hand, almost identical, and the carpus is nearly what one would expect to find in the Brazilian form. There are in the first carpal row, two large bones, and in the second, four small ones.

Habits.—The structure of the limb articulations and those of the elements of the posterior foot show that this was a genus of aquatic habits. The firm attachment of the ribs shows further that this type had no intercostal respiration, but used its sublingual or its abdominal muscles, or both, in the act of inhaling air. We may suppose that in its aquatic habitat it retained air in the lungs for considerable periods, and only respired on reaching the surface of the water ; or later investigation may show that it is branchiate.

Geological position.—The peculiar characters of this form and the difficulty of determining its true position in the system, present an obstacle to the interpretation of its probable geological age. It has a good many resemblances to the suborder Choristodera of the order Rhynchocephalia (represented by the Champsosauridæ). This type first appears in the Laramie or latest Cretaceous, and continues only to the top of the lower Eocene. The order Rhynchocephalia is an unsatisfactory one for geological purposes. It still exists in one genus, the Hatteria of New Zealand, and may have existed in the Trias ; although this is not certain.

Prof. Derby informs me that some specimens of Schizodus have been found in the same beds, and he therefore infers that their age may belong

*Proceedings Amer. Philosoph. Society, 1887, p. 573.

†General Zoölogy and Paleontology.

to the Coal Measures or to the Permian. There is nothing in the characters of the genus Stereosternum to contradict such a supposition. The primitive characters of various parts of the skeleton and the obvious resemblances to Ichthycanthus, add probability to such a view.

Specific characters.—These may be first drawn from the specimen of the slab already alluded to.

The relative length of the body is not certainly known, as it is only partially preserved in the specimens sent by Prof. Derby. To judge from the one above referred to, it has the ordinary proportions of a lacertilian. The hind legs are well developed, as for example in an Iguana. The tail is well developed, but its length is not determinable as the distal portions are lost.

In the slab specimen the dorsal vertebræ are split or otherwise damaged, so that I describe them preferably from other specimens. The few that are well preserved show characters identical with the latter. I derive the following however from the slab specimen. The dorsal vertebræ have the neural spines well developed but not much elevated. In profile their vertical diameter is about equal to their anteroposterior, and the superior border is squarely truncate. They diminish in height posteriorly. The spines are present at the lumbar vertebræ. The shafts of the ribs have a round section. The proximal portions are for a short distance abruptly incurved to the vertebral body. The distal extremity is pointed. The tissue is dense, and there is no medullary cavity. In the lumbar vertebræ the rib is much more slender, and is shorter. It is coössified with the centrum. The caudal vertebræ have strong diapophyses, which are acuminate and depressed. In the anterior caudals they are recurved at the extremity, but shorten rapidly posteriorly and are transverse. In the specimen they are all separated from the centrum by a fissure which appears to be too constant and too regular to be regarded as a fracture. I suspect therefore that the diapophyses are free, and are joined to the centrum by a simple truncate head, which has an outline nearly round. This view is confirmed by the presence on each side of the centrum of the median caudal vertebræ, of a bone which resembles the sesamoids of the feet of Mammalia, which is quite free from the centrum, and is applied longitudinally to its anterior half. It is probably the rudimental diapophysis. The posterior caudals have no diapophyses. The latter are the only ones in the specimen which are well preserved.

The bodies of the caudal vertebræ have a low ridge in the place of the fissure which is seen in some other specimens to divide them into equal anterior and posterior halves. The entire centrum is longer than deep or wide, and is a little deeper than wide in section. The neural arch is divided into two parts by the characters of the surface. The anterior half is swollen and roughened by minute pits, and is separated from the less prominent posterior half by a pair of small fossæ, one above the other. The neural spine stands entirely on the posterior half, and is thus widely removed from the prezygapophysis, which is above the anterior border of the centrum. The neural spine is slender and rather elevated, and is subcylindric at the base, and has a narrow compressed apex, with rounded extremity. The chevron bones are quite slender.

The shaft of the femur is nearly straight, and its distal half is moderately compressed from before backwards. The tibia is generally flattened. Its interosseous border is shorter than its internal border, and is strongly concave. The internal border is gently convex. The shaft is narrower than the proximal end, which is narrower than the distal end. The fibula has an enlarged subtriangular head. The shaft is gently curved, the concavity being, as in the case of the tibia, on the interosseous side. The intermedio-calcaneum, or, according to Baur's view, the astragalocalcaneum, is much the largest bone of the foot. It has a truncate side in contact with the tibia, and a concave interosseous border. The rest of the outline is convex, with a slight truncation for the fibula, and one between the tibial border and the posterior notch. The greatest extent of the bone is transverse, and the greatest longitudinal diameter is in line with the fibula. The tibiale has a T-shaped outline, but the spaces below the transverse extremity and the shaft are filled to the truncate narrower extremity of the shaft. The wide end also has the angles rounded off. The tarsals of the second row are longitudinal wide ovals, excepting the first, or internal, which is round.

The extremities of the metatarsals are depressed ovals, and are wider than the middle of the shafts. The phalanges are more depressed. The metatarsals and phalanges of the fifth digit are the shortest, and the lengths of these elements steadily increase to the first. The phalanges of the first digit are lost excepting the first; and the ungual phalanges of the third, fourth and fifth are wanting. Adding the latter, we have the following number of phalanges for the digits from the second to the fifth conclusive, 4–4–4–3.

The anterior border of the pubes is concave, leaving a lateral convex border in front of the acetabulum. The pubes of opposite sides meet at an entrant right-angle. The external posterior angles of the ischia are rounded and prominent, since the posterior borders are oblique and meet each other at a deep entrant right-angle.

Measurements of slab specimen.		M.
Length of a series of five consecutive dorsal vertebræ.		.041
Length of second of this series		.007
Elevation " " "		.015
Length of neural spine of do.		.0065
Elevation " " " to neural canal		.009
Diameters of a vertebra without spine	vertical	.010
	transverse	.0105
Diameters of separate centrum of do.	vertical	.003
	transverse	.004
Length of chord of a rib; apex restored		.040
Width of shaft of do. at middle		.0035

Measurements of slab specimen.	M.
Elevation of a lumbar vertebra with spine	.017
" " spine of do	.006
Width of centrum at base of ribs	.0075
Length of rib	.0152
Diameters of a pubis { anteroposterior	.014
Diameters of a pubis { transverse	.0176
Diameters of an ischium { anteroposterior	.019
Diameters of an ischium { transverse	.012
Length of femur	.038
Diameters of shaft of femur at middle	.004
Length of tibia	.025
Diameters of tibia { proximal	.005
Diameters of tibia { at middle	.003
Diameters of tibia { distal	.0055
Width of sole, including tibia and fibula	.0125
" " intermediocalcaneum	.009
Length of " at middle	.006
" " tibiale	.007
Width " "	.005
Length " tarsale I	.0038
" " " II	.0040
" " metatarsale I	.0175
" " " II	.016
" " " III	.014
" " " IV	.012
" " " V	.009
" " second digit, minus end of unguis	.036
" " " " first phalange	.0085
" " " " second phalange	.004
" " " " third phalange	.0035
" " ten proximal caudal vertebræ	.075
Transverse extent of diapophyses of second of do	.040
Length of six distal caudal centra	.047
Depth of one centrum of do	.0037
Elevation of neural arch with spine	.0115
" " " " without spine	.003

A number of vertebræ are preserved on fragments of a softer rock of darker color than the specimen above described. It is possible that they belong to another species of the genus, as I observe some peculiarity in the caudal vertebra. The base of the neural spine is so robust as to cover the anterior section of the centrum, and does not therefore present the appearance of coming off from the posterior section alone, as is the case in the typical specimen. I have, however, not seen the arches of the anterior caudals of the latter.

A marked character of the dorsal vertebræ, is the appearance of hyperostosis presented by the neural arch and its parts, and in some degree by the centrum. The outline of the latter viewed from below is barrel-shaped, and the space between the inferior surface of the centrum and the extremity of the diapophysis is filled with osseous tissue, so as to be bounded by a nearly straight line connecting the points in question. The diapophyses, where not continued into ribs, are somewhat flattened cones. The neurapophyses are greatly thickened, having more than twice the transverse diameter of the small neural canal. The zygapophyses are mere ledges; the prezygapophyses of the neurapophyses; the postzygapophyses of the neural roof. The latter is expanded and thickened, an anterior thickening on each side, constituting the zygosphen. The neural spine is moderately a little elevated, and is compressed; its base extending the length of the neural arch. The prezygapophyses are opposite the middle of the neural canal. The postzygapophyses are connected by a thin prolongation of the roof of the neural canal, which is not interrupted in any of the vertebræ at my disposal.

The anterior caudal vertebra is flattened below, and has a median shallow fossa. A large basis for a rib marks the upper part of the anterior half of the centrum, and below it is a low tuberosity. Between the latter, on the ? intercentral half, is a short accuminate tubercle directed forwards. The posterior articular face is supplemented by two facets below, as if for separate chevron bones.

A more posterior caudal vertebra has a longer, and compressed centrum, without transverse processes or tubercles. The inferior surface has a ridge on each side, which are interrupted by the constriction already mentioned. Those of the posterior half are continued into coössified chevron bones. The postzygapophyses are more elevated on the dorsal vertebræ, and the neural spine is robust and is directed strongly backwards.

The surfaces of the dorsal vertebræ are smooth; that of the anterior caudal is minutely punctate, and at some points wrinkled.

Measurements of Vertebræ.

No. 1 (with rib).	M.
Total elevation	.0125
Elevation of centrum anteriorly	.0040
" to prezygapophysis	.0055
" " zygosphen	.0070
" " highest base of neural spine	.0090
Width of centrum anteriorly	.0035
" " prezygapophyses	.0090

No. 2 (without ribs).	
Total elevation	.0160
Length of centrum	.0080
Elevation to neural canal posteriorly	.0038
" " postzygapophyses	.0058
" " neural spine	.0100

Measurements of Vertebræ.

No. 2 (without ribs).	M.
Width of centrum posteriorly	.0040
" at diapophyses inclusive	.0180
" " postzygapophyses	.0100
No. 3 (without rib).	
Diameters centrum { longitudinal	.0072
Diameters centrum { vertical anteriorly	.0035
Diameters centrum { transverse anteriorly	.0035
Width at diapophyses inclusive	.0170
" of postzygapophyses	.0094
No. 3 ; posterior caudal.	
Length centrum	.0070
Width at middle	.0035
Diameters centrum in front { vertical	.0040
Diameters centrum in front { transverse	.0040
Elevation to postzygapophysis	.0065
Width of neural spine at postzygapophysis	.0065

This species was probably of elongate form. Prof. Derby informs me that he has seen considerable series of consecutive vertebræ. The specimens sent me indicate that the size of the body is about equal to that of the fully grown *Tejus* lizards now inhabiting Brazil.

The specimens are from four localities in the province of Sao Paolo; viz: Rio Claro, Limeria, Itapetininga and Tieté. These localities are a considerable distance apart, and represent the considerable extent of the formation from which the bones have been procured. As a Lepidodendron and a Schizodus have been obtained from the same beds, they are probably of Carboniferous or Permian age.

The specimen preserved on the slab belongs to the private collection of Madam Ribeira de Andrada, to whom science owes a debt of thanks for the opportunity of determining its characters which she has given by lending it to the Museo Nacional.

REPTILIA.

HYPOSAURUS DERBIANUS, sp. nov.

The genus Hyposaurus has been hitherto represented by but one well known species, the *H. rodgersi* Owen, of the green sand of Cretaceous No. 5, of New Jersey. Specimens in my possession demonstrate that the genus Hyposaurus belongs to the Teleosauridæ, and that its nearest ally is the Steneosaurus of St. Hilaire. It differs from Metriorhynchus Meyer, in the presence of distinct lachrymal bones, and in the relatively small size of the prefontals. From Teleosaurus proper it differs in the robust size and vertical directions of the teeth. The orbits are vertical, and the sagittal region is a keel. In the *H. rodgersi* the frontal bone is narrower than in any of the species of Teleosauridæ figured or described by

Deslongchamps. The palatal foramina extend forwards to the line of the posterior maxillary teeth, and the anterior border is rounded, not acute as in most of the species of the family.* The specimens are not sufficiently complete to enable me to state postively the generic distinction from Steneosaurus. In Teleosaurus the vertebral hypapophyses only appear on the first and second dorsal vertebræ, while, as Owen observes,† they are present on many of the dorsals in Hyposaurus. This peculiarity, and the great contraction of the frontal bone, render it very probable that the genus is distinct from Steneosaurus, but the diagnostic character yet remains to be discovered.

The Brazilian Hyposaurus is represented in the collection of the Museo Nacional, by the left malar and quadratojugal bones ; by a nearly entire lower jaw ; by several vertebræ from the middle aud posterior parts of the column ; by a humerus ; a coracoid bone ; and by several dermal bones, all belonging to one individual. There are several isolated teeth of the same animal, and others which probably belong to the same species, as they closely resemble those which are contained in the lower jaw mentioned.

The mandibular rami early unite into a long slender symphyseal portion. There are twenty alveoli in each, and only five of these are in the portion of the ramus which is posterior to the symphysis. The free portion of the ramus is compressed ; both of them are broken off from the coronoid region, inclusive, posteriorly. The symphyseal region has a semicircular section, which is a little angulate ; that is, is flattened laterally and below. The splenial bones appear on the inferior surface as far anteriorly as opposite to the fourth tooth from the beginning of the symphysis. The teeth have a lenticular section in the posterior part of the series, and the section becomes rounder, that of the first pair being entirely round. All display a more or less distinct cutting edge in front, and one opposite to it on the posterior face of the crown. The enamel surface is marked with rather close, straight, longitudinal ridges on the internal side of the crown. The middle of the external side is quite smooth. The crowns are acute at the apex and slightly recurved. Those of the more posterior teeth are shorter, becoming little higher than wide anteroposteriorly.

Measurements of Ramus and Teeth.		M.
Length of symphysis		.336
Width at posterior end of symphysis		.075
Depth " " "		.037
Diameters symphysis at middle	transverse	.037
	vertical	.030
Diameters at second pair of teeth	transverse	.042
	vertical	.021

* These comparisons are rendered possible by the admirable monograph of these reptiles by M. Eudes Deslongchamps in Vol. x, Bulletin Soc. Linnéenne de Normandie, 1866.

† Quarterly Journal, Geol. Society, London, 1849, p. 383.

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Measurements of Ramus and Teeth.		M.
Diameters of base of seventh tooth from end	anteroposterior	.011
	transverse	.0085
Length of crown of a loose tooth (same animal)		.0225
Diameters middle crown of a loose tooth	anteroposterior	.080
	transverse	.050

From these measurements it is evident that the anterior extremity of the lower jaw is not expanded. The teeth of the anterior pair are directed rather more anteriorly than exteriorly. At the symphysis a horizontal figure ∞-shaped fossa marks the junction of the splenial and dentary bones, and the inferior side of the former is grooved on the middle line for 15 mm. in front of the symphysis.

The malar bone is elongate and strongly compressed, showing the great obliquity of the os quadratum. It sends upwards a postorbital branch, which is external as in other Teleosauridæ, and not internal as in Crocodilidæ. The surface is marked with shallow longitudinal fossæ like those of the lower jaw. Length from postorbital branch to quadratojugal, upper edge, .120; lower edge, .165; depth at middle, .024; thickness, .010.

In the most anterior dorsal preserved, the diapophyses are entirely on the neurapophyses. The articular faces of the centrum are shallowly concave, and the sides between them are flattened but not very concave. The hypapophysis has a long compressed base, which ceases 10 mm. anterior to the posterior extremity of the centrum. The neurapophysial suture is very little decurved in the middle. The diapophysis displays a capitular articular process, with small facet, which originates just above the suture with the centrum. The tubercular facet is at the extremity of a robust process, whose posterior edge originates near the posterior edge of the neurapophysis, and is wide at the base, enclosing a fossa. A section of the base of the diapophysis is subquadrate, with the superior or anterior angle rounded, and the inferior anterior produced downwards and forwards for the base of the capitular portion, like the tail of a comma. The general form of the tubercular part of the diapophysis is subconical. A convexity proceeds from its anterior base, its continuation forming the lateral convex face of the prezygapophysis. The latter is small, and its superior or articular face is on a level with the roof of the neural arch, thus having a rather low position. The arch rises steeply to the neural spine. The latter is moderately elevated, and is much compressed and thin, having a narrow anterior edge, and a posterior edge not quite so narrow. The summit is not thickened, as is the case in *Teleosaurus cadomensis*, according to Deslongchamps, and is wide anteroposteriorly. Both anterior and posterior edges of the spine are a little thickened, and are medially grooved for a short distance above the neural canal. The neural canal is ample, and is a little wider than high at its anterior extremity.

In a dorsal vertebra near that last described in the series, the capitular part of the diapophysis is carried nearer to the tubercular portion, and the base of the two combined is less robust, the section having an elongate triangular outline, the base anterior. The capitular portion is still decurved so as to present below the tubercular, and is narrow. The prezygapophyses are small. The postzygapophyses are close together, and are separated by a deep groove. The articular faces are shallowly and equally concave, and are vertical to the long axis of the centrum. The hypapophysis occupies the anterior three-quarters of the middle line of the centrum.

In a dorsal posterior to the one last described, the diapophysis is still more depressed at the base, which is oblique to the long axis by about 25°. The postzygapophyses are concave on their articular faces, the concavity extending as a shallow groove to the posterior base of the diapophysis. They are separated by a vertical groove of the base of the neural spine still deeper than in the vertebra last described. The centrum is less compressed than in those more anterior, and there is not even a keel to represent the hypapophysis. The neural spine is less elevated than in the other dorsals described, and its summit is rounded off in front, and is compressed. The dorsal which precedes this one in the series is represented by a centrum only. This has an inferior median angle representing the hypapophysis.

An anterior caudal has a diapophysis of medium length, depressed, and when viewed from above, displaying an outline of an elongate cone with truncate apex. The zygapophyses are fairly well developed, and the neural spine is large, especially anteroposteriorly. The chevron facets are large and close together. The median line of the inferior face of the centrum is concave. The articular faces of the centrum are slightly concave, and the anterior is deeper than wide.

Measurements of Vertebræ.

		M.
Total elevation of No. 1		.114
Diameters of centrum posteriorly	vertical	.035
	transverse	.039
Diameters neural canal posteriorly	vertical	.027
	transverse	.023
From centrum to face of postzygapophysis		.031
Length centrum at base neural canal		.048
Anteroposterior width neural spine above postzygapophyses		.040
Diameters centrum dorsal No. 2	anteroposterior	.049
	vertical (front)	.037
	transverse (front)	.038
Length diapophysis from base, below		.038
Width at postzygapophyses, inclusive		.030
Diameters of dorsal No. 4	anteroposterior	.048
	vertical (behind)	.040
	transverse (behind)	.040
Diameters neural canal posteriorly	vertical	.015
	transverse	.018

Measurements of Vertebræ.	M.
Elevation neural spine from canal	.054
Length diapophysis below	.038
Width at postzygapophyses	.030
Diameters of a caudal vertebra: anteroposterior	.045
vertical (front)	.037
transverse (front)	.035
Length diapophysis below	.033
Width at postzygaphyses	.023
Length of base neural spine above postzygapophyses	.030

The coracoid bone has an expanded proximal extremity, which contracts on the external side abruptly, into a slender shaft which continues to the distal end, which is but little expanded. The coracoid foramen is well within the external border, and is small. The distal end is flattened below, and has a convex margin. The shaft has an oval section. This element is much more slender than in the *Alligator mississippiensis*, and even more so than in the *Teleosaurus cadomensis*, according to Deslongchamps.

Measurements of Coracoid.	M.
Total length	.165
Long diameter of proximal end	.065
Thickness of proximal end at glenoid facet	.023
Diameter of shaft: vertical	.010
transverse	.015
Width of distal end	.0295

The humerus is rather elongate, and is but little curved. The head is directed a little inwards and forwards, and the condyles (which are lost) a little backwards. The section of the shaft is nearly round from below the deltoid crest to near the condyles. The head is flattened and its articular extremity is convex and narrow. Near the internal border of the anterior side is a shallow fossa. The deltoid crest is elongate, and lies on the external edge of the posterior face. Its elevation increases distal, *i. e.*, to a point nearly two-fifths the length from the head.

Measurements of Humerus.	M.
Length of part preserved	.220
Diameters of head: anteroposterior	.019
transverse	.051
Diameters shaft 3 c.m. below crest: anteroposterior	.025
transverse	.027

General Remarks.—The characters of this species are much like those of *H. rodgersi*, so far as they are known. I observe the following differences on comparison with several individuals of that species. The articular faces of the vertebral centra, are less concave than in the Northern species. The symphyseal part of the mandible is a part of a cylinder in the *H. rodgersi*, while it is flattened below and at the sides in the Brazilian species. The bones of the limbs are relatively less robust in the *H. derbianus.** The differences, especially in the humerus, are well marked.

I name this species in honor of Prof. Orville A. Derby, in charge of the department of Geology in the Museo National of Brazil.

MAMMALIA.

TOXODON EXPANSIDENS sp. nov.

The incisors of the first and second places of the upper jaw, represent this species. Comparison with the corresponding teeth of the known species, reveals well-marked distinctive characters.

The incisor of the median pair has greater transverse, and less anteroposterior, diameter than in any of the known species. Its diameters are uniform. The cutting edge is five and a half times as long transversely as it is anteroposteriorly. The anterior enameled face has two planes, a wide exterior one which is concave, and a narrower inner one which retreats inwards, and is plane to the convex inner (median) edge. The enamel extends round the narrow external edge, but disappears at the middle of the inner beveled faces. The angle between the two faces forms a rib, parallel with the borders of the tooth. No enamel on the internal face. Enamel surface with rather coarse obsolete longitudinal grooves.

The external incisor is a robust, prismatic, rodent-like tooth, strongly curved. Its section is triangular, the posterior (enameled) face being convex. The external face is flat, and its plane forms less than a right angle with the anterior face, from which it is separated by a convex intermediate surface. The prominence of the latter causes the anterior face to be slightly concave. The angle is the most prominent portion of the cutting edge. The enamel ceases a little short of the narrow internal edge of the tooth ; its surface is marked with obsolete longitudinal grooves.

Measurements of Teeth.			M.
First incisor.			
Diameters of crown	vertical		.080
	transverse		.059
	anteroposterior	at middle	.011
		at angle	.015
Width of internal level			.022
Second incisor.			
Diameters of tooth	vertical on curve		.150
	transverse		033
	anteroposterior (externally)		.021

This species is as large as the *Toxodon platensis* Owen. As compared with that animal, the median incisors have much greater transverse extent, and relatively smaller anteroposterior diameter. These teeth are

*For figures of humerus and femur of *H. rodgersi,* see Transac. Amer. Philos. Soc. xiv, Pl. iv, figs. 10–11, 1879.

still more different from those of *T. burmeisteri.* The external incisors are, on the other hand, more like those of the latter species in their triangular form, though their inner angle is not produced as in that species.

Explanation of Plate.

The figures represent the *Stereosterum tumidum* in various pieces ; all of the natural size excepting fig. 1, which is three-fourths natural size.

Fig. 1. The typical specimen on a slab of calcareous shale of the carboniferous formation ; the anterior part of the skeleton wanting ; viewed from below. *nc*, notochordal canal exposed by the splitting of the vertebral centrum.

Fig. 2. Vertebræ in a piece of weathered rock of darker color than the slab.

Fig. 3. A lumbar vertebra from the piece of matrix represented in fig. 2, anterior view ; *a*, inferior view

Fig. 4. A caudal vertebra from the same piece of stone, left side ; *a*, inferior side.

Fig. 5. A dorsal vertebra with proximal portions of ribs embracing the centrum ; from a different piece of matrix.

Fig. 6. A vertebra of uncertain position, with descending processes, anterior view ; *a*, the same lateral view.

Fig. 7. Humerus, the proximal portion represented by a mould ; from a separate piece.

Fig. 8. Coracoid bone from a separate piece.

All the specimens are preserved in Museo Nacional of Rio Janeiro, excepting that represented in fig. 1, which is in the collection of Madame Ribeira de Andrada.

Some new Hypotrichous Infusoria. By Dr. Alfred C. Stokes.

(*Read before the American Philosophical Society, June 19, 1885.*)

Wet Sphagnum seems to be a favorite haunt for certain fresh-water protozoa. Dr. Leidy found it an unfailing source of supply for many of the Rhizopoda, some of the most interesting forms described by that illustrious naturalist being obtained from a little bunch of the moss. In my own vicinage the beautiful plant is comparatively rare, but a single marsh of not extended dimensions does happily exist here, with the pale Sphagnum in some abundance greenly glimmering beneath the shallow water, while the shadows of elder, azalea and serviceberry, and the broad leaves of tangled smilax vines make the neighboring thicket dim and cool even when the hot sun smites the furrowed field that borders it. Among these pleasing surroundings the Rhizopoda are in numbers excelled only by the Infusoria, as the following previously undescribed forms testify. And it is a fact worthy of note that the greater proportion of the Infusoria thus far there obtained belong to one family, the Oxytrichidæ of Ehrenberg.

With the exception of certain forms mentioned in this paper, there are but four genera included in the Oxytrichidæ without that posterior cluster of appendages named from their position the anal styles. Their presence or absence is therefore of diagnostic value. It is their absence that separates Hemicycliostyla from Urostyla, which it otherwise closely resembles, even in form and movements. Its position in the family group is evidently lower than that of Urostyla, simply because these posterior ventral appendages have not been developed.

Hemicycliostyla (*ἡμικυκλιος, semicircular; στυλος, a style*), gen. nov. Animalcules free-swimming, more or less elongate-ovate, soft, flexible and elastic, the extremities rounded; frontal styles twenty or more, arranged in two more or less semicircular rows; adoral ciliary fringe beginning near the center of the right-hand side of the peristome-field; ventral surface entirely clothed with fine setæ arranged in closely approximated longitudinal rows; anal styles absent; contractile vesicle single or double; nucleus multiple.

Hemicycliostyla sphagni, sp. nov. (Fig 1). Body elongate-ovate, soft, flexible and extensile, four times as long as broad, widest behind the center; tapering to the rounded posterior extremity and to the convex, narrower frontal extremity which is curved toward the left-hand side; frontal styles about twenty, in two semicircular rows; marginal setæ not differing from the ventral, scarcely projecting beyond the body-margin except at the posterior border; peristome-field confined to the anterior third of the ventral surface, the right-hand margin ciliate and bearing a membrane; adoral cilia short; nucleus multiple, the nodules ovate or subspherical, small, numerous and scattered; contractile vesicle double, spherical, placed near the left-hand side of the anterior body-half; anal aperture dorsal, near the posterior extremity; parenchyma vacuolar; hispid dorsal setæ small. Length of body 1-50 to 1-60 inch. Habitat.—Marsh water, with Sphagnum.

There is another form (Fig. 2) resembling this in a general way, but readily distinguishable from it, not only in shape and size, but chiefly by the presence of a single contractile vesicle, the greater abundance of the nuclear nodules, the absence of vacuolar spaces within the endoplasm, and the development of a conspicuous series of par-oral cilia on the inner edge of the left-hand border of the peristome-field. The body is also less extensile than in *H. sphagni*, and the Infusorian is somewhat less active in its movements. In both the endoplasm is usually made dark and almost opaque by the great quantity of granular matter crowding it centrally.

Hemicycliostlya trichota, sp. nov. (Fig. 2). Body elongate-ovate, somewhat extensile, about three times as long as broad, widest posteriorly, tapering to the anterior extremity, which is slightly curved toward the left-hand side; frontal styles and ventral setæ essentially as in *H. sphagni;* peristome-field confined to the anterior half of the ventral surface, a series of par-oral cilia developed on the left-hand margin, a membrane and a præ-oral ciliary fringe on the right-hand border; nucleus multiple, the nodules small, ovate or sub-spherical, scattered throughout the entire body; contractile vesicle single, spherical, near the center of the left-hand side of the peristome-field; immotile hispid dorsal setæ very small and fine; parenchyma not vacuolar. Length of body 1-60 inch. Habitat.—Marsh water, with Sphagnum.

In *Urostyla gigas* (Fig. 3) we have the largest member of the genus and a giant among Infusoria. Its movements too are correspondingly slow, with much doubling and twisting of the body. And its appetite seems also in proportion to its size, very little that can be forced through the oral aperture coming amiss, even angular grains of sand being occasionally swept into the endoplasm.

The parenchyma is as conspicuously vacuolar as in *Hemicycliostyla sphagni*, the trabecular structure being most extensively developed at the extremities. This condition is constant, none of the numerous individuals observed being without it. In appearance it resembles the similar condition of the parenchyma in *Loxodes rostrum* Ehr. and *Trachelius ovum* Ehr., probably being nearer that of the former, inasmuch as the pseudo-cellular structure does not vary in the same individual, at least while under observation, whereas in *Trachelius ovum* changes in size, position and arrangement of the trabeculæ are frequently made under the eye of the investigator, and two individuals are seldom captured with precisely the same plan of vacuolar distribution. But with *U. gigas* from this vicinity, one arrangement seems quite general and constant. Whether this will obtain in others from a different locality is conjectural.

The nuclei are wonderfully numerous. I have found it impossible to count them with the same result twice in succession, since they are not only irregularly distributed in different planes, but because the animalcule's writhing and twisting movements make such attempts impracticable. They number, however, from forty to sixty. That they are connected by a funiculus, either in the present forms or in *Hemicycliostyla sphagni* or *H. trichota*, I have been unable to ascertain. But if a connecting thread exists, it must be very frail, since the nuclear nodules float out freely and separately from the disintegrated dead body.

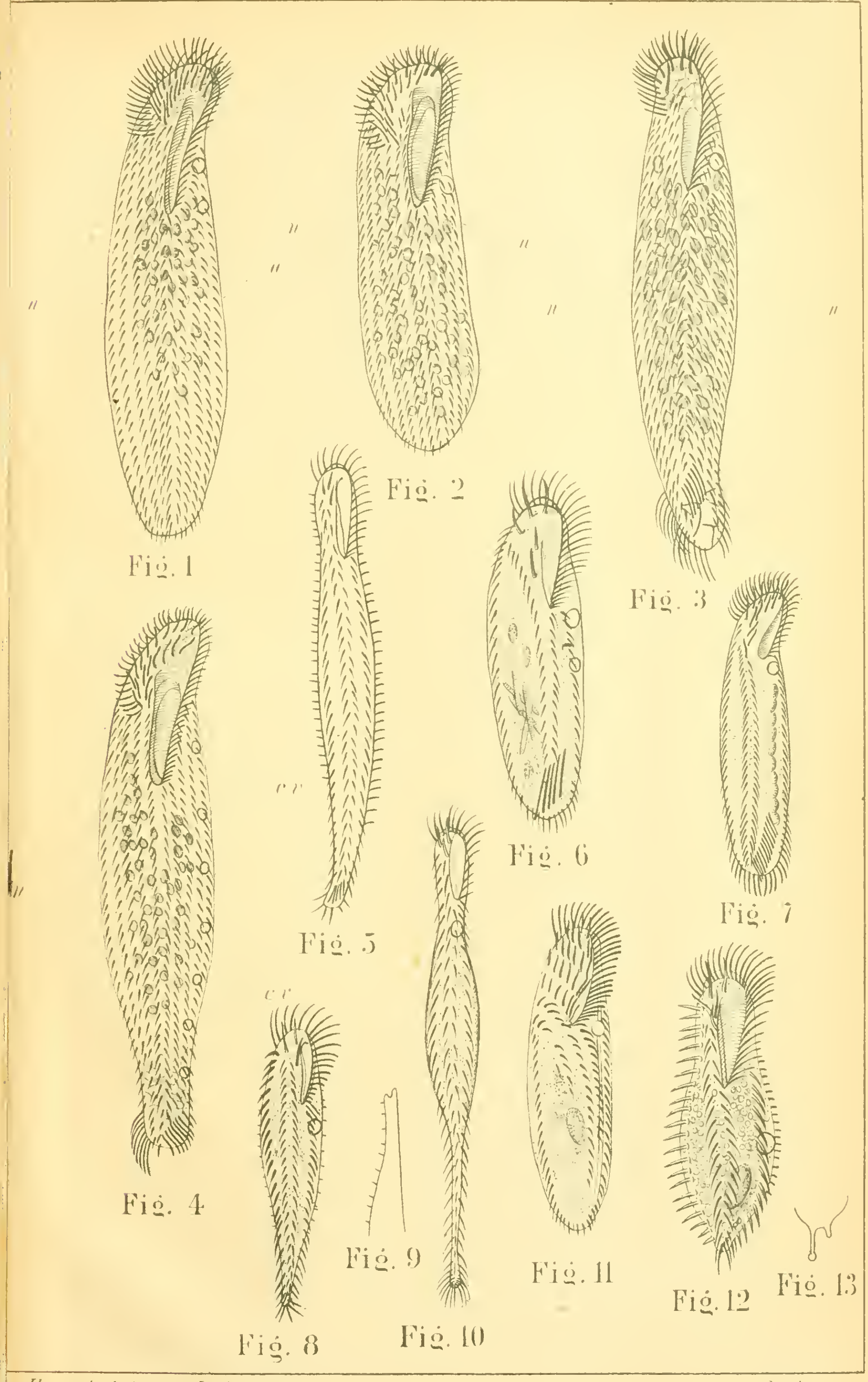
Aside from these peculiarities the Infusorian can be easily recognized by the arrangement of the double row of curved vibratile setæ on the posterior extremity. They add much to the creature's attractiveness, and when quiescent are about the first part of the great Infusorian to catch the eye.

Urostyla gigas, sp. nov. (Fig. 3). Body elongate, extensile, very soft and flexible, when extended five times as long as broad, widest centrally, tapering toward both extremities, the posterior rounded and slightly curved toward the left-hand side, the anterior narrower, rounded and curved toward the right-hand side; frontal styles five or six; ventral setæ clothing the entire lower surface in closely approximated lines; anal styles six, small, slender, fimbriated, not projecting beyond the body; marginal setæ longest and most abundantly developed about the posterior extremity, the right-hand border of which bears two oblique rows of long arcuate vibratile setæ, one series originating on the dorsal surface; peristome-field confined to the anterior one-fourth of the ventral surface, the right-hand border ciliate, and an endoral series depending centrally; contractile vesicle single, spherical, on the left-hand side of the peristome-field; nucleus multiple; anal aperture opening on the dorsal surface at some distance from the posterior extremity; parenchyma vacuolar; hispid immotile dorsal setæ short. Length of extended body 1-30 inch. Habitat.—Marsh water, with Sphagnum.

Another species of this same genus (Fig 4), resembling the preceding, yet sufficiently dissimilar to warrant the formation of a new specific title for its reception, is not uncommon in the Sphagnum. It, too, is comparatively gigantic, but the general aspect, aside from minute structural characteristics, renders it readily recognizable. The posterior portion is prolonged as a broad tail-like continuation, a feature thus far restricted to this member alone of the Urostylæ. The right-hand postero-lateral border of this part supports a single series of long arcuate setæ similar to the double row on *U. gigas*, the contractile vesicles are ten to twelve in number, and the peristomal structure is distinctive. To accurately ascertain the number of the pulsating vacuoles is almost as difficult as to count the number of nuclear nodules, but there are not less than ten nor more than twelve, their presence at once separating the Infusorian from all the species and making necessary a slight change in the generic diagnosis as it now stands. This form I have named *Urostyla caudata*.

Urostyla caudata, sp. nov. (Fig. 4). Body elongate-elliptical, soft, flexible and extensile, five times as long as broad, widest centrally, the anterior extremity rounded and curved toward the left-hand side, the posterior portion narrowed into a straight, broad tail-like prolongation; frontal styles about twenty; ventral setæ clothing the entire ventral surface in closely approximated longitudinal lines; anal styles eight to ten, long, slender, in an oblique row, usually projecting beyond the body; marginal setæ projecting posteriorly and developed on the right-hand border of the posterior extremity as a single oblique series of long arcuate setæ; peristome-field confined to the anterior third of the lower surface, the left-hand margin finely ciliate in addition to the adoral fringe, the right-hand border bearing a membrane and a præ-oral ciliary series; nucleus multiple, the nodules numerous, scattered; contractile vesicles multiple, arranged in a row along the left-hand body-margin; parenchyma vacuolar; anal aperture opening on the dorsal surface near the posterior extremity. Length of body 1-40 inch. Habitat.—Marsh water, with sphagnum.

Previously to the capture of the three forms of Holosticha here referred to, but a single fresh-water species had been recorded. The structure of these additional sweet-water members of the genus will necessitate a change in the generic description, since the peristomal membrane, the increased number of frontal styles in *H. hymenophora* and *H. similis*, and the double



Hypotrichous Infusoria

Stokes

contractile vesicle of the former, have not been previously noticed, while a moniliform nucleus is thus far restricted to *H. similis*.

Holosticha caudata, sp. nov. (Fig. 5). Body elongate, eight times as long as broad, soft and flexible, widest centrally, constricted near the apical extremity of the peristome-field, widened anteriorly, tapering posteriorly in a tail-like prolongation, the tip somewhat dilated and curved toward the right-hand side ; anterior border rounded, lip narrow, crescentic ; frontal styles three ; ventral setæ in two straight median rows, those on the right-hand side largest ; anal styles five, slender, the extremities often fimbriated ; marginal setæ numerous, large, flattened, projecting and most abundantly developed at the posterior border ; peristome-field confined to the anterior one-fifth of the ventral surface, the right-hand margin finely ciliate and bearing an undulating membrane ; contractile vesicle single, spherical, near the left-hand side of the apical extremity of the peristome ; anal aperture dorsal near the beginning of the tail-like prolongation ; immotile dorsal hispid setæ numerous, long and fine. Length of body 1-50 inch. Habitat.—Marsh water, with Sphagnum.

In *Holosticha hymenophora* (Fig. 6), a sub-terminal anal aperture exists and has been noticed several times, but whether on the ventral or dorsal surface was impossible to positively determine, as the Infusorian in each instance happened to be rapidly rotating on the long diameter, and the aperture opened and closed before the focus could be changed. My impression, however, is that it is dorsal, and I have no hesitation in predicting that the cytopyge will be observed in that position, not only among those described in this paper where the dorsal position is the rule, but with many of the Hypotricha, even with those common and seemingly best-known forms in which so important a structural point ought to have been observed long ago. An instance occurs in *Oxytricha platystoma* (Ehr.) S. K., where the writer has seen the anal aperture on the dorsal surface at the left-hand side of the median line and some distance from the posterior extremity. That it should become developed on the upper surface is certainly a satisfactory and a beautiful adaptation. The lower aspect is needed for the support of the ambulatory organs and anal styles, the posterior extremity is occupied by a luxuriant growth of marginal setæ, with usually one or more supplementary rows of similar appendages, while the dorsum is either entirely naked or only the bearer of immotile hispid hairs, which can be temporarily crowded out of position, or even permanently displaced, without inconvenience or injury to the Infusorian.

Holosticha hymenophora, sp. nov. (Fig. 6). Body elliptical, three to four times as long as broad, soft, flexible and somewhat extensile, narrowed anteriorly and slightly curved toward the left-hand side ; lip prominent, crescentic ; frontal styles five ; ventral setæ in two straight closely approximated median rows ; the left-hand series beginning at the apical extremity of the peristome ; anal styles five, straight, slender, in an oblique row, the first or right-hand one slightly projecting beyond the body ; marginal setæ longest and projecting posteriorly ; peristome-field extending for one-third the length of the body, the right-hand border nearly straight, finely ciliate and bearing an undulating membrane; contractile vesicle double, near the center of the left-hand body-margin; nucleus double, ovate; anal aperture sub-terminal, presumably dorsal; immotile hispid dorsal setæ short. Length of body, 1-125 to 1-150 inch. Habitat.—Shallow pools in early spring.

The form which I have named *Holosticha similis* (Fig. 7), is readily differentiated from all other species by the moniliform nucleus. Usually the nodules are arranged in a single row, but individuals occur not uncommonly with a double row, all the component nodules of each series then being in contact laterally. Here also the anal aperture is dorsal.

Holosticha similis, sp. nov. (Fig. 7). Body elongate-ovate, soft, flexible and somewhat extensile, more than four times as long as broad, the posterior extremity rounded, the anterior narrower, rounded, slightly curved toward the left-hand side; peristome-field oblique, confined to the anterior third of the lower surface, narrow, ovate, the right-hand margin ciliate; frontal styles about fourteen; ventral setæ in two straight median rows; anal styles twelve to fourteen, slender, in a long oblique row, only the most posterior ones projecting beyond the body; marginal setæ conspicuous, longest, most abundantly developed and projecting at the posterior border; contractile vesicle single, spherical, on the left-hand side of the apical termination of the peristome-field; nucleus moniliform, the nodules ovate or subspherical, in a single or double row, placed near the left-hand body-margin; anal aperture dorsal, near the posterior extremity; dorsal inmotile hispid setæ small and fine. Length of body, 1-130 inch. Habitat.—Marsh water, with Sphaghum.

The following animalcule is rather slow in its movements, especially when in contact with débris or algal filaments, then resting for a time, commonly with the dorsal surface upward, a position giving the observer an opportunity to study the numerous hispid setæ projecting from that part, but effectually concealing the more important arrangement of ventral styles and setæ. When it has reversed its position, the ventral setæ are seen to conspicuously differ in size in the two median rows, as well as in numbers. This difference is not uncommon in members of its genus (Uroleptus), but here it is unusually well marked. A similar difference also exists between the right and left-hand marginal setæ, the former being abundant and remarkably flat. This is unusual.

In many Infusoria the body is prolonged anteriorly as a narrow crescent, usually styled the upper lip. In many of these I believe this to be a continuation of the ventral plane and consequently to be in reality a lower lip. Such is the case with *Uroleptus dispar*, as shown in diagrammatic outline in figure 9.

Uroleptus dispar, sp. nov. (Figs 8 and 9). Body elongate-oblanceolate, elastic, four to five times as long as broad, widest centrally, tapering posteriorly and terminating in a narrow, flattened, tail-like prolongation; anterior region depressed; frontal border rounded, the ventral surface prolonged anteriorly as a short, projecting crescentic lip ; peristome-field extending for about one-third the entire length of the body, the right-hand border ciliate and apparently having a narrow band-like undulating membrane ; ventral setæ in two median lines continued to the termination of the caudal prolongation, those of the right-hand series largest and most numerous ; marginal setæ large, projecting beyond the body-margin anteriorly on the right-hand side, and about the caudal extremity where they are longest and most abundantly developed, those of the right-hand body margin largest and conspicuously flattened ; frontal styles three ; contractile vesicle single, spherical, near the center of the left-hand border ; nucleus double, ovate ; dorsal aspect bearing a median and an uninterrupted marginal series of immotile hispid setæ ; anal aperture opening on the dorsal surface near the beginning of the caudal prolongation. Length of body, 1-180 to 1-150 inch. Habitat.—Fresh water.

Another member of the preceding genus, whose habitat is the Sphagnum swamp, is so distinctive in form that the diagnosis and figure (Fig. 10) are alone needed for its recognition. It is one of the most active of all the usually frisky members of the genus, darting out of the field, frequently swimming backward at the moment, so as to make its study rather difficult. It is very flexible and elastic, and at the same time one of the brightest, most graceful and beautiful of the handsome group. The extended body is delineated, in Fig. 10, as well as the absence of color, life and motion permit.

Uroleptus longicaudatus, sp. nov. Body narrowly sub-fusiform, elongate, about eight times as long as broad, extensile, widest centrally, tapering posteriorly to a long, narrow, attenuate tail-like prolongation forming one-third the length of the entire body ; anteriorly constricted into a neck-like portion, the frontal region expanded and rounded ; lip narrowly crescentic ; frontal styles three ; marginal setæ large, flattened, projecting, longest and most abundantly developed about the caudal prolongation and posterior extremity ; ventral setæ in two closely approximated median rows, one only continued through the caudal prolongation ; peristome-field confined to the anterior fifth of the lower surface, the right-hand border bearing a narrow membrane ; contractile vesicle single, spherical, near the left-hand border of the neck-like constriction ; nucleus double, ovate ; anal aperture dorsal, near the beginning of the tail-like prolongation ; hispid dorsal setæ forming several longitudinal rows. Length of extended body, 1-120 inch. Habitat.—Marsh water, with Sphagnum.

Among the Hypotrichous Infusoria canal-like contractile vesicles are comparatively rare, but a spherical pulsating vacuole with canal-like diverticula, somewhat resembling that of Stentor, has been observed only in the animalcule here referred to under the name of *Eschaneustyla brachytona*. In Spirostomum the canal-like contractile vesicle possesses an enlargement at its posterior termination ; in Stentor the single spherical vacuole gives off one branch which encircles the peristome-field, and another that extends along one lateral border, thus presenting a likeness to what obtains in this

Hypotrichous animalcule, where the pulsating channel is interrupted by two spherical vacuoles.

The proper position of the following Infusorian in a scheme of classification would probably be before the next one to be noticed, both then immediately preceding Uroleptus. From both the genera the anal styles are absent, and in Eschaneustyla the ventral setæ, which are of vital importance in generic diagnosis, exhibit an arrangement not previously observed in the family group. In form it most nearly approaches Urostyla, for which it might readily be mistaken under insufficient amplification.

Eschaneustyla (*εσχατια, the furthest part; ανευ, without; στυλος, a style*), gen. nov. Animalcules free-swimming, elliptical or ovate, not encuirassed; frontal styles numerous, more or less uncinate; ventral setæ in three unequal longitudinal lines; anal styles none; marginal setæ uninterrupted; contractile vesicle canal-like, near the left-hand border. Inhabiting fresh water.

Eschaneustyla brachytona, sp. nov. (Fig. 11). Body elongate-ovate, soft, flexible and somewhat extensile, three and one-half to four times as long as broad, both extremities usually rounded, the anterior the narrower, somewhat curved toward the left-hand side, a slight constriction beneath the frontal border; peristome-field arcuate, narrow, oblique, confined to the anterior third of the ventral surface, the posterior termination widest, deepest and curved toward the right-hand side, the right-hand border finely ciliate; frontal styles about twenty-five, in oblique lines, two or three supplementary styles forming the first row; ventral setæ in three unequal series, the right-hand row shortest, the central line longest but not extending to the posterior extremity; no anal styles; marginal setæ uninterrupted, longest and projecting at the posterior border only; contractile vesicle canal-like, extending along the entire left-hand body-margin, interrupted anteriorly by two spherical or subfusiform dilatations, one near the posterior termination of the peristome-field, the other near the center of the lateral body margin; nucleus not observed; anal aperture postero-terminal. Length of body, 1-112 to 1-150 inch. Habitat.—Standing water, with dead leaves.

The last form to be here mentioned is one apparently bridging the space between Holosticha and Uroleptus. In general appearance, in the arrangement of the ventral appendages and the conspicuously flattened marginal setæ it recalls the latter. The caudal appendage is not constant, therein differing from and separating the Infusorian from the invariably caudate Uroleptus. In this soft and variable posterior extremity it has a peculiarity not possessed by the remainder of the body, and not possessed by any member of the highly organized group to which the creature belongs. This posterior extremity is changeable in form. When first observed the part may be conspicuously bifid, soon to give place to an obtusely pointed, a truncate or an evenly rounded tip, or, as seen in a single instance and illustrated in figure 13, one point of the bifurcation may be extended in a way to suggest a pseudopodium, with a bulbous termination, the whole to be finally withdrawn into a rounded, emarginate or otherwise modified border. Consequently the Infusorian has the ability, by the extrusion of a caudal prolongation, to come very close to a Uroleptus, and by the withdrawal of the tail to return to its proper generic position.

The lamelliform marginal setæ, as they approach the posterior extremity, gradually leave the ventro-lateral border and are developed on the dorsal surface in a single row passing about the posterior part at a short distance from the margin. The utility of this arrangement it is difficult to imagine, unless it is to accommodate the anal aperture. Near the center of the dorsal aspect, in addition to the numerous, immotile hispid hairs arranged in longitudinal lines, there are developed three long flattened setæ, voluntarily vibratile and resembling those on the body-margin. Such an addition to the dorsum of an Hypotrichous Infusorian has not been previously observed. If somewhat more luxuriantly developed, these dorsal appendages might, indeed in their present condition they do, lead to interesting suggestions in respect to the affinities of the Infusorian and its order with the Heterotricha.

The large adoral cilia somewhat abruptly change their position in relation to the peristome-field as they approach the center of the left-hand border, the free extremities of those most anterior being directed toward the body-margin, while the tips of the posterior ones are vibrated above the peristome-field, the alteration at the point of transition being quite sudden. I have long suspected that this might be the arrangement in other peristomal Infusoria, but have not been previously able to demonstrate it.

In its movements the creature is erratic. Remaining for a time quietly lying with the ventral aspect upwards, suddenly with a lunge like that of a microscopic cetacean it rolls over, and exposes the dorsal surface only to almost immediately begin a series of wild and grotesque backward tumblings, varying these acrobatic performances by rapid backward swimming, occasionally throwing a backward somersault. It was the broad marginal setæ and these curious movements that suggested the name as the flat-haired animalcule that tumbles over backward.

Platytrichotus (πλατυς, *broad ;* τρίχωτος, *haired*), gen. nov. Animalcules free-swimming, soft and flexible, more or less flask-shaped, widest and inflated posteriorly, narrowest and depressed anteriorly, the ventral surface flattened ; frontal styles five, uncinate ; ventral setæ in two straight median lines ; anal styles none ; marginal setæ broad, flat, uninterrupted ; nucleus single ; contractile vesicle single, near the center of the left-hand border. Inhabiting fresh water.

Platytrichotus opisthobolus, sp. nov. (Fig. 12). Body flask-shaped, less than three times as long as broad ; frontal margin rounded, lip narrow, crescentic ; posterior extremity soft and changeable in shape, obtusely pointed, emarginate, bifid, but usually evenly rounded ; frontal styles five ; ventral setæ in two median rows, increasing in length posteriorly, those of the right-hand series largest and most numerous ; marginal setæ large, lamelliform, obliquely truncate, projecting beyond the right-hand body-margin, the posterior ones continued across the posterior part of the dorsal aspect ; peristome-field extending to the center of the ventral surface, the left-hand margin with a series of fine par-oral cilia, the right-hand border ciliate and bearing a membrane ; contractile vesicle single, spherical, near the center of the left-hand border ; nucleus single, large, ovate, in the posterior body-half ; anal aperture postero-terminal ; dorsal surface bearing numerous long hispid hairs in longitudinal lines and three large vibratile setæ developed anteriorly. Length of body, 1-145 inch. Habitat.—Marsh water, with Sphagnum.

CONTRIBUTIONS FROM THE LABORATORY OF THE UNIVERSITY OF PENNSYLVANIA.

No. XXIV.

CONTRIBUTIONS TO MINERALOGY.

By F. A. Genth.

(*Read before the American Philosophical Society, October 2, 1885.*)

During the last two or three years numerous mineralogical observations have been made, some of which I had intended to investigate more fully, but, as I fear that the time which this would require would delay, if not altogether prevent their publication, I give in the following the more interesting :

1. *Tin, and associated Minerals.*

A highly interesting occurrence of native tin is that at the headwaters of several rivers in New South Wales. About a year ago Dr. Samuel B. Howell presented me with a specimen, and afterwards sent with another the following letter, giving fuller information about its occurrence :

"The washings I gave you sometime back came from Aberfoil river, "about fifteen miles from the town of Oban, N. S. Wales. There is with-"in two or three miles a very valuable diamond field, where corundum "gems are common. The specimens I now send you are from the Sam "river, which runs through the above-mentioned diamond field, twenty "miles from the other locality. These rivers are the headwaters of the "Clarence river, which empties into the South Pacific ocean. From this "locality I have detected platinum, iridosmine, tin and gold ; the mineral "formation appears to be the same."

Both specimens showed the same association of minerals.

Tin.—The tin exists in the form of irregular, somewhat globular grains or aggregations of such grains; they are distinctly crystalline, from 0.1 to rarely over 1^{mm} in size. When magnified 60 diameters they appear to be of an uneven surface, showing planes which are too indistinct, however, for determining their form. They are grayish-white and of metallic lustre. It was impossible to select enough of the pure grains to determine their specific gravity or to make a quantitative analysis. A portion, treated with hydrochloric acid, dissolved readily with disengagement of hydrogen, leaving fine scales of iridosmine behind. Not a trace of any other metal but tin could be found in the solution.

Platinum.—The sample from the Aberfoil river yielded only a very minute quantity of platinum, when the portion insoluble in hydrochloric acid was treated with aqua regia, whilst that from the Sam river contained a considerable amount of this metal.

The grains of platinum are of irregular shape, mostly flattened. Aqua regia dissolves some of the grains very slowly, leaving a crystalline skeleton of very fine scales, probably of iridosmine. Other grains are hardly acted upon and are probably iridium or platin-iridium. The solution contained principally platinum, but also iridium and palladium.

Iridosmine.—The so-called iridosmine seems to be present, both as newjanskite in tin white, flat scales and as sisserskite in grayish-white or lead-colored scales. Some of the scales are indistinct hexagonal plates, but mostly have an irregular shape.

Gold.—The gold which I have observed in these washings is associated with quartz and of a deep yellow color, showing its high degree of fineness.

Copper.—The Sam river washings contain fine particles of native copper in the wire form.

Cassiterite.—I have observed this mineral more largely in the Aberfoil river sample; it is mostly in small, rounded grains, the largest about 10^{mm} in size; some are of a deep aurora red color, others are hyacinth red, reddish-brown or variegated, black, red and white; crystals could not be observed.

Corundum.—Sapphires in rounded grains, also in asteriated crystals, the largest 12^{mm} in diameter, and of a deep blue color occur most abundantly in the washings of the Aberfoil river, but also, with other varieties of corundum, in those of the Sam river.

Besides these and an abundance of quartz I have observed topaz of a yellowish-white color, orthoclase, garnet, brown tourmaline and other minerals, too small to distinguish.

2. *Joséite and Tetradymite.*

The peculiar telluride of bismuth from San José, Minas Geraes, Brazil (Dufrénoy's bornine, which afterwards was named joséite by Kenngott), was analyzed by Damour in 1845. The composition being so peculiar, and not in accordance with the present views of chemical combination, a new analysis was very desirable.

Mr. Clarence S. Bement, who has in his magnificent cabinet a fine cleavage mass of about four inches in diameter, has kindly presented me with the material for this purpose.

The specimen received is of a dark steel-gray color and shows the most perfect lamination and cleavage. Between the laminæ could be observed a greenish and yellowish coating, which when magnified 100 diameters showed a crystalline structure. I also observed, under the microscope, a very minute quantity of yellowish-white globular aggregations. These coatings are the product of a partial oxidation of the mineral and were readily removed by dilute hydrochloric acid. They are probably montanite.

The analysis of the purified material gave results very close to those of Damour:

		Genth.		Damour.		
Te	=	14.67	—	15.93	—	15.68
Se	=	1.46	—	1.48	—	4.58
S	=	2.84	—	3.15	—	
Bi	=	81.23	—	79.15	—	78.40
		100.20		99.71		98.66

This composition cannot be expressed by a rational formula. There is also a doubt about its crystalline form, which is generally taken as hexagonal, with an eminently basal cleavage, although crystals, as far as I know, have never been found or examined.

Similar doubts exist about the form and rational composition of tetradymite, a question left open by Groth and others.

On crystals from Schubkau, in Hungary, Haidinger determined the form as rhombohedral, with perfect basal cleavage.

I am not aware that since then a crystallographic examination of this mineral has been made. These crystals are mostly dull, distorted and striated and not the best material for measurement. No other locality has furnished specimens in well defined crystals. It is very probable, however, that Haidinger's determination is correct, judging from a pseudomorph of gold after tetradymite from the Whitehall Mine, Spottsylvania county, Va., in the collection of the University of Pennsylvania, showing forms which appear to be combinations of a rhombohedron with a scalenohedron and the basal plane.

This does not exclude, however, that tetradymite may not also occur in rhombic forms and that the characteristic eminent cleavage may not be basal, but brachydiagonal, as in bismuthinite, stibnite and orpiment, which have an analogous composition.

It was Gustav Rose who first suggested that tetradymite was bismuth with a variable quantity of isomorphous tellurium, and this opinion has been adopted by many chemists and mineralogists, although many facts do not sustain it.

Bismuth and tellurium are not strictly isomorphous. It is true that both crystallize in rhombohedra of nearly the same angles ; bismuth, however, has an eminently basal and rhombohedral cleavage, while tellurium shows a very imperfect basal and no rhombohedral at all, but a very perfect cleavage parallel to the planes of an hexagonal prism.

There is also in all the tetradymites, excepting the two from Fluvanna county, Va., and from Highland, Montana, a portion of the tellurium replaced by sulphur, and, if therefore tellurium replaces bismuth, sulphur necessarily does it also.*

That tetradymite is not a native bismuth, *mixed* with an indefinite quantity of tellurium, becomes more than probable from the fact that all reliable analyses agree very closely with the formulæ of either of the two modifications, viz : $Bi_2\,Te_3$ or $Bi_2\,S_3 + 2\,Bi_2\,Te_3$; there are only the Cumberland (England) tetradymite, which, according to Rammelsberg, contains : Bi $= 84.33$, Te $= 6.73$, and S $= 6.43$, and the joséite, for the expression of a rational composition of which we must look for another explanation.

This seems to be very easy, if G. Rose's suggestion would be reversed, and that, instead of making tellurium (and sulphur) to replace bismuth, we make the latter substitute tellurium and sulphur.

This view is supported by numerous examples, and, if we examine the constitution of the natural sulphides, tellurides, arsenides, &c., &c., we find such substitutions very frequently ; the hexagonal millerite, Ni S, becomes niccolite, NiAs, or breithauptite, NiSb ; the isometric pyrite FeS_2, by substituting the greater portion of the iron by cobalt or nickel, smaltite (CoNiFe) As_2, or chloanthite (NiCoFe) As_2 or bismuth-chloanthite (NiCoFe) $(AsBi)_2$; the rhombic markasite, FeS_2, in the same manner gives : löllingite $FeAs_2$, safflorite (CoFeNi) As_2, and rammelsbergite (NiCoFe) As_2 ; or, if only a portion of the sulphur is replaced, we get as analogues for pyrite : cobaltite CoAsS, Ullmannite NiAsS or corynite Ni (SbAs) S, and for the rhombic marcasite wolfachite (NiFe) $(AsSSb)_2$, mispickel Fe $(AsS)_2$ and alloclasite (CoFe) (BiAs) S.

In the sulphosalts the substitution of bismuth for arsenic and antimony is still more frequent, but it suffices that in the examples given it is shown that sulphur is very often replaced by arsenic and antimony, and that bismuth, being analogous to these, can therefore replace sulphur and tellurium as well.

These views applied to tetradymite and allied minerals would lead to

*I have already repeatedly called attention to the fact that the analysis of the Virginia tetradymite, made by Coleman Fisher, in which he found 7.23 p. c. of selenium, was made with a part of the *identical* material which I have analyzed, and which contains not more than a trace of selenium. Notwithstanding these statements it seems to be impossible to eradicate this error, as I find it continually repeated in our best books on Mineralogy.

the general formula : Bi_2 (TeSeSBi)$_3$, and the Cumberland tetradymite (I) and the joséite (II) would be :

		I.		II.
Bi_2S_3	=	34.57	—	15.27
Bi_2Se_3	=	——	—	4.04
Bi_2Te_3	=	14.19	—	30.72
Bi_2Bi_3	=	48.84	—	50.17
		97.51		100.20

It would be interesting if a modification of bismuth of a rhombic form with brachydiagonal cleavage would be discovered, as it would throw some light upon the cause of dimorphism.

3. *Seleniferous Galenobismutite.*

H. Sjögren in 1879 gave the name galenobismutite with the formula : PbS. Bi_2S_3, to a mineral which is found massive and of a somewhat radiating structure at the Ko Mine, Nordmark, Sweden.

Mr. F. L. Garrison presented me last fall with a specimen of what was considered a selenide of bismuth, which he had received in Fahlun, Sweden, and which was said to have been found a short time ago in that celebrated mine.

The mineral has one very eminent cleavage, very similar to the brachydiagonal cleavage of bismuthinite, no other cleavage could be observed ; color, lead gray, but much darker than bismuthinite ; lustre eminently metallic ; H = 2. Sp. gr., corrected for the pure mineral, = 7.145. Very brittle. It is associated with quartz, chalcopyrite and pyrrhotite in a rock composed of greenish-black fibrous and radiating hornblende and quartz.

Unfortunately, only a limited quantity was at my disposal, and the material for analysis could not be obtained in a perfect state of purity, but, as the admixtures were only quartz, chalcopyrite and pyrrhotite, these could be easily calculated and deducted.

They were : in analysis I, 3.96 % ; in II, 4.25 % ; in III, 5.11 % ; in IV, 8.73%, and in V, 8.80 %. The following results were obtained :

	I.	II.	III.	IV.	V.	Mean.	Atomic ratio.	
Sulphur =	9.71	not det.	10.54	9.21	9.55	9.75	0.305	= 1.94
Selenium =	not det.	13.65	11.20	not det.		12.43	0.156	
Silver	28.23	28.18	0.28	0.39	0.32	0.33	0.002	= 1.1
Lead			28.27	27.72	27.69	27.88	0.135	
Bismuth =	50.19	49.49	49.35	50.49	49.90	49.88	0.238	2.—
			99.64			100.27		

This gives the formula : Pb ($S_{\frac{2}{3}}$ $Se_{\frac{1}{3}}$). Bi_2 ($S_{\frac{2}{3}}Se_{\frac{1}{3}}$)$_3$, giving :

Sulphur	=	10.43 %
Selenium	=	12.94 —
Lead	=	25.30 —
Bismuth	=	51.33 —
		100.00

Another specimen from the same locality, which was considered the same mineral, gave very different results :

This mineral, while it showed an eminent brachydiagonal cleavage, was much whiter, and less brittle. It had the same associations, but there appeared to be also some granular native bismuth in its immediate neighborhood. The analysis, after deducting 3 per cent of impurities, gave :

Sulphur	=	11.87 %
Selenium	=	4.25 —
Lead	=	5.36 —
Bismuth	=	74.44 —
		95.92

There is a loss of about 4 per cent, for which I cannot account, possibly selenium.

There was only a small quantity of the mineral obtainable for analysis, which would indicate that it is a mixture of probably about 20 per cent of the seleniferous galenobismutite with 63 per cent of bismuthinite and about 17 per cent of the native bismuth.

4. Argentobismutite (*Silberwismuthglanz*).

Prof. C. Rammelsberg described, in 1876, under the name silberwismuthglanz, a compact gray mineral from the Matilda Mine, Peru, corresponding to the formula : Ag_2S, Bi_2S_3.

Amongst the minerals which the late J. F. L. Schirmer presented me about eleven years ago, was a specimen of granular quartz penetrated by thin needle-shaped iron black crystals, about 1^{mm} in thickness and $10–25^{mm}$ in length, showing a deep longitudinal striation, apparently no cleavage, but an uneven fracture. It came from Lake City, Colorado, and was evidently a surface specimen. In vain I have endeavored since to get the same mineral again from the mines near Lake City.

I have made several rough tests and found in one about 24 per cent of silver and 55 per cent of bismuth. I have sacrificed the greater portion of my specimen, and by crushing and washing off the quartz and oxidized portion of the mineral, I obtained a small quantity for analysis, consisting of the nearly pure sulphide and quartz with ferric oxide, which latter were left undissolved by nitric acid.

The analysis gave :

			Atomic Ratio.
Silver	=	26.39 %	0.121
Lead	=	4.06 —	0.020
Bismuth	=	52.89 —	0.252
Sulphur, by difference	=	16.66 —	0.521

The lead may be an admixture of galenite, although the mineral had not that appearance, but it is more probably replacing some of the silver, the analysis nearly agrees with the formula : $(Ag_2Pb)\ S.\ Bi_2S_3$.

The pure $Ag_2S.\ Bi_2S_3$ would have the composition :

Ag	=	28.27
Bi	=	54.97
S	=	16.76

5. *Cosalite.*

The name *rezbanyite* was given, in 1858, by R. Hermann, to a mixture of a sulphobismutite of lead, silver and copper and sulphate of lead ; the unoxidized mineral was not analyzed, although he states that the interior mass of his specimen was quite fresh, and of a lead-gray color.

A sulphobismutite of the formula $2(PbAg_2)\ S.\ Bi_2S_3$ from Cosala in the Province of Sinaloa, Mexico, was described by me in 1868 as *cosalite.*

In 1874, A. Frenzel reëxamined the rezbanyite and proved its identity with cosalite. For another mineral $4PbS.\ 5Bi_2S_3$, also found at Rezbanya, he now adopts the name rezbanyite.

In 1877 A. E. Nordenskiöld distinguished as *bjelkite* a mineral from the Bjelke Mine in Nordmark, Sweden, of which Nilson Lundström gave the formula : $FePb_2Bi_2S_6$. H. Sjögren, however, showed, in 1879, that the iron in Lundström's analysis was owing to an admixture of pyrrhotite, and that the pure mineral was identical with cosalite.

About two years ago I received, through the kindness of Mr. F. M. Shideler, of Lake City, Colorado, a mineral from the Gladiator Mine in Ouray county, Col., which contained, besides bismuth, lead and silver, a considerable quantity of copper, but gave the atomic ratio of cosalite ; a similar mineral was described at the meeting of the Colorado Scientific Society of Dec. 3, 1883, by W. F. Hillebrand, as coming from the Comstock Mine, near Parrott City, La Plata Co., Col., and finally G. A. Kœnig, Proc. Am. Phil. Soc. xxii, 211, made an analysis of that which occurs associated with his alaskaite (galenobismutite) from the Alaska Mine, about six or eight miles above the Gladiator Mine.

The cosalite of the Gladiator Mine occurs associated with galenite, bismuthinite, chalcopyrite and pyrite in quartz. It forms small irregular masses more or less mixed with its associates, the largest which I have seen was not over 25^{mm} in diameter. It is compact, without any apparent crystalline structure ; where it appears to be fibrous it is mixed with bismuthinite. Some portions have a fringe of crystalline galenite, surrounding the whole patch of the cosalite. The bismuthinite is present in small particles of a few millimeters in size, and frequently occupies the centre of the cosalite (one fragment of about 4^{mm} long was examined and found to be perfectly pure Bi_2S_3).

The cosalite is between lead gray and iron black, fracture uneven. For the analysis I selected material which was perfectly free from bismuthinite, galenite and chalcopyrite, but I was not able to obtain any which was not slightly contaminated with pyrite and quartz. From the amount of iron found, the quantity of pyrite was calculated, and this and the quartz deducted from the material taken for analysis.

For comparison I have analyzed the cosalite from the Alaska Mine. This is free from pyrite, but contaminated with chalcopyrite, the amount of iron found gave that of chalcopyrite, which, together with quartz, were deducted from the material used for the analysis.

The following results were obtained after deducting in analysis I, 4.03 % quartz and chalcopyrite; in II, 20.67 % and in III, 19.66 % of pyrite and quartz:

		I. Alaska Mine.		II. Gladiator Mine.		III. Gladiator Mine.		Mean of II and III.	Atomic ratio.	
Sulphur	=	16.80	—	16.72	—	17.52	—	17.17	0.537	
Selenium	=	trace	—	——	—	——		——		
Arsenic	=	0.04	—	trace	—	trace	—	——		
Antimony	=	0.51	—	not det.	—	0.84	—	0.84	0.001	0.216
Bismuth	=	44.95	—	45.20	—	44.97	—	45.09	0.215	
Copper	=	8.00	—	5.87	—	5.80	—	5.84	0.046	0.201
Silver	=	1.44	—	5.67	—	5.82	—	5.75	0.027	
Lead	=	28.10	—	24.50	—	24.72	—	24.61	0.119	
Zinc	=	0.24	—	0.65	—	0.50	—	0.58	0.009	
		100.08		100.17				99.88		

Atomic Ratio of $(PbCu_2Ag_2) : Bi : S = 2 : 2 : 5 = 2(PbAg_2Cu_2)S.\ Bi_2S_3$.

6. *Schirmerite and Beegerite.*

Under the name *schirmerite* I described, in 1874, a mineral from the Treasury Mine, Geneva District, Park county, Col., of the formula $PbS.\ 2Ag_2S.\ 2Bi_2S_3$, which I had received about twelve years ago from Mr. Schirmer. Later, he sent me as schirmerite several specimens from the Treasury Vault Mine, Summit county, Colorado, and has furnished the latter mineral to numerous friends. He has not been able to give me another specimen of the *original schirmerite*, and I do not know that it has been preserved in any collection.

When I took up the investigation of the sulphobismutites above described, I observed that the original schirmerite, which was bright and fresh when received, had tarnished, was quite dull, and some portions almost black, while the mineral from the Treasury Vault Mine was quite fresh in appearance. As this indicated a difference in the composition, its true nature was endeavored to be established by an analysis.

That from the Treasury Vault Mine occurs in small particles and patches, the largest about 10^{mm} in size, disseminated through quartz, associated with cubical crystals of pyrite, very little chalcopyrite, and, in some of the cavities, a yellowish earthy coating, probably of bismite.

Only a very small quantity, not over 0.0312 grm., could be taken for analysis, in which the metals were determined, and the sulphur required by them calculated. It gave :

				Atomic ratio.		
Silver	=	15.40	—	0.072	=	1.5
Lead	=	50.16	—	0.242	=	5.1
Bismuth	=	19.81	—	0.095	=	2
Sulphur	=	14.59	—	0.456	=	9.7
		100.00				

This seems to indicate that the mineral from the Treasury Vault Mine agrees with the formula of *argentiferous beegerite :*

$$(Ag_2Pb)_6.\ Bi_2S_3.$$

Dr. Kœnig described, in 1881, Am. Chem. Journ., ii, 379, under the name of *beegerite,* a mineral from the Baltic vein, Park county, Colorado, which, however, he found to be entirely free from silver. Lately he described another variety from the Old Lout Mine near Lake City, Colorado, containing about 10 per cent of silver. Proc. Am. Phil. Soc. xxii, 211.

7. *Tetrahedrite. Sylvanite.*

Already about eleven years ago I have received from Mr. Schirmer specimens of a variety of tetrahedrite in quartz, associated with crystallized gypsum and a yellowish waxy oxidation product containing largely oxide of antimony, which came from the Hotchkiss Mine in the San Juan District, Colorado.

Almost identical in appearance and associations in the tetrahedrite from Governor Pitkins' Mine near Lake City, of which Mr. F. M. Shideler sent me a number of specimens.

The tetrahedrite does not show any signs of crystallization, but is massive, compact, disseminated through quartz; in the cavities are small crystals of gypsum.

Iron black. Its specific gravity = 4.885.

The material for analysis was slightly contaminated with quartz which was deducted, in I, 2.46 per cent ; in II, 3 per cent.

		I.		II.		Mean.
Sulphur	=	25.97	—	not det.	—	25.97
Arsenic	=	3.30	—	3.14	—	3.22
Antimony	=	25.51	—	not det.	—	25.51
Bismuth	=	0.41	—	0.32	—	0.37
Silver	=	0.51	—	0.69	—	0.60
Copper	=	37.80	—	37.56	—	37.68
Zinc	=	lost	—	7.15	—	7.15
Iron	=	0.57	—	} 0.77	—	0.64
Manganese	=	0.10	—		—	0.10
						101.24

The atomic ratio leads to the accepted formula :

$$4(Ag_2Cu_2ZnFe) S. (SbAsBi)_2 S_3.$$

An exceedingly interesting association of this tetrahedrite is that of *sylvanite.* There was in the lot of samples from Governor Pitkins' Mine a small piece of quartz, showing very few specks of tetrahedrite and also the antimony oxide coating, which showed a few silver-white, bright metallic particles, 2–3^{mm} in length and less than 1^{mm} broad, with one eminent cleavage. A qualitative examination showed that, when nitric acid was added, the particles at once became black, and on boiling dissolved, leaving bright brown gold ; the filtrate gave an abundance of silver chloride on addition of hydrochloric acid, and the filtrate evaporated to dryness yielded crystalline tellurous oxide, readily soluble in ammonium hydrate and ammonium sulphide, which latter solution, on acidulation, gave a black precipitate of tellurous sulphide.

Thus the mineral is proved to be sylvanite, which, I do not believe, has ever before been observed in this part of Colorado.

8. *Polybasite.*

Occurs with argentiferous galenite and pyrite at the Terrible Lode, Clear Creek Co., Colorado.

A crystal had a spec. grav. of 6.009 and contained :

Silver	=	62.70
Copper	=	9.57
Iron	=	0.07
Arsenic	=	0.78
Antimony	=	10.18
Sulphur (by difference)	=	16.70
		100.00

9. *Arsenopyrite and Scorodite.*

A number of years ago I received, from Northern Alabama, several lumps of ore, consisting of quartz with pale grayish-green granular scorodite, showing on some of the fissures microscopic crystals of the usual form of this mineral, the pyramidal planes predominating. The scorodite results from the oxidation of arsenopyrite, a portion of which is left unaltered in the form of grayish-white, granular patches with metallic lustre. Dilute hydrochloric acid dissolved the scorodite and left the arsenopyrite with a little quartz. After deducting 3.34 per cent of the latter the analysis gave :

				Atomic ratio.	
Sulphur	=	18.32	—	0.573	1
Arsenic	=	47.10	—	0.628	1.1
Iron	=	33.84	—	0.566	1
Copper	=	0.70			
		99.96			

1 : 1 : 1 = FeSAs.

10. Alteration of Magnesian limestone from Berks Co., Pa.

The magnesian limestones in the neighborhood of Reading, Berks Co., Pa., at Fritz's island, and about two miles east of Fritztown, two miles south of Sinking Spring, at the Wheatfield and Ruth's Mines, frequently undergo very interesting changes.

Evidently by the infiltration of siliceous waters the magnesian limestone is decomposed and from the magnesium carbonate, deweylite and serpentine are formed, while another portion of the magnesia separates as brucite; the calcium carbonate crystallizes, both in the form of aragonite, in small acicular crystals and radiating columnar masses, and in the form of calcite, in crystals and coarse granular masses.

Some of these minerals have already been described by E. F. Smith, jointly with D. B. Brunner and J. Schoenfeld. I am indebted to Prof. Brunner and Dr. Schoenfeld for numerous specimens of these interesting occurrences.

Brucite.—At Fritz's island brucite occurs in several varieties.

a. In coatings of indistinct crystals 3–4^{mm} in diameter and crystalline masses upon a granular limestone, largely altered into serpentine. It is colorless in thin laminæ and shows the characteristic pearly lustre. There is also, on some portions of the limestone, a thin, white coating with slight silky lustre, which may be brucite; analysis *a*1.

This brucite has already been analyzed by E. F. Smith (Am. Chem. Journ., v, 281), whose analysis I give for comparison, *a* 2.

b. A second variety is found in thin seams from 4 to 15^{mm} in thickness. I could not observe any crystals but masses which are highly crystallized, eminently showing the basal cleavage, but always in curved surfaces. It has a slightly brownish-yellow tint, and on ignition becomes dark brown from the oxidation of the considerable quantity of manganous oxide which it contains. Spec. grav. = 2.382. From the analysis it will be seen that in its composition it stands between pure brucite and Igelström's manganbrucite, although not so rich in manganous oxide, the latter containing as much as 14.16 per cent.

c. The brucite from near Sinking Spring, as Dr. Smith states, occurs in thin colorless laminæ in thin seams in the limestone, but also in silky fibrous masses or even pulverulent, with but a faint silky lustre. Dr. Smith has observed the fine silky fibres, but, not having had a sufficient quantity for analysis, mistook them for hydromagnesite. The brucite is associated with deweylite, coarse grained calcite and aragonite, in dolomite.

I have analyzed a perfectly pure piece of the silky fibrous brucite, which weighed nearly one gram, *c* 1, and for comparison give E. F. Smith's analysis of the laminated mineral, *c* 2, from the same locality:

	Fritz's Island.				Sinking Spring.	
	a 1	*a* 2	*b* 1	*b* 2	*c*1	*c* 2
Water	30.92	32.52	29.70	29.47	29.91	31.05
Carbon dioxide	——	——	——	——	2.42	——
Silica and alumina	——	——	——	0.46	——	——
Ferric oxide	0.82	0.44	0.30	0.04	0.75	1.24
Manganous oxide	0.63	——	4.04	4.66	——	——
Magnesium oxide	67.64	66.78	65.38	64.30	66.62	66.19
Calcium oxide	——	——	——	——	0.11	1.68
	100.01	99.74	99.42	98.93	99.81	100.16

The 2.42 per cent of carbon dioxide in analysis *c* 1 indicate the presence of 0.20 per cent of calcium carbonate, and about 4.45 per cent of magnesium carbonate or about 6 per cent of hydromagnesite, resulting from a conversion of a small quantity of brucite into these minerals—there are still, however, over 90 per cent of unaltered brucite present.

Deweylite, Aragonite, Calcite.—In the magnesian limestone occur these three minerals, more or less mixed together and associated with brucite.

The deweylite is white, yellowish-white or brownish, amorphous, sometimes in rounded grains or in stalactites or botryoidal forms, in thin plate-like masses or slabs occasionally over one inch in thickness, or in irregular coatings. These slabs are often arranged in layers of white or brownish deweylite of greater or less purity, often intimately mixed with aragonite, which sometimes separates in the form of radiating columnar masses, some of the individuals being over 50^{mm} in length. The layers often separate very easily and the surfaces of such planes of separation are covered with small brilliant crystals of aragonite.

Calcite is also present, both in small and insignificant crystals and in coarse crystalline masses.

This deweylite has been analyzed by E. F. Smith (l. c.), also by my assistant, Mr. H. F. Keller, who found a pure yellowish fragment of waxy lustre to contain :

Silicic oxide	=	39.32
Ferrous oxide	=	0.51
Calcium oxide	=	trace
Magnesium oxide	=	41.14
Water	=	18.41
		99.38

Neither the aragonite nor calcite have been analyzed.

Pseudomorph of deweylite after aragonite.—The needle-shaped crystals of aragonite and the radiating masses undergo a change and are gradually altered into brownish-yellow deweylite.

It begins with a very thin coating of colorless and brownish-yellow deweylite upon the aragonite, which gradually becomes thicker and finally changes the entire aragonite into pure deweylite.

Serpentine.—Another very important alteration of the magnesian limestone of Berks county is that into serpentine, which can be observed in all its stages, from the pure dolomite into the pure serpentine. The latter is generally of a greenish-yellow, greenish-white or yellow color, but also sometimes brownish and grayish. Aragonite and calcite are frequently associated and magnetite in fine grains is occasionally disseminated through the mass.

Several analyses of these serpentines have been made by my assistant, Mr. Harry F. Keller, who found in those of:

		Ruth's Mine.		Wheatfield Mine.
Silicic oxide	=	42.14	—	41.46
Ferrous oxide	=	2.06	—	0.99
Magnesium oxide	=	41.61	—	44.68
Calcium oxide	=	trace	—	——
Water	=	14.20	—	14.07
		100.01		101.20

M. E. Wadsworth, in his Lithological Studies, Cambridge, 1884, page 152, speaks of the serpentine of Fitztown (Fritztown), Berks Co., Pa., as a product of the alteration of *olivine, showing yet unaltered olivine.* I cannot imagine how olivine could be present in this rock and what it is which he has taken for that mineral.

The alteration of dolomite has produced, directly and indirectly, especially at Fritz's Island, a great variety of interesting minerals. Besides serpentine and deweylite, there are grossular, vesuviante in a beautiful yellow and orange-colored variety, apophyllite, chabazite, gismondite (?), thomsonite, mesolite, stilbite (at Rautenbush), datolite and others. In a subsequent paper I may give a fuller account of some of these.

11. Ilmenite from Carter's Mine, N. C. Oligoclase.

In the chrysolite rock (unnecessarily called dunite by some authors) occurs a vein which contains corundum, and some cross-fissures furnish a white plagioclase feldspar, others a peculiar variety of ilmenite.

My assistant, Mr. Harry F. Keller, has made analyses of both. The ilmenite has been found in two varieties (a) of a brownish-black color of a somewhat purplish hue, in small masses which show an indistinct crystalline structure and basal cleavage. On the margin it becomes somewhat columnar; fracture uneven. Sp. gr. = 4.67. H = 5.5; the second variety (b) occurs in rounded modules of about 1.5 to 2″ in diameter, irregular in shape, very brittle and breaking up into small fragments of about 5 to 10^{mm} in diameter, without any regular form, with subconchoidal fracture and tarnished with bluish and purplish colors. It much resembles the so-called *Schlackige Magneteisen* from Unkel on the Rhine, although the composition is quite different. Sp. gr. = 4.68. Neither variety is magnetic.

		a				b
Titanic oxide	=	52.73	—	52.71	—	52.64
Ferric oxide	=	8.08	—	not det.	—	10.07
Ferrous oxide	=	33.08	—	32.96	—	31.11
Magnesium oxide	=	5.33	—	not det.	—	5.33
Silica	=	0.14	—	0.16	—	trace
		99.36				99.15

The feldspar which is found associated shows large cleavages and is distinctly striated. It gave the composition of oligoclase :

Silicic oxide	=	62.32
Aluminum oxide	=	25.19
Calcium oxide	=	5.01
Sodium oxide	=	8.02
Potassium oxide	=	0.25
		100.79

12. Topaz from Stoneham, Maine.

I have made last fall, at the suggestion of Mr. G. F. Kunz, an analysis of the Stoneham topaz, of which he furnished me with a perfectly transparent and colorless fragment, in order to clear up the doubt then existing about its composition, on account of an analysis published by Mr. C. M. Bradbury (Chemical News, xlviii, 109), which had given very unusual results.

Although by the very elaborate investigation of F. W. Clarke and J. S. Diller (Am. Journ. Sc. [3] xxix), the main question has been settled by showing that the Stoneham topaz has the accepted composition of topaz, I may put on record the results which I have obtained :

Spec. grav.	=	3.553
SiO_2	=	32.03
Al_2O_3	=	57.18
Fl	=	18.83
		108.03
Deduct oxygen		7.92
		100.11

13. Orthoclase from French Creek, Chester Co., Pa.

A peculiar variety of orthoclase has lately been found at the iron mines of the French Creek region, of which Dr. A. E. Foote has presented me with several specimens. The crystals are columnar, very imperfect, but appear to show the planes P, M and n (Naumann) ; they are deeply striated and the slender crystals from 1 to 2^{mm} in thickness and about 50^{mm} in length are radiating from a centre, forming sheaf-like or club-like aggregations. Some portions show the orthoclase cleavage. Color reddish-white to flesh red. Sp. grav. = 2.528. Associated with a chloritic mineral, supposed to be glauconite, and magnetite.

The analysis gave :

Loss by ignition	=	0.67
SiO_2	=	62.68
Fe_2O_3	=	0.23
Al_2O	=	20.90
CaO	=	0.15
Na_2O	=	none
K_2O	=	15.99
		100.62

14. Muscovite, pseudomorphous after Nephelite?

Dr. A. E. Foote brought last year from Wakefield, Canada, peculiar hexagonal crystals occurring there in the granular limestone, which he gave me for analysis. The form seems to be hexagonal, the angle, between two prismatic planes, measured 120° ; the larger crystal 20^{mm} broad and 18^{mm} high shows the basal plane, but no pyramid, some of the smaller but less perfect crystals appear to have a very small pyramidal plane also.

Yellowish-white, finely crystalline, rarely some larger cleavage planes are visible, which are probably calcite ; lustre pearly to slightly vitreous. H = 3.0 ; spec. gr. = 2.755.

The analysis gave :

CO_2	=	0.69
H_2O	=	4.25
SiO_2	=	45.90
Al_2O_3	=	36.03
Fe_2O_3	=	trace
MgO	=	0.68
CaO	=	0.92
K_2O	=	12.08
		100.55

This is muscovite slightly contaminated with calcium carbonate.

The form suggests a pseudomorph after nephelite. In the same range at Diana, N. Y., as Geo. J. Brush has shown, nephelite is found altered into gieseckite, which latter in all probability is only a more compact and less pure variety of muscovite.

15. Stilpnomelane pseudomorphs. Ankerite.

Velvety coatings of a dark olive-green color and submetallic lustre, in pseudomorphs after an unknown tabular mineral. The specific gravity, taken in alcohol, was found to be, 2.957. Powder pale olive-green.

This variety has been analyzed in 1858, by G. J. Brush (Am. Journ. Sc.

[2] xxv, 198), who showed that the so-called chalcodite of C. U. Shepard, in all probability belongs to stilpnomelane, and, if this suggestion is correct, that this mineral contains both ferrous and ferric oxides, while Rammelsberg (Mineralchemie, 1875), assumes only ferrous oxide.

From Dr. A. E. Foote, who has lately collected this mineral at the Sterling Mine near Antwerp, N. Y., I have received some very pure material, which made it desirable to reëxamine it, especially with reference to the state of the oxidation of the iron.

For the determination of the ferrous oxide, 0.3522 grm. were dissolved in dilute sulphuric acid, after the air had been driven out by carbonic dioxide; and the ferrous oxide determined by titration with potassium permanganate; the water was determined directly in a chloride of calcium tube from 0.3635 grm. and 0.9854 grm. taken for the other determinations. The analysis gave:

				Atomic ratio.			
SiO_2	=	44.75 %	0.746	=			10.2
Al_2O_3	=	4.36 —	0.042	=	0.073	=	1.
Fe_2O_3	=	4.99 —	0.031				
MnO	=	trace					
FeO	=	30.34 —	0.421	=	0.558	=	7.6
MgO	=	5.47 —	0.137				
H_2O	=	9.18 —	0.510	=			7.
		99.09					

The empirical formula: $(Fe_{\frac{3}{4}}Mg_{\frac{1}{4}})_8\ (FeAl)_2\ Si_{10}O_{31} + 6H_2O$ agrees closely with the above results.

Ankerite.—Associated with the stilpnomelane is ankerite in groups of curved rhombohedral crystals of a yellowish-white color.

The analysis gave:

$CaCO_3$	=	54.98
$MnCO_3$	=	0.78
$FeCO_3$	=	19.28
$MgCO_3$	=	24.91
		99.95

16. *Calamine.*

A peculiar variety of calamine, which closely resembles hydrozincite, occurs as an incrustation upon a ferruginous calamine, the principal ore, at the Bertha Mine, Pulaski county, Va.

It is earthy and cryptocrystalline and some of the incrustations had a thickness of 5^{mm}.

I observed that after ignition it was dissolved by dilute hydrochloric acid almost instantaneously, far more readily than the hydrous mineral.

The analysis gave:

SiO_2	=	25.01
ZnO	=	67.42
H_2O	=	8.32
		100.75

17. Titanite.

Some time ago Mr. J. A. D. Stephenson, of Statesville, N. C., sent me a fragment of a crystal of titanite from the mica schist of the neighborhood, which also carries a beautiful variety of sunstone-oligoclase.

It was 15^{mm} broad, 2^{mm} thick, of a yellowish-white color, a greasy, vitreous lustre and a sp. gr. of 3.477.

The analysis gave:

SiO_2	=	29.45
TiO_2	=	38.33
Fe_2O_3	=	1.61
$\left.\begin{matrix} MnO \\ MgO \end{matrix}\right\}$	=	traces
CaO	=	29.11
Ignition	=	0.60
		99.10

18. Vanadinite.

The vanadinite from Wanlockhead, Scotland, occurs associated with calamine, a pale, greenish fibrous coating of pyromorphite, and rarely with minute black crystals of descloizite, in brownish-yellow barrel-shaped hexagonal prisms, generally united into globular groups, the surface of the globules often perfectly smooth and not showing a trace of the form of the crystals which produce them. They have been analyzed by A. Frenzel (Jahrb. Min., 1875, 673), but as it is very difficult to get material perfectly free from admixtures, some of his analyses do not fairly represent the composition of vanadinite. As I had some perfectly pure globules, I made an analysis which gave:

Cl	=	2.53
PbO	=	78.39
As_2O_5	=	0.34
P_2O_5	=	0.27
V_2O_5	=	18.04
		99.57

19. Annabergite.

In a previous paper, read before this Society, August 18, 1882, I mention under niccolite that an apple-green mineral is found with it at the Gem Mine, near Silver Cliff, Colorado.

It occurs as a crystalline coating or in minute somewhat globular aggregations, of a pale green to a rich apple-green color, in limestone associated with niccolite. It is frequently associated with aragonite in fine needle-shaped crystals, which often give it a superficial coating. I was able to obtain a small quantity of a state of fair purity, slightly contaminated with aragonite. After treating it in the cold with very dilute hydrochloric acid, to dissolve the aragonite, I had 0.0722 grm. for analysis, which gave :

H_2O	=	23.94
NiO	=	32.64
CoO	=	0.50
MgO	=	3.74
CaO	=	3.51
As_2O_5	=	36.64
		100.95

20. Dr. Clemens Winkler and Herderite.

Dr. Winkler published (Jahrb. Min., 1875, i, 172), a justification of his work on herderite in which he says that *my reproach that he had sacrificed valuable material by the use of incorrect methods, is unwarranted and that he must firmly repel it.*

I had intended to reply to Dr. Winkler, but really do not see any necessity for it, because, he fails to show any error in my work, but only tries to find excuses for his own shortcomings, and mentions experiments made with apatite, a mineral with which herderite has no resemblance, either physically or chemically.

That the minerals from Ehrenfriedersdorf and Stoneham are identical, *as I have suggested,* he now admits, and as this *settles* the *main question* it would be a waste of words to say more about this matter.

University of Pennsylvania, August 8, 1885.

On Polysynthesis and Incorporation as Characteristics of American Languages. By Daniel G. Brinton, M. D.

(*Read before the American Philosophical Society, October 2, 1885.*)

SYNOPSIS.

Races of mankind as co-extensive with linguistic groups.—Problems of American languages.—History of the doctrines of Polysynthesis and Incorporation.—Preliminary cautions.—Erroneous statements about aboriginal tongues.—Teachings of Duponceau.—Of Wilhelm von Humboldt.—Of Francis Lieber.—Of H. Steinthal.—Of Lucien Adam.—Of Friedrich Müller.—Of J. W. Powell.—Definitions of Polysynthesis, Incorporation and Holophrasis.—Examples of these processes.—Examinations of American tongues in which they are alleged to be absent.—(1) The Othomi and associated dialects—(2) The Bri-Bri and other Costa Rican dialects—(3) The Tupi-Guarani dialects—(4) The Mutsun.—Conclusions.

The division of the species Man into subspecies or races is not as yet a settled point in ethnology. The tendency, however, is to return to the classification proposed by Linnæus, which, in a broad way, subdivides the species with reference to the continental areas mainly inhabited by them in the earliest historic times. This is found to accord with color, and to give five subspecies or races, the White or European, the Black or African, the Yellow or Mongolian (Asiatic), the Brown or Malayan (Oceanic), and the Red or American Races.

No ethnologist nowadays will seek to establish fixed and absolute lines between these. They shade into one another in all their peculiarities, and no one has traits entirely unknown in the others. Yet, in the mass, the characteristics of each are prominent, permanent and unmistakeable; and to deny them on account of occasional exceptions is to betray an inability to estimate the relative value of scientific facts.

In the Science of Language it becomes of the highest importance to ascertain whether any such general similarity can be demonstrated between the tongues spoken by members of the same race.

On the surface, this is not apparent. Only one of the races named—the Malayan—is monoglottic. All the others seem to speak tongues with no genetic relationship, at least none indicated by etymology. The profounder study of language, however familiar to modern science, leads to a different conclusion—to one which, as cautiously expressed by a recent writer, teaches that "every large, connected terrestrial area developed only one, or scarcely more than one, fundamental linguistic type, and this with such marked individuality that rarely did any of its languages depart from the general scheme."*

This similarity is not to be looked for in likeness between words, but in the inner structural development of tongues. To ascertain and estimate such identities is a far more delicate undertaking than to compare columns of words in vocabularies; but it is proportionately more valuable.

This has yet to be done in any general way for the native tongues of America, and what I here present may be considered as merely clearing the road for some later investigator, well equipped from the arsenal of the higher linguistics.

The task—no light one—which such an investigator would have, would be, first, to ascertain what structural traits form the ground-plan or plans (if there are more than one) of the languages of the New World. Upon this ground-plan he would find very different edifices have been erected, which, nevertheless, can be classified into groups, each group marked by traits common to every member of it. These traits and groups he must carefully define. Then would come the separate question as to whether this community of traits has a genetic explanation or not. If the decision were affirmative, we might expect conclusions that would carry us much further than etymological com-

* "Diese thatsachen scheinen darauf hinzudeuten, dass jeder grössere in sich zusammenhängende ländercomplex nur einen oder doch nur ganz wenige sprachgrundtypen herausbildet, so eigenartig, dass selten eine sprache ganz aus dem allgemeinen rahmen heraustritt." Dr. Heinrich Winkler, *Uralaltaische Völker und Sprachen*, s. 147 (Berlin, 1884).

parisons, and will form a truly scientific basis for the classification of American nations.

Acting merely as a pioneer to this vast scheme, I shall confine myself to the examination of two closely-related traits, said by some to be common to the ground-plan of all American tongues, while by others they are dropped from consideration altogether, or are asserted to be absent in many instances. These traits are Polysynthesis and Incorporation.

I shall first sketch the history of these linguistic doctrines; next explain their nature; and then proceed to examine in detail several groups of tongues of this continent in which they are said not to appear. If I succeed in showing that when correctly understood, one or the other, or both of them, are really present in these tongues, then I shall have taken a step towards defining the "ground-plan" which I have referred to. As I shall show that they are both expressions of the same psychological motive, if either is present in a tongue it will make for my position, and the propriety of discussing them together will be obvious.

I would note at the outset that there are a few cautions which one must observe in the search for structural peculiarities in general, and especially of these.

Thus, it will become obvious to the student of the subject that those American languages which have been lauded for their simplicity are quite sure to be those of which we know very little! The Bri-Bri, the Mutsun, Chibcha, and the Othomi, are examples. Just in proportion as our means of studying them increase, their complexity becomes apparent. The little we know about a tongue is often the safe refuge of those who claim for it an exceptional character.

There is good reason to believe that such apparent simplicity arises from the slight knowledge of the tongues possessed by the whites, to whom we are indebted for our information about them. The trading jargons are always extremely simple, and even the most complex native language readily lends itself to the formation of a lingo as simple as "pigeon English." I have illustrated this in a recent work by a specimen of the Lenape (Algonkin) language, as in use by the settlers on the Delaware river in the seventeenth century. We know that an early missionary translated a catechism and preached sermons in this jargon. No doubt he thought he was using pure Lenape, and had that dialect shared the fate of so many others, and become extinct at an early date, we should at this day be obliged to accept Campanius' works as authentic examples of it, and should thus derive an entirely erroneous notion of its character.* I urge, therefore, that we should be extremely cautious about pronouncing on the structure of a language unless we have specimens of *native* composition—texts of *aboriginal* literature.

Even here we are not on perfectly safe ground, for there can be no doubt but that many native tongues have materially changed since their speakers have been brought more or less directly into contact with the whites.

On this point, the Rev. John Kilbuck, a very intelligent native Delaware Indian, writes me that most of his people speak Lenape only, but that they have come "to *think* like white men," and that the structure of the language is materially different from what it was formerly. This difference, as explained to me, is clearly that it is becoming more analytic, and is losing the flexibility, the power of polysynthesis, which it formerly possessed to a striking degree.

As I shall show later, Dr. Amaro Cavalcanti says the same of

*See *The Lenape and their Legends.* By D. G. Brinton, pp. 74–5. (No. v. of Brinton's "Library of Aboriginal American Literature.) The Lenape, as presented in Campanius' *Catechism*, offers no signs of incorporation, although it is really a markedly incorporative tongue; and polysynthesis does not appear, although it was on this very dialect that Duponceau chiefly founded his theories! The pretended oration by a native chief which Campanius gives in the original in his *History of New Sweden* is in this same ungrammatical jargon. His works should be a standing warning to students of American languages to be extremely solicitous about their authorities. Campanius lived seven years among the Lenape and studied their language zealously. Even Zeisberger, who lived sixty years among them, does not appear to have recognized the significance of the vowel changes in the verbs, the use of the obviatives, and such like delicate points of their syntax.

the Tupi; and the modern Maya, as it appears in the voluminous religious writings of Father Joaquin Ruz, is pronounced by so excellent a judge as Señor Pio Perez (author of the Maya Dictionary) and others to be almost a different tongue from the real spoken Maya of the natives themselves.*

The generalization that American languages constitute in certain essential structural features an independent group of tongues was first propounded in the second decade of this century by Mr. Peter Stephen Duponceau, at one time President of the American Philosophical Society, and his statements to this effect first saw the light in the publications of that society. He did not, indeed, fully analyze these features, and from this deficiency in comprehending them, was led to retract their application in certain examples (especially the Othomi) in which I shall endeavor to show they are actually present. He named, indeed, only one of them, to wit, *polysynthesis*, although it is evident that he perceived the second and equally important process, now known to linguists by the term *incorporation.*

As even quite prominent authorities have seriously misunderstood these processes, and in some instances have done grave injustice to their discoverer, I shall give an outline of their history.

Mr. Duponceau first developed his theory of the structure of American languages in his correspondence with the Rev. Mr. Heckewelder, in the summer of 1816. Referring to the forms of the Delaware verb as set forth by Zeisberger in his Grammar of that tongue, he observes: "I am inclined to believe that these

* Crescencio Carrillo writes in his *Disertacion sobre la Historia de la Lengua Maya*, sec. xvii, "El estilo del P. Ruz, como escritor maya, no ha sido de buena y general acceptacion en el país: hásele censurado por falta de claridad, y de que ha forzado mucho y de una manera extraña el giro y carácter proprio y genuino de la lengua yucateca." This was not through ignorance, for Father Ruz was thoroughly conversant with the Maya; but he wished to force it into accordance with the rules and structure of European tongues—a not uncommon tendency of missionary writers, and one quite as much to be watched for by the student of American languages as the simple ignorance of such authors as Campanius.

forms are peculiar to this part of the world, and that they do not exist in the languages of the old hemisphere." To express this peculiarity, he first employed the adjective *syntactic*, but later preferred *polysynthetic*."*

In his "Report on the General Character and Forms of American Languages," in 1819, he explained his views at greater length, and then first distinguishes, though not with desirable lucidity, between the two varieties of synthetic construction, the one (incorporation) applicable to verbal forms of expression, the other (polysynthesis) to nominal expressions. His words are—

"A *polysynthetic* or *syntactic* construction of language is that in which the greatest number of ideas are comprised in the least number of words. This is done principally in two ways. 1. By a mode of compounding locutions which is not confined to joining two words together, as in Greek, or varying the inflection or termination of a radical word as in most European languages, but by interweaving together the most significant sounds or syllables of each simple word, so as to form a compound that will awaken in the mind at once all the ideas singly expressed by the words from which they are taken. 2. By an analogous combination [of] the various parts of speech, particularly by means of the verb, so that its various forms and inflections will express not only the principal action, but the greatest possible number of the moral ideas and physical objects connected with it, and will combine itself to the greatest extent with those conceptions which are the subject of other parts of speech, and in other languages require to be expressed by separate and distinct words. Such I take to be the general character of the Indian languages."†

* *Correspondence between the Rev. John Heckewelder and Peter S. Duponceau, Esq.* Letters viii, xvi, and xxiii.

† *Report of the Corresponding Secretary to the Committee, of his progress in the Investigation committed to him of the General Character and Forms of the Languages of the American Indians.* Read 12th Jan., 1819, in the *Transactions of the Historical and Literary Committee of the American Philosophical Society.* Vol. i, 1819, pp. xxx, xxxi.

In his thesis, which received the prize of the Institute of France, in 1835, he was less explicit in his statements, defining the distinguishing trait of the American languages to be "the formation of words, not only by prefixes and suffixes, but by the intercalation, not merely of syllables, but of significant simple sounds, by which they can multiply words indefinitely."*

It should be distinctly stated on the part of Mr. Duponceau, that he at no time claimed this as a peculiarity universal to American languages. His mind was of altogether too scientific a cast to venture such a rash generalization. He guards himself repeatedly and with care against being so understood, and reiterates that his opinion must not be held to extend beyond the tongues he had studied, although he was inclined to believe that all would be found to reveal these characteristics.†

The incorporative plan—*das Einverleibungssystem*—of American languages attracted early the attention of Wilhelm von Humboldt, and in his monumental treatise, *Ueber die Verschiedenheit des menschlichen Sprachbaues und ihren Einfluss auf die geistige Entwickelung des Menschengeschlechts*, he explains, illustrates, and analyses it at considerable length. In a previous essay I have dwelt in detail on Humboldt's theory of the psychology of the incorporative system, and shall here confine myself to his objective description of it.‡

Its purpose he defines to be, "to impress the unity of the sentence on the understanding by treating it, not as a whole composed of various words, but as one word."§

A perfect type of incorporation will group all the elements of the sentence in and around the verbal, as this alone is the bond of union between the several ideas. The designation of time and manner, that is, the tense and mode signs, will include both

* *Mémoire sur le Système Grammatical des Langues de quelques Nations Indiennes de l'Amérique du Nord*, p. 247 (Paris, 1836).

† *Ibid*, pp. 67, 436.

‡ *The Philosophic Grammar of American Languages as set forth by Wilhelm von Humboldt.* By Daniel G. Brinton, pp. 21–27 (Philadelphia, 1885).

§ *Ueber die Verschiedenheit des Menschlichen Sprachbaues*, etc., s. 166.

the object and subject of the verb, thus subordinating them to the notion of action. It is "an indispensable basis" of this system that there should be a difference in the form of words when incorporated and when not. This applies in a measure to nouns and verbals, but especially to pronouns, and Humboldt names it as "the characteristic tendency" of American languages, and one directly drawn from their incorporative plan, that the personal pronouns, both subjective and objective, used in connection with the verbs, are of a different form from the independent personal pronouns, either greatly abbreviated or from wholly different roots. Outside of the verbal thus formed as the central point of the sentence, there is no syntax, no inflections, no declension of nouns or adjectives.*

Humboldt was far from saying that the incorporative system was exclusively seen in American languages, any more than that of isolation in Chinese, or flexion in Aryan speech. On the contrary, he distinctly states that every language he had examined shows traces of all three plans; but the preponderance of one plan over the other is so marked and so distinctive that they afford us the best means known for the morphological classification of languages, especially as these traits arise from psychological operations widely diverse and of no small influence on the development of the intellect.†

Dr. Francis Lieber, in an essay on "The Plan of Thought in American Languages,"‡ objected to the terms *polysynthesis* and *incorporation* that "they begin at the wrong end; for these names indicate that that which has been separated is put together, as if man began with analysis, whereas he ends with it." He therefore proposed the noun *holophrasis* with its adjective *holophras-*

* See *Ueber die Verschiedenheit*, etc., pp. 170–173, 325–6, etc.

† *Ibid*, p. 167. All references are to the edition of 1818. For a full discussion of Wilhelm von Humboldt's views on this and allied topics see the work above referred to, *The Philosophic Grammar of American Languages as set forth by Wilhelm von Humboldt; with the Translation of an unpublished Memoir by him on the American Verbs* (Philadelphia, 1885).

‡ Published in H. R. Schoolcraft's *History and Statistics of the Indian Tribes of the United States*. Vol. ii, pp. 346–349 (Washington, 1853).

tic, not as a substitute for the terms he criticized, but to express the meaning or purpose of these processes, which is, to convey the whole of a sentence or proposition in one word. Polysynthesis, he explains, indicates a purely etymological process, holophrasis "refers to the meaning of the word considered in a philosophical point of view."

If we regard incorporation and polysynthesis as structural processes of language aiming to accomplish a certain theoretical form of speech, then it will be convenient to have this word holophrasis to designate this theoretical form, which is, in short, the expression of the whole proposition in a single word.

The eminent linguist, Professor H. Steinthal, has developed the theory of incorporation more fully than any other writer. He expresses himself without reserve of the opinion that all American languages are constructed on this same plan, more or less developed.

I need not make long quotations from a work so well-known as his *Charakteristik der hauptsächlichsten Typen des Sprachbaues*, one section of which, about thirty pages in length, is devoted to a searching and admirable presentation of the characteristics of the incorporative plan as shown in American languages. But I may give with brevity, what he regards as the most striking features of this plan. These are especially three :—

1. The construction of words by a mixed system of derivation and new formation.

2. The objective relation is treated as a species of possession ; and

3. The possessive relation is regarded as the leading and substantival one, and controls the form of expression.

The first of these corresponds to what I should call *polysynthesis ;* the others to *incorporation* in the limited sense of the term.

Some special studies on this subject have been published by M. Lucien Adam, and he claims for them that they have refuted and overturned the thesis of Duponceau, Humboldt, and Steinthal, to the effect that there is a process called *incorporative* or *polysynthetic* which can be traced in all American languages, and though not in all points confined to them, may fairly and profitably be taken as characteristic of them, and indicative of the psychological processes which underlie them. This opinion M. Adam speaks of as a "stereotyped phrase which is absolutely false."*

So rude an iconoclasm as this must attract our careful consideration. Let us ask what M. Adam understands by the terms *polysynthesis* and *incorporation.* To our surprise, we shall find that in two works published in the same year, he advances definitions by no means identical. Thus, in his "Examination of Sixteen American Languages," he says, "*polysynthesis* consists essentially in the affixing of subordinate personal pronouns to the noun, the postposition and the verb." In his "Study of Six Languages," he writes: "By *polysynthesis* I understand the expression in one word of the relations of cause and effect, or of subject and object."†

Certainly these two definitions are not convertible, and we are almost constrained to suspect that the writer who gives them was not clear in his own mind as to the nature of the process. At any rate, they differ widely from the plan or method set forth by Humboldt and Steinthal as characteristic of American languages. M. Adam in showing that polysynthesis in his understanding of the term is not confined to or characteristic of American tongues missed the point, and fell into an *ignoratio elenchi.*

* "Je suis donc autorisé à conclure qu'il faut tenir pour absolument fausse cette proposition devenue faute d'y avoir regardé de près, une sorte de cliché: que si les langues Américaines diffèrent entre elles par la lexique, elles possedent néanmoins en commun une seule et même grammaire." *Examen grammatical comparé de seize langues Américaines*, in the Compte-rendu of the Congrès international des Américanistes, 1877, Tome ii, p. 242. As no one ever maintained the unity of American grammar outside of the *Einverleibungssystem,* it must be to this theory only that M. Adam alludes.

† *Études sur Six Langues Américaines*, p. 3 (Paris, 1878); and compare his *Examen Grammatical* above quoted, p. 21, 243.

Equally narrow is his definition of incorporation. He writes, "When the object is intercalated between the subject and the verbal theme, there is *incorporation*." If this is to be understood as an explanation of the German expression, *Einverleibung*, then it has been pared down until nothing but the stem is left.

As to Dr. Lieber's suggestion of *holophrastic* as an adjective expressing the plan of thought at the basis of polysynthesis and incorporation, M. Adam summarily dismisses it as "a pedantic succedaneum" to our linguistic vocabulary.

I cannot acknowledge that the propositions so carefully worked up by Humboldt and Steinthal have been refuted by M. Adam; I must say, indeed, that the jejune significance he attaches to the incorporative process seems to me to show that he did not grasp it either as a structural motive in language, or as a wide reaching psychological process.

Professor Friedrich Müller, whose studies of American languages are among the most extended and profitable of the present time, has not given to this peculiar feature the attention which we might reasonably expect. Indeed, there appears in the standard treatise on the science of language which he is now engaged in publishing almost the same vagueness as to the nature of incorporation which I have pointed out in the writings of M. Adam. Thus, on one page he defines incorporating languages as those "which do away with the distinction between the word and the sentence;" while on another page he explains incorporation as "the including of the object within the body of the verb."* He calls it "a peculiarity of most American languages, but not of all." That the structural process of incorporation is by no means exhausted by the reception of the object within the body of the verb, even that this is not requisite to incorporation, I shall endeavor to show.

**Gründriss der Sprachwissenschaft.* Von Dr. Friedrich Müller. Compare Bd. i, s. 68, und Bd. ii, s. 182.

Finally, I may close this brief review of the history of these doctrines with a reference to the fact that neither of them appears anywhere mentioned in the official "Introduction to the Study of Indian Languages" issued by the United States Bureau of Ethnology! How the author of that work, Major J. W. Powell, Director of the Bureau, could have written a treatise on the study of American languages, and have not a word to say about these doctrines, the most salient and characteristic features of the group, is to me as inexplicable as it is extraordinary. He certainly could not have supposed that Duponceau's theory was completely dead and laid to rest, for Steinthal, the most eminent philosophic linguist of the age, still teaches in Berlin, and teaches what I have already quoted from him about these traits. What is more, Major Powell does not even refer to this structural plan, nor include it in what he terms the "grammatic processes" which he explains.* This is indeed the play of "Hamlet" with the part of Hamlet omitted!

I believe that for the scientific study of language, and especially of American languages, it will be profitable to restore and clearly to differentiate the distinction between polysynthesis and incorporation, dimly perceived by Duponceau and expressed by him in the words already quoted. With these may be retained the neologism of Lieber, *holophrasis*, and the three defined as follows:

Polysynthesis is a method of word-building, applicable either to nominals or verbals, which not only employs juxtaposition with aphæresis, syncope, apocope, etc., but also words, forms of words and significant phonetic elements which have no separate existence apart from such compounds. This latter peculiarity marks it off altogether from the processes of agglutination and collocation.

Incorporation, *Einverleibung*, is a structural process confined

**Introduction to the Study of Indian Languages.* By J. W. Powell, p. 55, Second edition. Washington, 1880.

to verbals, by which the nominal or pronominal elements of the proposition are subordinated to the verbal elements, either in form or position; in the former case having no independent existence in the language in the form required by the verb, and in the latter case being included within the specific verbal signs of tense and mood. In a fully incorporative language the verbal exhausts the syntax of the grammar, all other parts of speech remaining in isolation and without structural connection.

Holophrasis does not refer to structural peculiarities of language, but to the psychological impulse which lies at the root of polysynthesis and incorporation. It is the same in both instances —the effort to express the whole proposition in one word. This in turn is instigated by the stronger stimulus which the imagination receives from an idea conveyed in one word rather than in many.

These words, when understood, are good enough, without inventing others. Professor Julien Vinson would like to substitute "syncopated composition" for polysynthesis.* But the process is not simply syncopated composition; and if it were, why substitute two words for one?

A few illustrations will aid in impressing these definitions on the mind.

As *polysynthetic* elements, we have the inseparable possessive pronouns which in many languages are attached to the names of the parts of the human body and to the words for near relatives; also the so-called "generic formatives," particles which are prefixed, suffixed, or inserted to indicate to what class or material objects belong; also the "numeral terminations" affixed to the ordinal numbers to indicate the nature of the objects counted; the negative, diminutive and amplificative particles which convey certain conceptions of a general character, and so on. These are

* "Le polysynthétisme, ou, pour employer une meilleure expression: la *composition syncopée.*" M. Julien Vinson in the *Compte-Rendu du Congrès International des Américanistes*, 1883, p. 365.

constantly used in word-building, but are generally not words themselves, having no independent status in the language. They may be single letters, or even merely vowel-changes and consonantal substitutions ; but they have well defined significance.

In *incorporation* the object may be united to the verbal theme either as a prefix, suffix or infix ; or, as in Nahuatl, etc., a pronominal representative of it may be thus attached to the verb, while the object itself is placed in isolated apposition.

The subject is usually a pronoun inseparably connected, or at least included within the tense sign ; to this the nominal subject stands in apposition. Both subjective and objective pronouns are apt to have a different form from either the independent personals or possessives, and this difference of form may be accepted as *a priori* evidence of the incorporative plan of structure —though there are other possible origins for it. The tense and mode signs are generally separable, and, especially in the compound tenses, are seen to apply not only to the verb itself, but to the whole scope of its action, the tense sign for instance preceding the subject.

Some further observations will set these peculiarities in a yet clearer light.

Although in polysynthesis we speak of prefixes, suffixes, and juxtaposition, we are not to understand these terms as the same as in connection with the Aryan or with the agglutinative languages. In polysynthetic tongues they are not intended to form words, but sentences ; not to express an idea, but a proposition. This is a fundamental logical distinction between the two classes of languages.

With certain prefixes, as those indicating possession, the form of the word itself alters, as in Mexican, *amatl*, book, *no*, mine, but *namauh*, my book. In a similar manner suffixes or postpositions affect the form of the words to which they are added.

As the holophrastic method makes no provisions for the syntax of the sentence outside of the expression of action (*i. e.*, the verbal and what it embraces), nouns and adjectives are not declined. The "cases" which appear in many grammars of American languages are usually indications of space or direction, or of possession, and not case-endings in the sense of Aryan grammar.

A further consequence of the same method is the absence of true relative pronouns, of copulative conjunctions, and generally of the machinery of dependent clauses. The devices to introduce subordinate propositions I have referred to in the previous essay already mentioned.

As the effort to speak in sentences rather than in words entails constant variation in these word-sentences, there arise both an enormous increase in verbal forms and a multiplication of expressions for ideas closely allied. This is the cause of the apparently endless conjugations of many such tongues, and also of the exuberance of their vocabularies in words of closely similar signification. It is an ancient error—which, however, I find repeated in the official "Introduction to the Study of Indian Languages" issued by our Bureau of Ethnology—that the primitive condition of languages is one "where few ideas are expressed by few words." On the contrary, languages structurally at the bottom of the scale have an enormous and useless excess of words. The savage tribes of the plains will call a color by three or four different words as it appears on different objects. The Eskimo has about twenty words for fishing, depending on the nature of the fish pursued. All this arises from the "holophrastic" plan of thought.

It will be seen from these explanations that the definition of Incorporation as given by M. Lucien Adam (quoted above) is entirely erroneous, and that of Professor Müller is visibly inadequate. The former reduces it to a mere matter of position or placement; the latter either does not distinguish it from polysynthesis, or limits it to only one of its several expressions.

In fact, Incorporation may take place with any one of the six possible modifications of the grammatical formula, "subject + verb + object." It is quite indifferent to its theory which of these comes first, which last; although the most usual formula is either,

subject + object + verb, or

object + subject + verb;

the verb being understood to be the verbal theme only—not its tense and mode signs. Where either of the above arrangements occurs, we may consider it to be an indication of the incorporative tendency; but as mere position is insufficient evidence, Incorporation may be present in other arrangements of the elements of the proposition.

As a fair example of polysynthesis in nouns, we may select the word for "cross" in the Cree. The Indians render it by "praying-stick" or "holy wood," and their word for "our praying-sticks" (crosses) is:

N't'ayamihewâttikuminânak.

This is analyzed as follows:

n't', possessive pronoun, $\frac{1}{3}$ person plural.

ayami, something relating to religion.

he, indicative termination of the foregoing.

w, a connective.

âttik, suffix indicating wooden or of wood.

u, a connective.

m, sign of possession.

i, a connective.

nân, termination of $\frac{1}{3}$ person plural.

ak, termination of animate plural (the cross is spoken of as animate by a figure of speech).

Not a single one of the above elements can be employed as an independent word. They are all only the raw material to weave into and make up words.

As a characteristic specimen of incorporation we may select this Nahuatl word-sentence:

onictemacac,

I have given something to somebody;

which is analyzed as follows:

o, augment of the preterit, a tense sign.

ni, pronoun, subject, 1st person.

c, "semi-pronoun," object, 3d person.

te, "inanimate semi-pronoun," object, 3d person.

maca, theme of the verb, "to give."

c, suffix of the preterit, a tense sign.

Here it will be observed that between the tense-signs, which are logically the essential limitations of the action, are included both the agent and the near and remote objects of the action.

Or we may take the Cakchiquel

xbina camizah,

Thou wilt not kill me.

Composed of

x, sign of the future tense.

b, for *ba*, negative.

in, for *quin*, pronoun, 1st person, object.

a, pronoun, 2d person, subject.

camizah, verbal theme, "to kill."

Here the object does not come between verb and subject, but precedes the latter; but it is a true specimen of incorporation, as is proved by the prefixed tense sign.

In the modifications of meaning they undergo, American verbal themes may be divided into two great classes, either as they express these modifications (1) by suffixes to an unchanging radical, or (2) by internal changes of their radical.

The last mentioned are most characteristic of synthetic tongues. In all pure dialects of the Algonkin the vowel of the verbal root undergoes a peculiar change called "flattening" when the proposition passes from the "positive" to the "suppositive" mood.* The same principle is strikingly illustrated in the Choctaw language, as the following example will show :†

takchi, to tie (active, definite).

takchi, to be tying (active, distinctive).

tak'chi, to *tie* (active, emphatic).

taiakchi, to tie tightly (active, intensive).

tahakchi, to keep tying (active, frequentative).

tahkchi, to tie at once (active immediate).

tullakchi, to be tied (passive definite).

tallakchi, to be the one tied (passive distinctive), etc., etc.

This example is, however, left far behind by the Qquichua of Peru, which by a series of so-called "verbal particles" affixed to the verbal theme confers an almost endless variety of modification on its verbs. Thus Anchorena in his Grammar gives the forms and shades of meaning of 675 modifications of the verb *munay*, to love.‡

These verbal particles are not other words, as adverbs, etc., qualifying the meaning of the verb and merely added to it, but have no independent existence in the language. Von Tschudi, whose admirable analysis of this interesting tongue cannot be too highly praised, explains them as "verbal roots which never reached independent development, or fragments handed down from some earlier epoch of the evolution of the language."§ They are therefore true synthetic elements in the sense of Duponceau's definition, and not at all examples of collocation or juxtaposition.

In contrast to this we may take the Maya-Quiche dialects, where there are only slight traces of these internal changes, most of the modifications being effected by affixes. Thus Francisco

*This obscure feature in Algonkin Grammar has not yet been satisfactorily explained. Compare Baraga, *Grammar of the Otchipwe Language*, p. 116 (Montreal, 1878), and A. Lacombe, *Grammaire de la Langue des Cris*, p. 155 (Montreal, 1874).

†See *Grammar of the Choctaw Languages*. By the Rev. Cyrus Byington. Edited by D. G. Brinton, pp. 35, 36 (Philadelphia, 1870).

‡ *Gramática Quechua, ó del Idioma del Imperio de los Incas.* Por el Dr. José Dionisio Anchorena, pp. 163–177 (Lima, 1874).

§ *Organismus der Khetsua-Sprache.* Von J. J. von Tschudi, p. 368 (Leipzig, 1884).

Ximenez in his *Quiche Grammar* gives twenty-four variations of the theme *bak*, bored, all by suffixes, as :*

bak, first passive.

bakatuh, second passive.

bakou, first absolute.

bakon, second absolute.

bake, first neuter.

baker, second neuter, etc., etc.

While the genius of American languages is such that they permit and many of them favor the formation of long compounds which express the whole of a sentence in one word, this is by no means necessary. Most of the examples of words of ten, twenty or more syllables are not genuine native words, but novelties manufactured by the missionaries. In ordinary intercourse such compounds are not in use, and the speech is comparatively simple.

Of two of the most synthetic languages, the Algonkin and the Nahuatl, we have express testimony from experts that they can be employed in simple or compound forms, as the speaker prefers. The Abbé Lacombe observes that in Cree "sometimes one can employ very long words to express a whole phrase, although the same ideas can be easily rendered by periphrasis."† In the syllabus of the lectures on the Nahuatl by Prof. Agustin de la Rosa of the University of Guadalaxara I note that he explains when the Nahuatl is to be employed in a synthetic, and when in an analytic form.‡

I shall now proceed to examine those American tongues which

* *Gramatica de la Lengua Quiche.* Ed. Brasseur de Bourbourg, p. 8 (Paris, 1862).

†"Ces exemples font comprendre combien quelquefois on peut rendre des mots très longs, pour exprimer toute une phrase, quoiqu' aussi on puisse facilement rendre les mêmes ideés par des périphrases." Lacombe, *Grammaire de la Langue des Cris*, p. 11 (Montreal, 1874).

‡"Se explicara la razon filosófica de los dos modos de usar las palabras en Mexicano, uno componiendo de varias palabras uno solo, y otro dejandolas separadas y enlazandolas solo por el regimen" From the programme of Prof. A. de la Rosa's course in 1870. It is greatly to be regretted that the works of this author on the Nahuatl, though recent, are so scarce as to be unobtainable.

have been authoritatively declared to be exceptions to the general rules of American grammar, as being devoid of the incorporative and polysynthetic character.

The Othomi.*

As I have said, the Othomi was the stumbling block of Mr. Duponceau and led him to abandon his theory of polysynthesis as a characteristic of American tongues. Although in his earlier writings he expressly names it as one of the illustrations supporting his theory, later in life the information he derived from Señor Emmanuel Naxera led him to regard it as an isolating and monosyllabic language, quite on a par with the Chinese. He expressed this change of view in the frankest manner, and since that time writers have spoken of the Othomi as a marked exception in structure to the general rules of synthesis in American tongues. This continues to be the case even in the latest writings, as, for instance, in the recently published *Anthropologie du Mexique*, of Dr. Hamy.†

Let us examine the grounds of this opinion.

The Othomis are an ancient and extended family who from the remotest traditional epochs occupied the central valleys and mountains of Mexico north of the Aztecs and Tezcucans. Their

*The original authorities I have consulted on the Othomi are:

Reglas de Orthographia, Diccionario, y Arte del Idioma Othomi. By Luis de Neve y Molina (Mexico, 1767).

De Lingùa Othomitorum Disserlatio. By Emmanuel Naxera (Philadelphia, 1835).

Cateiesmo en Lengua Otomi. By Francisco Perez (Mexico, 1834).

†He speaks of the Othomi in these terms:—"Une langue aux allures toutes spéciales, fondamentalement distincte de toutes les langues qui se parlent aujourd' hui sur le continent américain." *Mission Scientifique au Mexique*, Pt. i. Anthropologie, p. 32 (Paris, 1884). This is the precise opinion, strongly expressed, that it is my object to controvert. Many other writers have maintained it. Thus Count Piccolomini in the *Prolegomena* to his version of Neve's Othomi Grammar says: "La loro lingua che con nessuna altra del mondo conosciuto ha la menoma analogia, è semplice. * * * La formazione dei loro verbi, nomi ed altri derivati ha molta semplecitá," etc. *Grammatica della Lingua Otomi.* p. 3 (Roma, 1841). This writer also offers an illustration of how imperfectly Duponceau's theory of polysynthesis has been understood. Not only does Piccolomini deny it for the Otomi, but he denies that it is anything more than merely running several words together with some phonetic syncopation. See the *Annotationi* at the close of his Othomi Grammar.

language, called by themselves *nhiân hiû*, the fixed or current speech* (*nhiân*, speech, *hiû*, stable, fixed), presents extraordinary phonetic difficulties on account of its nasals, gutturals and explosives. M. A. Pinart has informed me that of the many American tongues which he has studied from the lips of the natives, it is far the most difficult to catch.

It is one of a group of related dialects which may be arranged as follows:

- The Othomi.
- The Mazahua.
- The Pame and its dialects.
- The Meco or Jonaz.

It was the opinion of M. Charencey, that another member of this group was the Pirinda or Matlazinca; a position combatted by Señor Pimentel, who acknowledges some common property in words, but considers them merely borrowed.†

At the outset, it is well to express a caution about accepting without reserve Naxera's opinions on the tongue. No doubt he had practical familiarity with it in its modern and rather corrupt form, but his treatise was largely written to prove that it was not only structurally similar but lexicographically related to the Chinese:—and we all know how such a prepossession obscures the judgment. Thus, part of his object was to prove that every syllable of the polysyllabic words had an independent meaning which it always retained in the compound. It is easy to think out deceptive etymologies of this kind, especially in languages where there are many monosyllables. Thus the participle *rowing* might plausibly be compounded of the two monosyllables *row*, and *wing*, as the oarmen are seated in a row, and the blade of the oar resembles a wing.

*This is the orthography of Neve. The terminal vowels are both nasals; *nhiân* is from the radical *hiâ* to breathe, breath.

†See the "Comparacion del Othomi con el Mazahua y el Pirinda," in the *Cuadro Descriptivo y Comparativo de las Lenguas Indigenas de México*, por Francisco Pimentel. Tomo iii, pp. 431–445 (Mexico, 1875).

Bayard Taylor's humorous derivation of *restaurant—res*, *taurus*, "bully thing"—is of similar character. That Naxera was led into this false route by his anxiety to prove the Othomi monosyllabic is evident, for example, from his treatment of the verbal terminations *tza*, *tze*, *tzi;* he makes them independent words, characterizing the imperative, and meaning to happen, to effect, and to carry; whereas Neve treats them as mere terminations, which is shown to be correct by the fact that they are retained with syncope and elision in other moods as well as in the imperative itself.* Thus

Da phāx Oghā:

Thee aid God.

Where *phāx* is an abbreviation of *phātzi.*

Naxera made the statement that the Mazahua is monosyllabic, an error in which his copyists have obediently followed him; but Pimentel pointedly contradicts this assertion and shows that it is a mistake, both for the Mazahua and for the Pame and its dialects.†

We may begin our study of the language with an examination of the

Tense signs in Othomi.

PRESENT TENSE.

1. I wish,	*di nee.*
2. Thou wishest,	*gui nee.*
3. He wishes,	*y nee.*

PAST AORIST.

1. I wished,	*da nee.*
2. Thou wished,	*ga nee.*
3. He wished,	*bi nee.*

* Compare Naxera, *Dissertatio*, p. 286, with Neve, *Reglas*, p. 149.

† See Pimentel, *Cuadro Descriptivo*, etc. Tomo iii, pp. 429 and 455.

PERFECT.

1. I have wished,	*xta nee.*
2. Thou hast wished,	*xca nee.*
3. He has wished,	*xpi nee.*

PLUPERFECT.

1. I had wished,	*xta nee hma.*
2. Thou hadst wished,	*xca nee hma.*
3. He had wished,	*xpi nee hma.*

FIRST FUTURE.

1. I shall wish,	*ga nee.*
2. Thou wilt wish,	*gui nee.*
3. He will wish,	*da nee.*

SECOND FUTURE.

1. I shall have wished,	*gua xta nee.*
2. Thou wilt have wished,	*gua xca nee.*
3. He will have wished,	*gua xpi nee.*

The pronouns here employed are neither the ordinary personals nor possessives (though the Othomi admits of a possessive conjugation), but are verbal pronouns, strictly analogous to those found in various other American languages. Their radicals are:

I,	*d*—.
Thou,	*g*—.
He, it,	*b*—.

In the present, the first and second are prefixed to what is really the simple concrete form of the verb, *y-nee*. In the past tenses the personal signs are variously united with particles denoting past time or the past, as *a*, the end, to finish, *ma* and *hma*, yesterday, and the prefix *x*, which is very noteworthy as being precisely the same in sound and use which we find in the Cakchiquel past and future tenses. It is pronounced *sh* (as in *sh*ove) and precedes the whole verbal, including subject, object, and theme; while in the pluperfect, the second sign of past time *hma* is a suffix to the collective expression.

The future third person is given by Neve as *da*, but by Perez as *di*, which latter is apparently from the future particle *ni* given by Neve. In the second future, the distinctive particle *gua* precedes the whole verbal, thus inclosing the subject with the theme in the tense-sign, strictly according to the principles of the incorporative conjugation.

This incorporative character is still more marked in the objective conjugations, or "transitions." The object, indeed, follows the verb, but is not only incorporated with it, but in the compound tense is included within the double tense signs.

Thus, I find in Perez's Catechism,

di	*ûn-ba*	*magetzi*,
He will	give-them	heaven.

In this sentence, *di* is the personal pronoun combined with the future sign; and the verb is *ûn-nì*, to give to another, which is compounded with the personal *ba*, them, drops its final syllable, forming a true synthesis.

In the phrase,

xpi	*ûn-ba*	*hma*	*magetzi*,
he had	given-them	(had)	heaven,

both subject and object, the latter inclosed in a synthesis with the radical of the theme, the former phonetically altered and coalesced with a tense particle, are included in the double tense-sign, *x-hma*. This is as real an example of incorporation as can be found in any American language.

Ordinary synthesis of words, other than verbs, is by no means rare in Othomi. Simple juxtaposition, which Naxera states to be the rule, is not all universal. Such a statement by him leads us to suspect that he had only that elementary knowledge of the tongue which Neve refers to in a forcible passage in his *Reglas*. He writes;—"A good share of the difficulty of this tongue lies in its custom of syncope; and because the tyros who make use of it do not syncopate it, their compositions are so rough and lacking in harmony to the ears of the natives that the latter count their talk as no better than that of horse-jockeys, as we would say."*

The extent of this syncopation is occasionally to such a degree that only a fragment of the original word is retained. As:

The charcoal-vendor, *na māthiâ.*

Here *na*, is a demonstrative particle like the Aztec *in*, and *māthiâ* is a compound of *pà*, to sell, and *thêhñâ*, charcoal.

The expression,

y mahny oqha, he loves God,

is to be analyzed,

y	*mâhdì*	*nuny*	*oqha*;
he	loves	him	God;

where we perceive not only synthesis, but the object standing in apposition to the pronoun representing it, which is incorporated with the verb.

So: *yot-gua*, light here; from *yotti*, to light, *nugua*, here.

These examples from many given in Neve's work seem to me to prove beyond cavil that the Othomi exhibits, when properly spoken, precisely the same theories of incorporation and polysynthesis as the other American languages, although undoubtedly its more monosyllabic character and the extreme complexity of its phonetics do not permit of a development of these peculiarities to the same degree as many.

Nor am I alone in this opinion. It has already been announced by my learned friend, the Count de Charencey, as the result of his comparison of this tongue with the Mazahua and Pirinda. "The Othomi," he writes, "has all the appearance of a language which was at first incorporative, and which, worn down by attri-

*"Parte de la dificultad de este idioma consiste en la syncopa, pues el no syncopar los principiantes artistas, es causa de que sus periodos y oraciones sean tan rispidos, y faltos de harmonia, por cuyo motivo los nativos los murmuran, y tienen (como vulgarmente decimos), por quartreros." *Reglas de Orthographia*, etc., p. 146.

tion and linguistic decay, has at length come to simulate a language of juxtaposition."*

Some other peculiarities of the language, though not directly bearing on the question, point in the same direction. A certain class of compound verbs are said by Neve to have a possessive declension. Thus, of the two words *puengui*, he draws, and *hiâ*, breath, is formed the verb *buehiâ*, which is conjugated by using the verb in the indefinite third person and inserting the possessives *ma*, *ni*, *na*, my, thy, his; thus,

ybuemahia, I breathe.
ybuenihia, thou breathest.
ybuenahia, he breathes.†

Literally this would be "it-is-drawing, my-breath," etc.

In the Mazahua dialects there is a remarkable change in the objective conjugations (transitions) where the whole form of the verb appears to alter. In this language *ti* = I; *ki* or *khe* = thou.

I give, *ti une*.
I give thee, *ti dakke*.
He will give us, *ti yakme*.‡

The last example is not fully explained by my authorities; but it shows the verbal change.

Something like this occurs in the Pame dialects. They reveal a manifest indifference to the integrity of the theme, characteristic of polysynthetic languages. Thus, our only authority on the Pame, Father Juan Guadalupe Soriano, gives the preterit forms of the verb "to aid:"

Ku pait, I aided.
Ki gait, thou aidedest.
Ku mait, he aided.

* "L'Othomi nous a tout l'air d'une langue primitivement incorporante, et qui, parvenu au dernier degré d'usure et délabrement, a fini par prendre les allures d'un dialecte à juxtaposition." *Melanges de Philologie et de Paléographie Américaine.* Par le Comte de Charencey, p. 80 (Paris, 1883).

† Neve, *Reglas* etc., pp. 159, 160.

‡ Pimentel, *Cuadro Descriptivo*, Tom. iii, p. 424.

So, of "to burn:"

Knu aum, I burned.

Kuddu du taum, they burned.*

A large number of such changes run through the conjugation. Pimentel calls them phonetic changes, but they are certainly, in some instances, true syntheses.

All these traits of the Othomi and its related dialects serve to place them unquestionably within the general plan of structure of American languages.

The Bri-Bri Language.

The late Mr. William M. Gabb, who was the first to furnish any satisfactory information about it and its allied dialects in Costa Rica, introduces the Bri-Bri language, spoken in the highlands of that State, by quoting the words of Alexander von Humboldt to the effect that "a multiplicity of tenses characterizes the rudest American languages." On this, Mr. Gabb comments: "This certainly does not apply to the Costa Rican family, which is equally remarkable for the simplicity of its inflections.†"

This statement, offered with such confidence, has been accepted and passed on without close examination by several usually careful linguists. Thus Professor Friedrich Müller, in his brief description of the Bri-Bri (taken exclusively from Gabb's work), inserts the observation—"The simple structure of this idiom is sufficient to contradict the theories generally received about American languages."‡ And M. Lucien Adam has lately instanced its verbs as notable examples of inflectional simplicity.§

* Pimentel, *Cuadro Descriptivo*, Tomo iii, p. 462.

† Wm. M. Gabb, *On the Indian Tribes and Languages of Costa Rica*, in the Proceedings of the American Philosophical Society for 1875, p. 532.

‡ "Dessen einfacher Bau die über die Amerikanischen Sprachen im Allgemeinen verbreiteten Theorien zu widerlegen im Stande ist." *Grundriss der Sprachwissenschaft*, ii Band, s. 318 (Wien, 1882).

§ *Le Taensa a-t-il été forgé de toutes Pièces?* Réponse à M. Daniel G. Brinton. Par Lucien Adam, p. 19 (Paris, Maisonneuve et Cie, 1885).

The study of this group of tongues becomes, therefore, of peculiar importance to my present topic.

Since Mr. Gabb published his memoir, some independent material, grammatical as well as lexicographical, has been furnished by the Rt. Rev. B. A. Thiel, Bishop of Costa Rica,* and I have obtained, in addition, several MS. vocabularies and notes on the languages prepared by Prof. P. J. J. Valentini (now of New York City) and others.

The stock is divided into three groups of related dialects, as follows :—

I. The Brunka, Bronka or Boruca, now in Southwestern Costa Rica, but believed by Gabb to have been the earliest of the stock to occupy the soil, and to have been crowded out by later arrivals.

II. The Tiribi and Terraba, principally on the head-waters of the Rio Telorio and south of the mountains.

III. The Bri-Bri and Cabecar on the head-waters of the Rio Tiliri. The Biceitas (Vizeitas) or Cachis, near the mouth of the same stream, are one of the off-shoots of the Bri-Bris ; so also are the small tribes at Orosi and Tucurrique, who were removed to those localities by the Spaniards.

The Bri-Bri and Cabecar, although dialects of the same original speech, are not sufficiently alike to be mutually intelligible. The Cabecars occupied the land before the Bri-Bris, but were conquered and are now subject to them. It is probable that their dialect is more archaic.

The Bri-Bri is a language of extreme poverty, and as spoken at present is plainly corrupt. Gabb estimates the total number of words it contains as probably not exceeding fifteen hundred. Some of these, though Gabb thinks not very many, are borrowed from the Spanish ; but it is significant, that among them is the pronoun "that," the Spanish *ese*.

* *Apuntes Lexicograficos de las Lenguas y Dialectos de los Indios de Costa-Rica.* Por Bernardo Augusto Thiel, Obispo de Costa-Rica (San José de Costa-Rica, 1882. Imprenta Nacional).

Let us now examine the Bri-Bri verb, said to be so singularly simple. We are at once struck by Mr. Gabb's remark (just after he has been speaking of their unparalleled simplicity) that the inflections he gives "have been verified with as much care as the difficulties of the case would admit." Evidently, then, there were difficulties. What they are become apparent when we attempt to analyze the forms of the eighteen brief paradigms which he gives.

The personal pronouns are

je, I.	*sa*, we.
be, thou.	*ha*, you.
ye, he, etc.	*ye-pa*, they.

These are both nominative and objective, personal and, with the suffix *cha*, possessives.

The tenses are usually, not always, indicated by suffixes to the theme; but these vary, and no rule is given for them, nor is it stated whether the same theme can be used with them all. Thus,

To burn, *ĭ-norka.*	Present, *i-nyor-ket-ke.*
To cook, *i-lu'.*	" *ĭ-luk.*
To start, *i-be-te.*	" *i-be-te.*

Here are three forms for the present, not explained. Are they three conjugations, or do they express three shades of meaning, like the three English presents? I suspect the latter, for under *ikiana*, to want, Gabb remarks that the form in-*etke*, means "he *wants* you," *i. e.*, is emphatic.

The past aorist has two terminations, one in *-na*, and one in *-e*, about the uses and meaning of which we are left equally in the dark.

The future is utterly inexplicable. Even Prof. Müller, just after his note calling attention to the "great simplicity" of the tongue, is obliged to give up this tense with the observation, "the structural laws regulating the formation of the future are still in obscurity!" Was it not somewhat premature to dwell on the impliscity of a tongue whose simplest tenses he acknowledges himself unable to analyze?

The futures of some verbs will reveal the difficulties of this tense:—

To burn, *i-nyor-ka;*	future, *i-nyor-wane-ka.*
To cook, *i-lu';*	" *i-lu'.*
To start, *i-bete';*	" *i-bete.*
To want, *i-ki-ana;*	" *i-kie.*
To count, *ishtaung;*	" *mia shta'we.*

In the last example *mia*, is the future of the verb, *imia*, to go, and is used as an auxiliary.

The explanation I have to suggest for these varying forms is, either that they represent in fact that very "multiplicity of tense-formations" which Humboldt alluded to, and which were too subtle to be apprehended by Mr. Gabb within the time he devoted to the study of the language; or that they are in modern Bri-Bri, which I have shown is noticeably corrupted, survivals of these formations, but are now largely disregarded by the natives themselves.

Signs of the incorporative plan are not wanting in the tongue. Thus in the objective conjugation not only is the object placed between subject and verb, but the latter may undergo visible synthetic changes. Thus:

Je be sueng.

I thee see.

Ke je be wai su-na.

Not I thee (?) see-did.

In the latter sentence *na* is the sign of the past aorist, and the verb in synthesis with it drops its last syllable. The *wai* Gabb could not explain. It will be noticed that the negative precedes the whole verbal form, thus indicating that it is treated as a collective idea (holophrastically).

Prepositions always appear as suffixes to nouns, which, in composition, may suffer elision. This is strictly similar to the Nahuatl and other synthetic tongues.

Other examples of developed synthesis are not uncommon, as away, *imibak*, from *imia* to go, *jebak*, already.

very hot, *palina*, from *ba* + *ilinia*.

The opinion that the Bri-Bri is at present a considerably corrupted and worn-down dialect of a group of originally highly synthetic tongues is borne out by an examination of the scanty materials we have of its nearest relations.

Thus in the Terraba we find the same superfluous richness of pronominal forms which occurs in many South American tongues, one indicating that the person is sitting, another that he is standing, a third that he is walking.*

The Brunca has several distinct forms in the present tense: I eat, *cha adeh*, and *atqui chan* (*atqui* = I).

Although Bishop Thiel supplies a number of verbal forms from this dialect, the plan of their construction is not obvious. This is seen from a comparison of the present and perfect tenses in various words. The pronouns are $\frac{1}{3}$ $\begin{cases} \textit{atqui}, \text{ I.} \\ \textit{ique}, \text{ he.} \end{cases}$

For instance :—

Brunka Verbal Forms.

To kill (radical, *ai*).

Present, I kill, *cha atqui i aíra.*

Perfect, he has killed, *iang i aíc.*

To die (radical, *cojt*).

Present, I die, *cójo drah.*

Perfect, he has died, *cojt crah.*

To hear (radical, *dój*).

Present, I hear, *aari dój ograh.*

Perfect, I have heard, *aqui dój crah.*

*Gabb, ubi suprá, p. 539.

To forget.

Present, I forget, *atqui chita uringera.*

Perfect, I have forgotten, *ochita úringea.*

These examples are sufficient to show that the Brunka conjugations are neither regular nor simple, and such is the emphatic statement of Bishop Thiel, both of it and all these allied dialects. In his introduction he states that he is not yet ready to offer a grammar of these tongues, though well supplied with lexicographical materials, and that "*their verbs are especially difficult.*"*

The Cabecar dialect, in which he gives several native funeral poems, without translations, is apparently more complicated than the Bri-Bri. The words of the songs are long and seem much syncopated.

The Tupi-Guarani Dialects.

Several writers of the highest position have asserted that these dialects, spoken over so large a portion of the territory of Brazil, are neither polysynthetic nor incorporative. Thus the late Prof. Charles F. Hartt in his "Notes on the Lingoa Geral or Modern Tupi," expressed himself:—"Unlike the North American Indian tongues, the languages of the Tupi-Guarani family are not polysynthetic in structure."† With scarcely less positiveness Professor Friedrich Müller writes :—"The objective conjugation of the Tupi-Guarani does not show the incorporation usually seen in American languages, but rather a mere collocation."‡

It is, I acknowledge, somewhat hazardous to venture an opinion contrary to such excellent authorities. But I must say, that while, no doubt, the Tupi in its structure differs widely from the

* "Especial dificultad ofrecen los verbos." *Apuntes Lexicograficos*, etc. Introd. p. iv. This expression is conclusive as to the incorrectness of the opinion of M. Adam, and Prof. Müller above quoted, and shows how easily even justly eminent linguists may fall into error about tongues of which they have limited means of knowledge. The proper course in such a case is evidently to be cautious about venturing positive assertions.

† *Transactions of the American Philological Association*, 1872, p. 58.

‡ *Grundriss der Sprachwissenschaft*, Bd. ii, p. 387.

Algonkin or Nahuatl, it yet seems to present unmistakeable signs of both an incorporative and polysynthetic character such as would be difficult to parallel outside of America.

I am encouraged to maintain this by the recent example of the erudite Dr. Amaro Cavalcanti, himself well and practically versed in the spoken Tupi of to-day, who has issued a learned treatise to prove that "the dialects spoken by the Brazilian savages present undoubtedly all the supposed characteristics of an agglutinative language, and belong to the same group as the numerous other dialects or tongues of America."* Dr. Cavalcanti does not, indeed, distinguish so clearly between agglutinative and incorporative languages, as I should wish, but the trend of his work is altogether parallel to the arguments I am about to advance.

Fortunately, we do not suffer from a lack of materials to study the Tupi, ancient and modern. There are plenty of dictionaries, grammars and texts in it, and even an "Ollendorff's Method," for those who prefer that intellectual (!) system.†

All recent writers agree that the modern Tupi has been materially changed by long contact with the whites. The traders and missionaries have exerted a disintegrating effect on its ancient forms, and often directly in the line of erasing their peculiarities, to some of which I shall have occasion to refer.

Turning our attention first to its synthetic character, one can-

* *The Brazilian Language and its Agglutination.* By Amaro Cavalcanti, LL.B., etc., p. 5 (Rio Janeiro, 1883).

† The most valuable for linguistic researches are the following:

Arte de Grammatica da Lingua mais usada na Costa do Brazil. By Joseph de Anchieta. This is the oldest authority, Anchieta having commenced as missionary to the Tupis in 1556.

Arte, Vocabulario y Tesoro de la Lengua Guarani, ó mas bien Tupi. By Antonio Ruiz de Montoya. An admirable work representing the southern Tupi as it was in the first half of the seventeenth century.

Both the above have been republished in recent years. Of modern writings I would particularly name:

Apontamentos sobre o Abañeênga tambem chamado Guarani ou Tupi. By Dr. B. C. D'A. Nogueira (Rio Janeiro, 1876).

O Selvagem i Curso da Lingua Geral. By Dr. Couto de Magalhaes (Rio de Janeiro, 1876).

not but be surprised after reading Prof. Hartt's opinion above quoted to find him a few pages later introducing us to the following example of "word building of a more than usually polysynthetic character." *

akáyu, head ; *ayú*, bad.

akayayú, crazy.

muakayayu, to seduce (make crazy).

xayumuakayayú, I make myself crazy, etc.

Such examples, however, are not rare, as may be seen by turning over the leaves of Montoya's *Tesoro de la Lengua Guarani.* The most noticeable and most *American* peculiarity of such compounds is that they are not collocations of words, as are the agglutinative compounds of the Ural-Altaic tongues, but of particles and phonetic elements which have no separate life in the language.

Father Montoya calls especial attention to this in the first words of his *Advertencia* to his *Tesoro.* He says:—"The foundation of this language consists of particles which frequently have no meaning if taken alone; but when compounded with the whole or parts of others (for they cut them up a great deal in composition) they form significant expressions; for this reason there are no independent verbs in the language, as they are built up of these particles with nouns or pronouns. Thus *ñemboé* is composed of the three particles *ñe*, *mo*, *e.* The *ñe* is reciprocal ; *mo* an active particle ; *e* indicates skill ; and the whole means 'to exercise oneself,' which we translate, 'to learn,' or 'to teach,' indeterminately; but with the personal sign added, *anemboe*, 'I learn'."

This analysis, which Montoya carries much further, reminds us forcibly of the extraordinarily acute analysis of the Cree (Algonkin) by Mr. James Howse.† Undoubtedly the two

* *Notes on the Lingoa Geral*, as above, p. 71.

† James Howse, *A Grammar of the Cree Language* (London, 1844). A remarkable production which has never received the attention from linguists which it merits.

tongues have been built up from significant particles (not words) in the same manner.

Some of these particles convey a peculiar turn to the whole sentence, difficult to express in our tongues. Thus the element *é* attached to the last syllable of a compound gives an oppositive sense to the whole expression; for example, *ajur*, "I come" simply; but if the question follows: "Who ordered you to come?" the answer might be, *ajuré*, "I come of my own accord; nobody ordered me."*

Cavalcanti observes that many of these formative elements which existed in the old Tupi have now fallen out of use.† This is one of several evidences of a change in structure in the language, a loss of its more pliable and creative powers.

This synthesis is also displayed in the Tupi, as in the Cree, by the inseparable union of certain nouns with pronouns. The latter are constantly united with terms of consanguinity and generally with those of members of the body, the form of the noun undergoing material modifications. Thus:

tete, body; *cete*, his body; *xerete*, my body.

tuba, father; *oguba*, his father; *xerub*, my father.

mymbaba, domestic animal; *gueymba*, his domestic animal.

tera, name; *guera*, his name.

Postpositions are in a similar manner sometimes merged into the nouns or pronouns which they limit. Thus: *tenonde*, before; *guenonde*, before him.

It appears to me that the substratum, the structural theory, of such a tongue is decidedly polysynthetic and not agglutinative, still less analytic.

Let us now inquire whether there are any signs of the incorporative process in Tupi.

We are at once struck with the peculiarity that there are two special sets of pronouns used with verbals, one set subjective

* Anchieta, *Arte de Grammatica*, etc., p. 75.

† *The Brazilian Language*, etc., pp. 18–9.

and the other objective, several of which *cannot be employed in any other construction.** This is almost diagnostic of the holophrastic method of speech. The pronouns in such cases are evidently regarded by the language-faculty as subordinate accessories to the verbal, and whether they are phonetically merged in it or not is a secondary question.

The Tupi pronouns (confining myself to the singular number for the sake of brevity) are as follows:

Independent personals.	Possessives.	Verbal affixes. Subject.	Object.
ixe or *xe*.	*se* or *xe*.	*a*.	*xe*.
inde or *ne*.	*ne* or *re*.	*re*, *yepe*.	*oro*.
ae or *o*.	*ae* or *i*.	*o*.	*ae* or *i*.

The verbal affixes are united to the theme with various phonetic changes and so intimately as to form one word. The grammars give such examples as:—

areco, I hold; *guereco*, they hold him.
ahenoi, I call; *xerenoi*, they call me.
ayaca, I dispute him; *oroaca*, I dispute thee.

In the first person, singular, the two pronominal forms *xe* and *a* are usually merged in the synthesis *xa;* as, *xamehen*, I love.

Another feature pointing to the incorporative plan is the location of the object. The rule in the old language was to place the object in all instances *before* the verb, that is, between the verb and its subject when the latter was other than a personal suffix. Dr. Cavalcanti says that this is now in a measure changed, so that when the object is of the third person it is placed after the verb, although in the first and second persons the old rule still holds good.† Thus the ancient Tupis would say:

boia aè o-sou,
snake him he-bites.

* See Anchieta, *Arte de Grammatica*, etc., p. 52.
† *The Brazilian Language*, etc., p. 111.

But in the modern tongue it is:

boia o-sou aè.
snake he-bites him.

With the other persons the rule is still for the object to precede and to be attached to the theme:

xeoroinca, I thee kill.
xepeinca, I you kill.
xeincayepe, me killest thou.

Many highly complex verbal forms seem to me to illustrate a close incorporative tendency. Let us analyze for instance the word,

xeremimboe,

which means "him whom I teach" or "that which I teach." Its theme is the verbal *mboe*, which in the extract I have above made from Montoya is shown to be a synthesis of the three elementary particles *ñe*, *mo*, and *e*; *xe* is the possessive form of the personal pronoun, "my"; it is followed by the participial expression *temi* or *tembi*, which, according to Montoya, is equivalent to "illud quod facio;" its terminal vowel is syncopated with the relative *y* or *i*, "him, it"; so the separate parts of the expression are:—

xe + *tembi* + *y* + *ñe* + *mo* + *e*.

I will not pursue the examination of the Tupi further. It were, of course, easy to multiply examples. But I am willing to leave the case as it stands, and to ask linguists whether, in view of the above, it was not a premature judgment that pronounced it a tongue neither polysynthetic nor incorporative.

The Mutsun.

This is also one of the languages which has been announced as "neither polysynthetic nor incorporative," and the construction of its verb as "simple to the last degree."*

* "Kein polysynthesis und keine incorporation," says Dr. Heinrich Winkler (*Uralaltaische Völker und Sprachen*, p. 149), who apparently has obtained all his knowledge of it from the two pages devoted to it by Professor Friedrich Müller, who introduces it as "äusserst einfach." (*Grundriss der Sprachwissenschaft*, Bd. ii, p. 257.

We know the tongue only through the Grammar and Phrase-Book of Father de la Cuesta, who acknowledges himself to be very imperfectly acquainted with it.* With its associated dialects, it was spoken near the site of the present city of San Francisco, California.

Looking first at the verb, its "extreme simplicity" is not so apparent as the statements about it would lead us to expect.

In the first place, the naked verbal theme undergoes a variety of changes by insertion and suffixes, like those of the Quiche and Qquechua, which modify its meaning. Thus:

Ara, to give.

Arsa, to give to many, or to give much.

Arapu, to give to oneself.

Arasi, to order to give, etc., etc.

Again:

Oio, to catch.

Oiñi, to come to catch.

Oimu, to catch another, etc.

The author enumerates thirty-one forms thus derived from each verb, some conjugated like it, some irregularly. With regard to tenses, he gives eight preterits and four futures; and it cannot be said that they are formed simply by adding adverbs of time, as the theme itself takes a different form in several of them, *aran*, *aras*, *aragts*, etc. In the reflexive conjugation the pronoun follows the verb and is united with it: As,

aragneca, I give myself,

where *ca* is a suffixed form of *can*, I; *ne*, represents *nenissia*, oneself; the *g*, is apparently a connective; and the theme is *ara*. This is quite in the order of the polysynthetic theory and is also incorporative.

Such syntheses are prominent in imperative forms. Thus from the above-mentioned verb, *oio*, to catch, we have,

oiomityuts, gather thou for me,

* *Grammatica Mutsun;* Por el R. P. F. F. Arroyo de la Cuesta; and *Vocabulario Mutsun*, by the same, both in Shea's "Library of American Linguistics."

in which *mit* is apparently the second person *men*, with a post-position *tsa*, *mintsa;* while *yuts* is a verbal fragment from *yuyuts*, which the author explains to mean "to set about," or "to get done." This imperative, therefore, is a verbal noun in synthesis with an interjection, "get done with thy gathering." It is a marked case of polysynthesis. A number of such are found in the Mutsun phrases given, as:

Rugemitithsyuts cannis, Give me arrows.

In this compound *cannis*, is for *can* + *huas*, me + for; *yuts* is the imperative interjection for *yuyuts;* the remainder of the word is not clear. The phrase is given elsewhere

Rugemitit, Give (thou) me arrows.

Without going further into this language, of which we know so little, it will be evident that it is very far from simple, and that it is certainly highly synthetic in various features.

Conclusions.

The conclusions to which the above study leads may be briefly summarized as follows:

1. The structural processes of Incorporation and Polysynthesis are much more influential elements in the morphology of language than has been conceded by some recent writers.

2. They are clearly apparent in a number of American languages where their presence has been heretofore denied.

3. Although so long as we are without the means of examining all American tongues, it will be premature to assert that these processes prevail in all, nevertheless it is safe to say that their absence has not been demonstrated in any of which we have sufficient and authentic material on which to base a decision.

4. The opinion of Duponceau and Humboldt, therefore, that these processes belong to the ground-plan of American languages, and are their leading characteristics, must be regarded as still uncontroverted in any instance.

Aus Bosnien und der Hercegovina. By Dr. Friedrich S. Krauss.

Read before the American Philosophical Society, Oct. 2, 1885.

Die Ethnographie als die Wissenschaft von der geistigen Entwicklung und dem geistigen Wachsthum und Reifen der Völker in Bezug auf ihre innersten gesellschaftlichen Einrichtungen, Sitten, Gebräuche, Volksglauben und was drum und dran sich knüpft, diese Wissenschaft ist in diesem Sinne und Umfange neu, wenn auch noch nicht modern.

Wohl hat es seit Herodot bis auf die Gegenwart eine Unzahl Reisender gegeben, die fremde Länder und Völker besuchten und über dieselben berichteten. Die s. g. Reisebeschreibungen mögen zuweilen recht werthvolle Angaben darbieten, doch unsere neue Wissenschaft kann sich damit nun und nimmer begnügen. Dank den ausgezeichneten Verkehrsmitteln der Gegenwart sind Völker und Länder auf früher unerhörte Weise einander nahe gerückt. Für den Ethnographen gibt es keine Wunder und keine Fremde mehr. Die Wissenschaft der Ethnographie spürt den seelischen Erscheinungen des Völkerlebens überall nach, trachtet ihre Wesenheiten aufs Genaueste festzustellen und ihnen auf den Grund zu kommen.

Es ist gewiss schon Namhaftes auf diesem Gebiete geleistet worden, namentlich hat der deutsche Forscher auch hier wie sonst in den Geschäften der geistigen Arbeit Bahnbrechendes geschaffen. Thatsächlich sind uns nun Völker aufs Eingehendste bekannt von den nördlichen *Čhuškeu* bis zu den *Patagoniern* auf der äussersten Südspitze Amerikas, über die man noch vor fünfzig Jahren nur sagenhafte Nachrichten besass. Leider bewährte sich auch hier die alte Bemerkung, dass weite Fremde mehr zur Betrachtung und Beobachtung reise als die Heimat. Das ist leicht begreiflich, denn das Fernliegende, Verschwommene, das undeutlich Ausgesprochene entzündet die Phantasie und spornt mehr an als das Naheliegende, das Einheimische.

Daraus erklärt sich die bedauerliche Thatsache, dass uns manche kleine Völkerschaften, die mit unserer Völkersippe in keiner Weise in Berührung stehen, fast bekannter sind als unsere nächsten Nachbaren, unsere uns durch gemeinsame Abstammung, Sprache, Sitte und Brauch enge verwandten Südslaven.

Sie werden sich verwundert fragen: „Wäre es denn möglich, dass die Südslaven nichts dazu gethan hätten, dass man über ihr Volksthum ausreichenden Bescheid von ihnen selbst erhielte?" Diese Frage ist ebenso berechtigt als der Vorwurf den einige südslavische Schriftsteller gegen mich erhoben: ‚Aber das sind ja lauter altbekannte Dinge, über welche mancher Bauer mehr weiss als Du!'

Freilich, gewisse Erscheinungen, der Gegenwart zum Mindesten, sind denjenigen zum Theil wohl bekannt, die an jenen Sitten und Gebräuchen festhalten, gerade so wie der Bauer die Pflanzen seiner Fluren, die Kräuterlerin ihre Heilwurzeln kennt. Ist aber deshalb der Bauer, der die Frucht säet und einheimst, ist die Kräutlerin bei allen ihren getrockneten Kräuterbüscheln ein Botaniker?

Die Südslaven können sich wohl einiger ausgezeichneten Sammlungen von Volksliedern, Sagen, Märchen, Sprüchwörtern und auch zweier grosser Sammelwerke über Sitten und Gebräuche berühmen. Zu einer eigentlich wissenschaftlichen Verarbeitung dieses Stoffes finden sich bei ihnen nicht viel mehr als wenige Anläufe.

Ein wüstes, brachliegendes Gebiet eröffnet sich hier dem Forscher. Die anthropologische Gesellschaft in Wien nahm sich der Sache zuerst an, um die Wissenschaft der südslavischen Ethnographie allzeitig zu hegen und zu pflegen.

Von der Gesellschaft ermuntert, publizirte ich in ihren Mittheilungen zwei grössere Abhandlungen über südslavische *Pest- und Hexensagen*, und bald darauf wieder im Auftrage der Gesellschaft, auf Grundlage zahlreicher gedruckter und ungedruckter heimischer Quellen, mein grosses Werk *Sitte und Brauch der Südslaven.* Durch die Veröffentlichung eines ethnographischen Fragebogens über die Südslaven—der Bogen enthält an tausend Fragen—hat sich die Gesellschaft ein besonderes Verdienst um die Erforschung südslavischen Volksthums erworben. Wohl gelangten die meisten Fragen zur Beantwortung, dies allein konnte aber nicht genügen, deshalb sandte mich die Gesellschaft im Sommer des Vorjahres auf eine ethnographische Forschungsreise nach dem Balkan aus, damit ich an Ort und Stelle Erhebungen pflege.

Vor Kurzem habe ich meine Reise beendet. Ich begieng einen Theil von Slavonien und Dalmatien, hauptsächlich aber das Occupationsgebiet, Bosnien und die Hercegovina.

Der Weg den ich durchgemessen beträgt nicht viel mehr als Dreitausend Km. Auf den ersten Blick gewiss wenig im Verhältniss zu der aufgewandten Zeit. Im Flug und im Vorübergehen gewinnt man aber keine bedeutenden ethnographischen Ergebnisse. Hier gilt es unermüdlich beobachten und wieder beobachten. Die Geheimnisse des Volkslebens müssen abgelauscht, können nicht mit Hast ergriffen werden.

Ich bereiste die Flussgebiete der *Bosna* mit ihren Hauptzuflüssen der *Bobovača, Lašva, Tešanjka* und der *Spreča,* ferner das Gebiet der *Drina* und der *Drinača,* des *Vrbas,* der *Neretva* und der *Rama* und der *Cetina* und den grössten Theil des ebenen bosnischen Lavelandes.

Das hatte seinen guten Grund, denn längs der Flüsse wohnt immer eine dichtere und reichere ackerbautreibende Bevölkerung, bei welcher sich die Aeusserungen des Volksgeistes reger bethätigen als bei dem vereinzelt im Hochgebirge hausenden Hirten. Indessen besuchte ich auch das ganze Hochgebirge der *Majevica* und der *Treskavica planina* und zog von *Livno* über das Hochplateau von *Malovan* nördlich bis zu den Ausläufern des *Kunar,* des *Otrosa* und der *Orahovica.*

Der Reiseplan hätte gewiss noch zweckmässiger eingerichtet sein können, wäre es mir nur möglich gewesen irgendwie vor der Reise die ethnographischen Verhältnisse des Landes genauer kennen zu lernen. Wohl bewahrheitet sich hier ein altes Wort in neuer Fassung: „Der Zigeuner, der Hausirer und der Ethnograph finden überall eine Auslese.“ Uebrigens lächelte mir auf meiner Reise sonniges Glück zu, indem ich ein ethnographisches Material in unerhörter Menge und von unschätzbarem Werthe aufgesammelt. Der blosse Abdruck dieses Stoffes dürfte bei sieben starke Bände in Grossoctav umfassen. Mehr als in flüchtigen Umrissen die Art dieses Stoffes anzudeuten, ist nicht möglich innerhalb des engen Rahmens dieses Vortrages.

Bosnien und die Hercegovina werden von nahezu 1,300,000 Seelen bewohnt. Davon sind bei 600,000 Mahomedaner, etwas weniger Altgläubige, bei 200,000 Katholiken und an fünftausend Juden, spanischer Abstammung. Letztere bedienen sich untereinander im Umgange eines verballhornten Spanisch, leben von der übrigen Bevölkerung streng abgesondert und haben ihre eigenen gesellschaftlichen und religiösen Gebräuche, die in Vielem von den Gebräuchen deutscher Juden abweichen.

Die allgemeine Landessprache besteht hauptsächlich aus zwei von einander unwesentlich verschiedenen Mundarten, der serbische-kroatischen Schriftsprache. Richtiger gesagt, die angenommene Schriftsprache ist ein Abklatsch der besonderen hercegovinischen Mundart, die von *Trebinje* und *Gacko* gesprochen wird.

Ethnographisch betrachtet hat man *ein* Volk vor sich, in Wirklichkeit aber begegnet man drei durch religiöse Anschauungen, Erziehung und Bildung streng abgesonderten Religionsekten. Nur dem Ethnographen gelten Sprachgrenzen als Grenzen eines Volkes. Eine solche Auffassung kann sich freilich nur bei einem geistig hochstehenden Culturvolke allgemeineren Eingang verschaffen.

Frägt man einen Deutschen oder einen Franzosen oder einen Engländer: ‚Was bist Du?‘ so wird der Deutsche antworten, er sei ein Deutscher, der Franzose ein Franzose, der Engländer ein Engländer. Frage man einen Bošnjaken und er nennt sich entweder einen Türken oder Altgläubigen oder Katholiken.

Seine Sprache heisst der Bosnier sowohl als der Hercegoviner die *bosnische* oder gewöhnlich *‚unsere Sprache‘ naški.* Diese „unsere“ Sprache wimmelt von allen möglichen türkischen, arabischen und zum Theil persischen, deutschen, griechischen, albanesischen, italienischen und magyarischen Bezeichnungen für die gewöhnlichsten Gegenstände des Alltagslebens. Jedes sechste Wort ist ein Fremdwort. Sowohl das Haupt- als das Zeitwort erfuhren dabei slavische Wandlungen. In syntaktischer Beziehung hat die türkische Sprache vielfach auf die slavische eingewirkt, so wie sich ein nachhaltiger Einfluss auch im Sagen und Märchenschatze des Volkes unverkennbar geltend macht.

Ein ethnographisches Curiosum bildet die handschriftlich weit verbreitete mahomedanisch-slavische Kunstliteratur. Es sind dies Lieder meist lehrhaften Inhaltes zu Schulzwecken nach arabischen Vorbildern angefertigt. Hier ist jedes zweite Wort ein Lehnwort. Form und Inhalt dieser Lieder widerstreben ganz und gar dem slavischen Geiste.

Geschrieben sind diese Werkchen mit türkischen Schriftzeichen. Von den Mahomedanern sind wohl über 60% des Schreibens und Lesens türkisch kundig. Die altbosnische *Glagolica* ist gegenwärtig dem Volke unbekannt, nur in einigen mahomedanischen Adelsfamilien, z. B. bei den *Čengić* in Sarajevo und bei den *Ljubavić* in der Hercegovina noch im inneren Verkehr in Uebung. Da der Handel und das Gewerbe fast ausschliesslich von altgläubigen Serben betrieben wird, so ist es natürlich dass die cyrillische Schrift mehr als jede andere täglich an Verbreitung gewinnt. Der Bauer auf den Dörfern benützt dagegen Kerbstöcke, selbst zu Mittheilungen, statt eines Briefes, da die Kerbezeichen auf althergebrachten Ueberlieferungen beruhend, überall im Lande gekannt sind. Die Kerbe sind zum Theil der Glagolica, zum Theil den römischen Zahlzeichen nachgebildet. Auch rechnet der Bauer wesentlich mit römischen Zahlzeichen, wie der Römer vor 2000 Jahren.

In Bosnien wohnt der reichere Mahomedaner in einstöckigen, unsauberen Holzhäusern mit gewaltigen Thurmdächern. Erkennbar ist das Haus jedes Mahomedaners an der spitzen Wetterstange auf dem Dache und an der hohen Verzäunung, die den Einblick in den Hofraum wehrt. Arme Leute wohnen in niedrigen, schmutztriefenden Hütten. So sieht der verkörperte Jammer aus. In der Hercegovina sind bei Arm wie Reich die Behausungen nach dalmatinischer Art aus Stein gebaut, denn das Land ist zu dreiviertel gräulich entwaldet. Da kann man oft einen ganzen Tag reisen ohne einen schattenspendenden Baum zu finden. Die Hercegovina ist ein versteinertes Elend.

Die Städte sind nichts anderes als grosse Dörfer, deren Bewohner sich zumeist von Ackerbau und Viehzucht nähren. Die heimische Industrie arbeitet jetzt so wie vor Jahrhunderten und vermag kaum den Bedürfnissen der anspruchslosen Bevölkerung gerecht zu werden. Da die Städte zumeist an den Abhängen steiler Anhöhen oder in Schluchten erbaut sind, wo sie von starker Befestigung beschützt wurden, so ist nur bei wenigen Städten Wachsthum und Entwicklung von Vorneherein möglich. Ungesund und unrein sind alle, sammt und sonders.

Die Dörfer bestehen aus weit von einander abgelegenen Gehöferschaften, von welchen manche für sich ein kleines Dorf bilden, da noch die Hausgemeinschaft mit zahlreichem Kopfbestande ziemlich häufig ist. So z. B. leben in dem Dorfe *Gornja Dragunja* bei Srebrenik sieben verheiratete Brüder Martinovič sammt ihren Nachkommen und Seitenverwandten in einer Hausgemeinschaft. In der Hercegovina ist diese gesellschaftliche Einrichtung weitaus seltener, weil die Lebensbedingungeu für grosse Familien von der Natur nicht gegeben sind. Indessen bildet als Ersatz für die Hausgemeinschaft die Bruderschaft (*bractvo*) und der *Stamm* (plene) ein die kleineren Hausbestände einigendes Band.

Bedeutsam sind unter den Baulichkeiten im Lande die zahllosen Rundthürme mit Auslugwarten und die zerfallenen Burgen, deren man überall welche findet.

Auf jedem Hügel, auf jeder Anhöhe mit weitem Fernblick steht noch oder stand einst eine Veste. Selten sind welche Namen von den Ruinen bekannt, man nennt sie einfach bloss *Kula* oder *Grad.*

Ebenso wenig oder, genau gesagt, gar nichts weiss das Volk über die altbosnischen Gräber und Tunnele sachliches zu berichten. Solcher Gräber sah ich an 12,000; ihre Zahl in Bosnien und der Hercegovina dürfte leicht das Dreifache davon betragen.

Dieses Dunkel über die Vergangenheit findet darin seine Erklärung, dass die alte Bevölkerung von Bosnien und der Hercegovina vor zweihundert Jahren einem mächtigen Andrange neuer Ansiedler weichen musste.

Nachdem die mahomedanischen Slaven, die doch den Grundstock der türkischen Macht in Europa bildeten, Ungarn, Kroatien und Slavonien räumen mussten, zogen die mahomedanischen Likaer in die obere Krajina von Banjaluka bis Udbina, *Skoplje, Livno* und *Glamoč*; die slavonischen Mahomedaner besiedelten die Hercegovina und Mittelbosnien, während die Mahomedaner aus Ungarn das ganze Drinagebiet, sowohl auf der serbischen Seite als auf bosnischer, von *Rača* bis *Srebrenica* und die *Treskavica* bis *Olovo* und *Maglaj* und die Romanija für sich in Anspruch nahmen. Die christliche Bevölkerung musste diesem Ansturm weichen. Zu jener Zeit wanderten die Bosnier nach Slavonien und Kroatien, die Hercegoviner nach der Cruagora, Serbien und Dalmatien aus. Dagegen zogen gegen die Mitte des vorigen Jahrhundertes bei hunderttausend Dalmatiner nach Ostbosnien ein. Also erklärt es sich, wie in Slavonien die alte *ikavische* und in *Dalmatien* die kroatische *čakavische* Mundart durch die bosnisch-hercegovinische verdrängt worden, während die letzere durch ihre weite geographische Ausbreitung zur allgemeinen Verkehrssprache der Südslaven sich erhob.

Ueber diese Vorgänge erhält man durch die Heldenlieder, die zu den Gusle gesungen werden, klarsten Aufschluss, denn die Auswanderer und Einwanderer haben die Thaten ihrer Vorfahren getreulich im Liede verewigt. Kein Volk der Erde kann sich eines so reichen Schatzes epischer Lieder berühmen als die Südslaven, und zwar unter diesen besonders die Bosnier und noch mehr als diese die Hercegoviner.

Ich allein notirte über 60,000 Verse bloss des epischen Volksliedes und zwar hauptsächlich des mahomedanisch-slavischen.

Das Epos des katholischen Bosniers ist ganz verkümmert, wie denn überhaupt der Katholike unter der strengen Bevormundung von Seiten seiner Geistlichkeit am Wenigsten alte slavische Sitten und Bräuche beibehalten.

Unendlich reichhaltiger und mannigfaltiger ist das Volksleben der Altgläubigen, die sich Serben nennen. Ihre Geistlichkeit ist nicht zum geringsten Theil so gut wie illiterat und unterschied sich bis vor der Occupation äusserlich durch nichts als durch langen Bart und lange Haare von der übrigen Bevölkerung. Der Priester war Bauer, Wirth oder Kaufmann, wie sonst einer im Lande.

Das kirchliche Ceremoniell übte keinen bedeutenden Einfluss aus, so dass der Bauer an uralthergebrachten heidnischen Vorstellungen noch immer festhält. *Vile* (Waldfräulein), *Divi* (Riesen), *Mora* (die Trut oder Mar), *Vještice* (Hexen) und noch eine schwere Menge derartiger mystischer Gestalten sind ihm gerade so wie den Mahomedanern thatsächliche Wesen. Noch feiert der Serbe, wie sein Urvorfahr vor eintausend Jahren, das Sippenfest und das Fest der winterlichen und sommerlichen Sonnenwende.

Alle drei Sekten huldigen aber einem gemeinsamen Alltags-Aberglauben, einem wahnwitzvollen Gemisch unverdauter östlicher und westlicher Angstbrauereien.

Mädchenraub oder, milder gesagt, Entführung kommt noch ziemlich häufig vor und gilt als Heldenthat. Polygamie gestatten sich nur reichere Mahomedaner. Das Weib ist dem Bošnjaken ein unbesoldeter Knecht für Alles.

Merkwürdig ist auf jeden Fall der überhandnehmende Brauch, dass das Mädchen von selbst zu ihrem Auserwählten ins Haus kommt. Eine solche wird *samodošla* oder *uskočica* genannt. Die Trauung findet oft erst nach Jahren statt. Dabei ersparten die Eltern die Ausstattung, der Bräutigam den kostspieligen Hochzeitsschmaus.

Das epische Lied des Serben is wesentlich ein Rachegesang des Unterdrückten und Verzweifelten, der den Mahomedaner für vogelfrei erklärt. Daraus haben sich Rechtsanschauungen heraus entwickelt, die vielfach von den altslavischen abweichen. Ein grosser Theil dieser Lieder ist nach einer gewissen Schablone gearbeitet und strotzt von sagenhaften Uebertreibungen. Uebrigens ist der Grundstock dieser Lieder schon früher gesammelt worden.

Es ist kein Uebelwollen, wenn ich behaupte, dass man auf Grund dieser serbischen Lieder das südslavische Volksthum in seiner Allgemeinheit nicht beurtheilen darf. Mir war es gegönnt, an einem unendlich reicheren und klareren Borne der Volksdichtung zu schöpfen und zwar die mahomedanisch-slavische Epik zu entdecken.

Der slavische Mahomedaner stand zu dem Sultan in Konstantinopel im Verhältniss des Feudalherrn gegenüber dem obersten Lehensgeber. Die Lehenspflicht bestand darin, dass der Slave die Reichsgrenzen gegen Deutschland zu vor feindlichen Einfällen bewachen musste. Sonst war er unumschränkt Herr und Gebieter und durfte selbst auf eigene Faust Feldzüge unternehmen. Hier lernt man den Südslaven als Sieger in grossen Kriegsunternehmungen kennen—einen Slaven, der abenteuerlustig bis nach Italien, Malta und Egypten zur See, und zu Lande bis Hermannstadt und Wien vordringt, und seine alte Sitte und seiner Vorfahren Brauch als Panier hochhält. Der Mahomedanismus war zu jener Zeit für den Slaven nur ein Deckmantel ; deshalb spielt das religiöse Moment bei den Kriegszügen fast gar keine Rolle. Hier haben wir ein allseitig ausgebildetes slavisches Ritterthum vor uns, mit allen den uns durch mittelalterliche Dichtung wohlbekannten Ritterspielen, Gelagen, Mädchenpreisen bei Wettrennen und dergl. Und auch der Sänger fehlte nie.

Nur der Freie hat ein freies Lied. Der slavische Mahomedaner ist mit Nichten der Fanatiker, als den ihn Priester anderer Religionen verschrieen. In seinen Liedern erkennt er des Nichtmahomedaners Tugenden ebenso gerecht an als wären es die seinigen. Selbst der eigenen erlittenen Niederlagen schämt er sich nicht. Sein Epos ist, wie das der alten Griechen, objectiv gehalten, grossartig in der Darstellung und zuweilen von einer bedeutenden Gedankentiefe. Welch gewaltige Selbstironie liegt z. B. in den Worten, mit welchen der Sänger die Schilderung einer Schlacht bei *Mohač* abschliesst:

Bilojada i tamo i amo.
Sve je polje Khrvca potopila,
Crna khrvca turska ko i vlaška.
Tupo khrvi vlah i turčinbraća.

Jammer gab es drüben so wie hüben.
Ueberschwemmt vom Blute war das Schlachtfeld.
Schwarz ist gleich das Blut von Christ wie Türke,
Türke und Christ sind hier durch Blut verbrüdert.

Das mahomedanisch-slavische Lied gestattet uns den weitesten Einblick in die Verhältnisse der engeren Familie, der Sippe und des Stammes. Die Rechtsverwicklungen, welche Anlass zu verschiedenen Fehden geboten, und wie diese Fehden ausgetragen wurden, machen uns mit den slavischen Rechtsanschauungen auf's Eingehendste vertraut, zeigen uns den Südslaven als bedeutsames Glied in der Kette indogermanischer Völkerschaften.

In Mostar erscheinen in wenigen Tagen zwei Büchlein solcher Lieder und in Ragusa werden gegenwärtig zwei grosse Epen gedruckt, von welchen das eine, *Smailagić Meho*, 2173 Verse, das andere, *Golotinja Bogjulagić Ibro*, 1725 Verse zählt. Ein reichhaltiger Commentar erleichtert das Verständniss der Dichtungen. Die zwei letzteren Epen behandeln Episoden aus der Abenddämmerung türkischer Macht in Ungarn, wo die Tüchtigkeit der türkischen Waffen schon der Vergangenheit angehörte, wo der mahomedanische Slave allein noch der Schützer des Reiches war. Hätte sich durch irgend einen Zufall das ganze Südslaventhum um die grüne Fahne des Propheten geschaart, wohl wäre die serbische Sprache von Wien bis Konstantinopel zur allgemeinen Volkssprache geworden. Die tausend slavischen Lehnworte im magyarischen Sprachschatze sind während der hundertundsechzigjährigen mahomedanisch-slavischen Herrschaft in Ungarn aufgenommen worden, nicht aber, wie man annimmt, zur Zeit der magyarischen ersten Einwanderung. Aus diesen Liedern erwirbt man Kenntniss über ethnographische Verhältnisse einer Zeit, über die uns sonst keine ausreichenden Nachrichten zur Verfügung stehen.

Doch nicht bloss inhaltlich, sondern auch formell, sind die mahomedanisch-slavischen Lieder bemerkenswerth. Diese Lieder sind Meisterstücke volksthümlicher Erzählungskunst. Nicht fünf Verse könnte man daraus ausscheiden, ohne das Ganze zu schädigen. Solche Schöpfungen eines urwüchsigen Volksgeistes gehören, ebenso wie die Homerischen Gesänge und das Nibelungenlied, der Weltliteratur an.

Ausser den 60,000 Versen meiner Sammlung erlangte die Gesellschaft von Herrn Prof. *Miroslav Alačević* in *Spalato* eine ungedruckte Sammlung dalmatinischer epischer Volkslieder. Diese Sammlung zählt über 30,000 Verse. Ferner sind uns noch von anderen Correspondenten von allen Seiten des slavischen Südens über 50,000 Verse, nebst zahlreichen anderen Beiträgen zur Volkskunde eingeschickt worden, so dass wir mit gerechtem Stolze behaupten dürfen, dass durch die Verarbeitung und Veröffentlichung dieses gewaltigen Stoffes das Südslaventhum in ethnographischer Hinsicht endlich auch eine der neuen Wissenschaft würdige Beleuchtung erfahren wird. Das kann dann, als das endgiltige Ergebniss meiner Reise gelten.

Catalogue of the Species of Batrachians and Reptiles contained in a collection made at Pebas, Upper Amazon, by John Hauxwell. By E. D. Cope.

(Read before the American Philosophical Society, October 2, 1885.)

The contents of a previous collection made at Pebas by Mr. Hauxwell are enumerated in the Proceedings of the American Philosophical Society for 1870, page 553. It included ten species of batrachians, four of lizards, and nine of snakes. The present collection embraces six species of batrachians, eleven of lizards, and fifteen species of snakes. The total number of species obtained is, fifteen batrachians, fourteen lizards, and twenty-three species of. snakes. A considerable collection was made in the same region by the late Professor Orton, and the species are enumerated and described in the Journal of the Philadelphia Acadamy of 1875, p. 159. A previous collection, made by Professor Orton, is described in the Proceedings of the Philadelphia Academy for 1868, and one from Western and Central Peru is reported on in the Proceedings of the American Philosophical Society for 1877. These collections form the basis of a general review of the herpetology of Peru, which the writer hopes to publish with illustrations at no distant day.*

* Some species were obtained in the same region by Prof. Steere of Ann Arbor, Mich., and my thanks are due to this gentleman for the opportunity of examining them. From near Tarapota come the following species: *Dendrobates trivittatus* Spix; *Leptodactylus pœcilochilus* Cope; *Neusticurus ecpleopus* Cope; *Polychrus marmoratus* L. From Tombez: *Bufo hæmatiticus* Cope; *Hyla phæota* Cope.

From the Mamoré River in Eastern Bolivia, Dr. E. R. Heath presented to the museum of Ann Arbor the following species: 1. *Amphisbæna alba* L.; 2. *Pseudoëryx mimeticus* sp. nov. The genus Pseudoëryx Tsch., 1826, is the *Hydrops* Wagler, 1830, and *Dimades* Gray, 1843. It includes two banded species, the present

Batrachia.

Hyla favosa, sp. nov.

The internal nares are about as large as the choanæ, and are a little longer than wide. The patches of vomerine teeth are between them, opposite a point anterior to their middle. The head is short and wide, and the canthus rostralis is rounded and concave. The muzzle is truncate viewed in profile, and the nostrils, though opening laterally, are terminal in position. The tympanum is small, being one-half the long diameter of the eye-slit, or a little less than half that of the eyeball. It is a little larger than the digital palettes of the anterior foot. On all the upper surfaces the skin is smooth. The usual areolation covers the abdomen and part of the femora. The three external fingers are about half webbed, the web not reaching the palettes of the third and fifth digits. The toes are more than half webbed, the membrane reaching the dilatations of all the toes except the fourth, where it reaches the base of the penultimate phalange. When the posterior limb is extended, the heel reaches the front border of the orbit. The upper arm is bound to the side for the greater part of its length by a strong extension of the skin. A trace only is seen at the anterior base of the femur.

one and the *P. plicatilis* Linn., and two ringed species, the *P. martii* Spix and *P. callostictus* Gthr. The *P. mimeticus* has a remarkable resemblance to the *Hydrocalamus quinquevittatus* (D. & B.) Cope, Proceeds. Amer. Philos. Soc., 1884, p. 176. The scuta of the head are as in the *P. plicatilis.* Dorsal region brown for a width of five and two half rows of scales. Sides, on the third and fourth and half of the second and fifth rows, marked with a black band, which extends from the orbit to end of the tail, and is yellow-bordered above. Below yellow with two small brown spots on each gastrostege and one on each urostege. Lips black, yellow spotted; a yellow band from eye to angle of mouth. A few small blackish spots on top of muzzle. Gastrosteges 163; anal 1–1; urosteges 35. Total length M. .490; of tail .056. 3. *Liophis almadensis* Wagl. 4. *Herpetodryas fuscus* Linn. 5. *Xenodon bipræoculis*, sp. nov. Body much compressed, and scales in nineteen longitudinal rows, and scarcely alternating. Anal plate entire. Eye large, profile convex. Superior labials eight, fourth and fifth entering orbit; seventh very wide above. Oculars 2–2, the anterior narrow, permitting the posterior angle of the large loreal to almost reach the orbit. Temporals 1–3; the anterior as deep as long. Both internasals and prefrontals a little wider than long. Frontal large, wide in front, longer than common suture of parietals. Parietals as wide as long. Ten inferior labials, the sixth much the largest. Geneials very short, the anterior a little the longer. Gastrosteges, 136; urosteges, 44. Color above olivaceous with three rows of equidistant spots. These are composed of coarse, black punctulations, and are without definite outline. Every third spot of the median line is in the centre of a pale ground, while the pairs between are connected by a dark shade. Inferior surfaces yellow; every other, or every second gastrostege, with a blackish edging at each end. Top of head olive, with black punctulations symmetrically arranged, so as to leave a curved unspotted space between the orbits and on the external border of the parietals. Labial plates unspotted. A very narrow black line from eye to superior border of last labial. Total length M. .590; of tail, .101. From its compressed form and natural coil, this species might be supposed to have arboreal habits. It agrees with three other species in its entire anal plate; vis., *X. suspectus* Cope; *X. colubrinus* Günth; and *X. angustirostris* Pet. In *X. rhabdocephalus* Boie, I find the anal plate entire or divided. 6. *Elaps surinamensis* Cuv.

The color of the upper surface is a brown, which is interrupted by a coarse honeycomb or net-like pattern of a bright yellow color. The inclosed spaces are as large or larger than the eye, excepting on the sides of the head and body and on the forelimbs, where they are smaller. They are distinct on the external two digits on both feet. The posterior faces of the femur, with all the inferior surfaces are uniform brown. The eyelids are of a paler brown, but whether this is due to the condition of the specimen or not, is uncertain.

Measurements.

	M.
Length of head and body	.635
Length to line connecting posterior borders of tympana	.010
Width of head at do	.012
Length of fore limb	.0233
" " foot	.010
" " hind limb	.056
" " tibia	.019
" " posterior foot	.026
" " astragalus	.011

This species belongs to the same type as the *Hyla leucophyllata*. Its coloration is unique in the genus. An allied species or subspecies has been brought from the Purus river, Brazil, by Prof. Steere, of Ann Arbor, Mich. It agrees in all respects with the *H. favosa*, but the heel reaches the end of the muzzle, and the color of the superior surfaces differs. The yellow covers the dorsal region, an imperfect reticulate pattern being only visible on the sides of the head and body.

Hyla marmorata Daud.

Pithecopus tomopternus Cope.

Ceratophrys dorsata Wied.

Dendrobates tinctorius Schn.

Dendrobates trivittatus Spix.

Lacertilia.

Mabuia agilis Raddi.

Mionyx parietalis Cope, gen. et sp. nov.

In his monograph of the Ecpleopodine division of the Teidæ, Professor Peters referred the known species to five genera, three of which were divided into subgenera. The definitions of most of these groups were derived from the pholidosis, the exception being Iphisa (Gray), which was defined by the lack of claws on the pollices. I am of the opinion that Professor Peters was not fortunate in his selection of the pholidosis as the basis of generic and subgeneric divisions. Although such a system may associate species which agree in general appearance, and hence be thought by some to be "natural," it is certain that the various forms of scales pass into each other by such gradations, as to be unavailable for the characterization of tangible divisions. On the other hand, Professor Peters quite overlooked important characters of the squamation of the head, such as are usually found to distinguish natural genera in other families, including them only in his descriptions of the species. I propose to give a synopsis of the genera of this group as they appear to me. One result is a considerable reduction in the number of names. Agreeing with Dr. Boulenger that these species do not form a family distinct from the Teidæ, I define them as a group in that family with the nostril pierced in a single plate.

I. "Thumbs without claws."

A series of scuta on the nape ; frontonasal and frontoparietal scuta present. *Iphisa* Gray.

II. Claws all straight, conic.

No nucleal scuta ; frontoparietals and frontonasals present.. *Mionyx* Cope.

III. Claws curved, present on all digits.

a. Dorsal series of large scuta.

Scuta in separate longitudinal series ; forming keels on the tail.......... *Neusticurus* D. & B.

Scuta continuous, transverse ; frontonasal and frontoparietal scuta....... *Placosoma* Tsch.

aa. No larger series of dorsal scuta.

Frontonasals and frontoparietals present................. *Leposoma* Spix.

Frontoparietals, but no frontonasals................... *Proctoporus* Tsch.

No frontoparietals or frontonasals .... *Emphrassiotis* O'Sh.

In the above arrangement there is included, under Iphisa, *Perodactylus* R. & L. Leposoma includes nearly all the reputed genera of Peters and other authors, viz : *Loxopholis* Cope : *Cercosaura* Wagl. ; *Pantodactylus* D. & B. ; *Ecpleopus* D. & B.; *Aspidolæmnus* Pet.; *Euspondylus* Tsch. ; *Argalia* Gray (Peters) ; *Chalcidolepis* Cope ; *Xestosaurus* Pet. ; and *Pristidactylus* O'Sh. Proctoporus Tsch. includes *Pholidobolus* Pet., *Oreosaurus* Pet., and species referred to Ecpleopus by O'Shaughnessy. Of the species referred to the group Leposoma, as originally restricted, but two have the abdominal scuta acute posteriorly, viz : the *L. scincoides* Spix, and the *L. carinicaudatum* Cope. The other species referred by O'Shaughnessy and Peters to that group have, according to them, the abdominal scuta truncate posteriorly, and must hence be referred to the group Loxopholis Cope, of which *L. rugiceps* Cope is type. These are the *L. dispar* Peters, and *L. buckleyi* O'Sh. The species thus arranged will be as follows :

Mionyx parietalis Cope.
Iphisa elegans Gray.
" *modesta* R. & L.
Neusticurus bicarinatus L.
" *ecpleopus* Cope.
Placosoma cordylinum Tsch.
Leposoma scincoides Spix.
Leposoma carinicaudatum Cope.
" *rugiceps* Cope.
" *dispar* Pet.
" *buckleyi* O'Sh.
" *ocellatum* Wagl.
" *humile* Pet.
" *olivaceum* Gray.

Leposoma reticulatum O'Sh.	*Leposoma guentheri* O'Sh.
" *picticeps* Cope.	" *olivaceum* Gray.
" *vertebrale* O'Sh.	" *marmoratum* Gray.
" *schreibersii* Wiegm.	" *pœcilochilus* L. & Von M.
" *bivittatum* Cope.	" *metallicum* Cope.
" *concolor* Tsch.	" *bogotense* Pet.
" *argulus* Pet.	*Proctoporus pachyurus* Tsch.
" *gaudichaudi* D. & B.	" *unicolor* Gray.
" *affinis* Pet.	" *fraseri* O'Sh.
" *maculatum* Tsch.	" *oculatus* O'Sh.
" *rhombiferum* Gthr.	" *montium* Peters.
" *acutirostre* Pet.	" *striatus* Pet.
" *ocellatum* Gray.	" *luctuosus* Pet.
" *strangulatum* Cope.	*Emphrassiotis simoterus* O'Sh.

The species number as follows :

Mionyx	1
Iphisa	2
Neusticurus	2
Placosoma	1
Leposoma	28
Proctoporus	7
Emphrassiotis	1
Total	42

The characters of the genus Mionyx are the following : First toe of both anterior and posterior extremities with rudimental straight claw ; claws of other digits small, straight and conic. Prefrontal and fronto-parietal plates present and distinct from each other. Ear-drum exposed. No distinct collar. Femoral pores present. Pholidosis squamous, nearly homogeneous.

Char. specif. These resemble those of the group Leposoma within that genus. The scales are imbricate and keeled, with acute posterior borders above and below. When the epidermis is lost the inferior scales are nearly truncate.* The dorsal and ventral scales are subequal and form twenty-one transverse series between the anterior and posterior limbs, across the back. Behind the auricular meatus, and in the axilla, they are coarsely granular. The upper and lower arms are covered with large keeled scales, although those of the posterior side of the former are smaller than those on the anterior side. The hind leg is similarly surrounded by large keeled scales, excepting on a band on the posterior side of the femur where they are granular.

There is a transparent disk of the lower eyelid, which is covered by two scales. The plates of the head are smooth. There is a loreal plate

* The truncation of the abdominal scales in the *L. rugiceps* is seen in the epidermis as well as the true skin.

which is higher than long, and projects at an angle between two preoculars. Of these the superior is large and extends partly over the eye, leaving only three narrow superciliaries. There are four well-developed supraorbitals. The large internasal is about as wide as long. The frontonasals are well in contact by suture. The frontal is considerably longer than wide, as are also the frontoparietals. The interparietal is large, as wide as long, and would be a regular hexagon, but that the posterior border is rounded. The parietals are much smaller and trapezoidal, and longer than wide. No occipitals. Temporals small, squamous. Superior labials seven, separated from the orbit by a row of narrow suborbital scales. Inferior labials five. A symphyseal and an undivided postsymphyseal. Four infralabials, of which the first two are in contact, and the last two separated by flat scales, the fourth truncate posteriorly ; no distinct pectoral scales.

The limbs are slender ; when pressed to the side, the fingers reach to the middle of the tibia, and the toes to a little beyond the elbow. The toes themselves are weak and slender. The first digit is rudimental, and the second and fifth are very short, and of subequal length on the fore foot ; and on the posterior foot, the second is a little the longer. The third digit is shorter than the fourth on both feet. They are all protected by a single row of flat scales below. The femoral pores extend entirely across in front of the anal scuta ; there are ten on each side of the middle line. Of anal scuta there are six, arranged as follows : Two small ones on the middle line, one of which is marginal, and the other anterior to it ; one large one on each side of these, also marginal ; and a small one on the external side of these, also marginal.

Color, brown ; dark above, pale below, darkest on the sides. The exact color is probably lost, as the specimen is not in the best condition. Side of head with some yellow spots. Lips and throat white, the former with a dark brown spot on some of the labial scuta.

Measurements.	M.
Length from muzzle to vent	.032
" " " to axilla	.015
" " " to auricular meatus	.0075
Width at auricular meatus	.005
Length of fore limb	.0105
" " hand	.0035
Length of hind limb	.0145
" " tibia	.0048
" " foot	.0056

Leposoma picticeps, sp. nov.

Dorsal scales very narrow, in regular cross-series, the acute extremities of those of one row alternating with those of the rows in front and posterior ; each with a strong epidermal keel which is represented by a weak one of the true skin. These scales commence at the interparietal plate, and present nine transverse series to the axilla, and twenty from the axilla to the groin. The scales of the tail are similar. The abdominal scales are smooth and parallelogrammic, being truncate behind, and are in sixteen transverse rows between the axilla and groin. A rather wide space posterior to the auricular meatus, and posterior to the axilla is covered with granular scales. The larger and square scales of the throat are in four transverse rows of two scales each. They are separated from the cross-row that marks the axilla by two cross-rows, and are bounded by some flat scales in front and at the sides.

The internasal plate is a little wider than long. The frontonasals are well in contact. The frontal is longer than wide. The frontoparietals are as wide as long, and are regularly five-sided, the supraorbital side a little longer than the others. The interparietal is nearly three times as long as wide. The parietals are larger and their posterior border forms, with that of the interparietal, a straight line. The posterior exterior border is excavated. The loreal is higher than long, and presents an obtuse angle posteriorly between the two preoculars. Of these the superior extends posteriorly over the eye, leaving three narrow superciliaries. Three supraoculars, the posterior with a small round plate posterior to it. Temporal scales rather large, smooth ; no free marginal meatal scales. Seven superior labials ; six inferiors. A short symphyseal and a long postsymphyseal, both undivided. Posterior to the latter two pairs of large infralabials, touching on the middle line, followed by a large pair of infralabials which are separated on the middle line, each of which is followed by two large and some smaller scales.

Limbs rather short, posterior feet elongate. The fingers reach to the heel when both limbs are pressed to the side of the body, and the toes to the middle of the humerus. The limbs are covered by large, smooth scales, except on the posterior faces of the humerus and tibia, where they are smaller, and on the posterior face of the femur where they are granular. The claws are present on all the digits and are curved. Second and fifth fingers equal. Second toe longer than fifth, and fourth a good deal longer than third. Seven femoral pores and two preanals on each side. Preanal plates, seven. Of these six are marginal, a large one with a small one on each side of it, on each side of the middle line. The seventh is in front of the two median marginals, and is a large triangle.

Color, olive-brown or grayish, shaded with blackish on the head. The plates of the head have pale borders and centres, and the rostral and labial plates are yellow, the latter with a dark brown spot in the centre. A light (? yellow) band over the eye, and two rows of similar spots on the temporal region. Several rows of similar dark-edged spots on the nape. Granular region black, with yellow spots. The spots fade out on the dorsal region, each cross-row of scales has a blackish edge. On the tail two rows of such spots can be made out on each side. Inferior surfaces pale, probably yellow ; lower labials, and the posterior infralabials with a dark brown spot in the centre.

Measurements.	M.
Length from muzzle to vent	.057
" " " " axilla	.025
" " " " auricular meatus	.012
Width at auricular meatus	.0076
Length of fore limb	.015
" " hand	.0065
" " hind limb	.026
" " tibia	.007
" " foot	.0132

This species is evidently nearly related to the *Leposoma reticulatum* of O'Shaughnessy (*Cercosaura reticulata* O'Sh., Proceedings Zoöl. Society London, 1881, p. 230). It differs in not possessing the following characters of that species, as described and figured. In *L. reticulatum* there are two parietal plates on each side; abdominal scales are rounded in posterior outline, and in only eight rows, while they are in ten in *L. picticeps*; in having an azygous marginal anal instead of two, and in having a stripe on the body, and the tail differently colored from the back. The type of *L. picticeps* is a considerably larger animal than that of the *L. reticulatum.*

CENTROPYX DORSALIS Gthr. *Monoplocus dorsalis* Günth. *Centropyx pelviceps* Cope.

Mr. O'Shaughnessy finds these supposed species to be identical. Dr. Günther having established a new genus (Monoplocus) for the species on the supposed absence of femoral pores, I did not think it worth while to compare my specimens, in which they are numerous, with the one described by Dr. Günther. Mr. O'Shaughnessy has discovered that Günther's type possesses the pores.

AMIVA SURINAMENSIS Gray.

HYPSIBATUS AGAMOIDES Spix.

HYPERANODON PELTIGERUS Cope.

ENYALIUS LATICEPS Guich.

ANOLIS BUCKLEYI O'Sh.

ANOLIS BOUVIERI Boc. O'Sh.

ANOLIS MACROPUS, sp. nov.

Tail subround, without crest. Ventral scales small, smooth; dorsal scales minute, rough. Occipital scale small, well separated from supraorbitals; the latter separated from each other by three rows of scales, and not continued as a larger row anterior to orbit. Interorbital region concave; facial rugæ obtuse, separated by a concavity. Facial scales small, keeled, about twenty longitudinal rows at the middle of the muzzle, and ten in the facial concavity. No distinct canthus rostralis, and but two canthal scales distinguishable from those of the muzzle in size. Supraocular disk embracing a dozen scales of unequal sizes, and surrounded by granules. Seven or eight loreal rows; labials, $\frac{9}{10}$; infralabials all small. Auricular meatus small, but larger than occipital scale. The limbs are slender and long. The anterior appressed reaches the end of the muzzle by the end of the fifth digit; the posterior reaches the same by the end of the fourth digit. Digital dilatations narrow. Fan small.

The general color is blackish, below white, the line of junction of the colors on the sides of the belly, and ragged. A pale line across the chin.

Measurements.	M.
Length of head and body	.045
" to posterior border of meatus auditorius	.061
Width at posterior border of meatus auditorius	.0065
Length of fore leg	.021
" " fore foot	.0072
" " hind leg	.041
" " tibia	.0125
" " hind foot	.017

This species approaches most closely the *A. limifrons* Cope from Veragua. In that species the facial rugæ have distinct large scales, which are wanting in the *A. macropus*, and the hinder legs are not so long. The facial scales are a good deal smaller, and the posterior legs shorter in *A. macropus* than in the *A. trachyderma*, which it otherwise resembles. The long hind legs distinguish it from other allied species.

OPHIDIA.

TYPHLOPS RETICULATUS L.

BOA CONSTRICTOR L.

RHABDOSOMA BREVIFRENUM Jan.

RHABDOSOMA MICRORHYNCHUM Cope.

CONTIA SERRATA, sp. nov.

RHADINÆA NICAGA Cope, *Lygophis nicagus* Cope, Proceeds. Phila. Academy, 1868, p. 132. Proceeds. Amer. Philosoph. Soc., 1870, p. 553.

Scales in seventeen rows, without fossæ, all of moderate width, the first not very wide. Eight superior labials, third, fourth and fifth entering orbit; fifth, sixth and seventh largest, subequal, their superior borders increasing in length in the order named. Rostral plate very small, barely visible from above. Nasal decurved forwards, deeper posteriorly; loreal deeper than long; ocular 1–2; the preocular narrow and widely separated from the fróntal above. Temporals 1–2; the anterior in contact with the inferior postocular only. Internasals small, as wide as long; prefrontals much larger, wider than long. Frontal elongate, truncate in front, and with parallel sides; parietals long and large, extending on each side to the inferior postocular. Gastrosteges 160; anal divided; urosteges 52. Total length, M. .245; to rictus oris, .0065; of tail, .070.

Color above dark brownish-gray. A line of darker color extends along the third row of scales, and a similar one on the eighth row, which leaves the ninth or median row of the ground color. These lines are quite indistinct. Ends of the gastrosteges of the ground color, shaded with bluish, so as to give the color border a serrate outline. Under surface of body and tail yellow, immaculate. Top of head paler. The frontal plate with dark edges and some dark specks on the prefrontals. A pair of light dark-edged small spots, close together, one on each side of the common parietal suture. Superior labial dark-edged. Lower labials and adjacent plates obscurely speckled.

Near the head the dorsal lines unite and form a serrate dorsal band, which is separated by a paler band from a darker lateral band with the superior edges serrate; but these markings are obscure. In another specimen which Prof. Steere, of Ann Arbor, brought from the Purus river,* the dorsal band is more distinct and extends to the end of the tail.

I originally referred this species to (Lygophis) Aporophis, but its equal teeth exclude it from that genus.

OPHEOMORPHUS MELEAGRIS Shaw.

HELICOPS ANGULATUS Linn.

OXYRRHOPUS SCOLOPAX Klein.

DIPSAS CENCHOA L.

RHINOBOTHYRUM LENTIGINOSUM Scop.

LEPTOGNATHUS CATESBYI Weigel.

LEPTOPHIS MARGINATUS Cope.

DRYIOPHIS ARGENTEUS Daud.

ELAPS LEMNISCATUS L.

BOTHROPS BRASILENSIS Latr.

* This collection was made at Canutama, a distance of six hundred miles, and at Marrahan, a distance of seven hundred miles above its mouth on the Purus river, and as the first indication of the reptile fauna of that region possesses considerable interest. It includes the following species: 1. *Liophis almadensis* Wagl.; 2. *Rhadinœa nicaga* Cope; 3. *Pseudoeryx callostictus* Günth (*Hydrops*); 4. *Tortrix scytale* Linn; 5. *Bufo agua* L.; 6. *Hyla leucophyllata* var. Beir; and 7. *Lithodytes cinereus* sp. nov. This frog has a smooth belly and free toes with truncate pallettes on all the digits. There are no cranial crests, and but slight traces of dorsolateral dermal folds. The vomerine teeth are in J-shaped patches commencing opposite the posterior border of the choanæ, and curving inwards and backwards. Ostia pharyngea as large as choanæ. Nostril terminal. Tympanic drum round, two-thirds size of eye. Tongue oval, slightly notched behind. Head oval; muzzle truncate; lores straight, grooved; canthus rostralis distinct, straight. Heel of extended hind leg to end of muzzle. First finger longer than second. A prominent sharp metatarsal tubercle attached to base of first toe. No external tubercle. Color above gray, with pale brown markings. The most distinct of these is a cross-band between the orbits. Lower surfaces dirty-white; concealed surfaces brown. Upper lip with three yellowish spots extending from the orbit; to which two or three marks on the lower jaw correspond. Limbs faintly brown cross-banded. Length of head and body M. .053; width of head at tympana .018. Length of fore-leg .029; of hind leg .084; of hind foot .038.

A Sketch of the Life of Robert E. Rogers, M.D., LL.D., with Biographical Notices of his Father and Brothers. By W. S. W. Ruschenberger, M.D.

(Read before the American Philosophical Society, November 6, 1885.)

The life of Dr. Robert E. Rogers was interwoven in many ways with the lives of his brothers. All were able university professors. They labored jointly as well as separately to increase and diffuse knowledge. On this account they were more or less distinguished. All were members of the American Philosophical Society. All are dead. No obituary minute of either has been recorded in its archives.* Therefore it seems proper to group together sketches of the four brothers in such manner as may give to each, if possible, his characteristic features.

Each followed his routine course; but often they engaged jointly in one investigation, so that the public sometimes confounded their labors and gave credit to one which truly belonged to another. Their works were frequently mentioned at home and abroad as of "the brothers Rogers," and always in respectful and kindly terms. Mistakes of the sort never disturbed the perfect harmony that always existed between them, as they might have done had the brothers been rivals or competitors for reputation. Their days of boyhood were passed together in delightful companionship with their father, whom they regarded with profound respect. Their tastes and pursuits were similar. Their home-training taught them to love one another, so they went through life practising, unconsciously, no doubt, the affectionate ways which they had inherited and learned from their mother, a sensible woman of a gentle and loving nature.

From their earliest youth the brothers were ardent students, and learned to concentrate their energies to do in the best manner possible whatever they undertook. To them the axiom that whatever is worth doing at all is worth doing well, was an inflexible law. From the start they knew that their worldly success was contingent upon the quality of their work. They could look to no valuable bequest. None of their near kinsmen was

* Dr. Joesph Carson presented to the library of the Society a printed copy of a memoir, written by him, of the late James B. Rogers, M.D., and was excused from his appointment to prepare an obituary notice of Dr. Rogers for the Society.—*See Proceedings Am. Phil. Soc. Dec.* 19, 1856, *vol. vi, p.* 223.

opulent; none occupied high social or political station from which patronage might possibly flow to them. They had little patrimony besides those qualities which the human organism has when it comes into the world. And yet they might be justly thankful for their ancestral gifts, gifts which have no equivalent value in coin. Their organic inheritance included a healthy though not robust body, a sound mind, quick perceptivity and capability, a ready aptitude for toil, with many of the constituent attributes of that sort of nobility which needs neither title nor rent-roll to set it off. Titled ancestors had no part in the genesis of their endowments.

Robert Rogers, the fifth in lineal descent, was born about the year 1753, and lived on the Edergole, or Knockbrack estate, which he owned in fee, and held on lease acres of land adjoining. This estate lies between Omagh and Fintano, in Tyrone county, Ireland. Newtown Stewart, in the barony of Strabane, then a good market for cloth and yarn,* ten miles off, is the nearest town, and Londonderry, forty miles distant, the city nearest to it. The number of his tenants or extent of acreage held by him is not now known. His social grade in the community is not indicated by his estate alone. When the Presbyterian church which he attended was reconstructed, he rebuilt and furnished anew the large central pew in it, which he had inherited. He was disposed to favor what was then termed the new light doctrine, but tolerant enough to listen to the religious and political opinions ascribed to the French philosophers.

In the small villages and rural districts of Ireland at that period—more than a hundred years ago—those whose wardrobe was limited to a single suit and an extra shirt or two (and they were largely in the majority there, as well as everywhere), determined social position in the community by the interval between the family wash-days. In their estimation those whose wardrobe was extensive enough to have their washing done once a year constituted "the great families;" and those who needed to have a family wash-day every six months composed the second class in society. The washing of the Rogers family was done only twice a year, at the brook which flows through the estate.

In the winter of 1774-75, when twenty-one years old, Robert

*Statistical Survey of the County of Tyrone for 1801-2. By John McEvoy, Dublin, 1802.

Rogers married Sarah Kerr, of about the same age, who, tradition avers, was sprightly, conspicuous in conversation, and ever ready to discuss and advocate the new light doctrines of the Presbyterian Church, of which she was a member. This marriage had been delayed a year by her father, a recognized "gentleman" in the community, who insisted that Robert Rogers must attain his majority before he could lawfully make a marriage settlement of all his lands upon the children of this union, share and share alike, and that without compliance with this stipulation his assent to it would not be given.

Robert Rogers was a well-to-do Irish gentleman, liberal in his views, hospitable, convivial, and duly appreciated education and learning.

Patrick Kerr Rogers, the father of the subjects of this notice, was the first born, in 1776, of the twelve children of Robert Rogers and his wife Sarah Kerr. Four of them died infants.

The rudiments of Patrick's education were received in a school-house built upon the estate. It is described as having clay walls, a thatched roof, clay seats covered with bits of carpet and warmed by a turf fire. The teacher was a lame rustic boy, whom his aunt, Margaret Rogers, a lady of notable intelligence, had trained for the office.

It is conjectured that he acquired his classical learning from a private tutor at the house of a kinsman.

His mother died in 1790, and his father married again in 1791, a lady who bore him three sons and two daughters.

At the age when he should choose a profession, he found himself one of a numerous family of brothers and sisters and, though the eldest, without the right of primogeniture in his father's estate. Entertaining opinions not rigidly orthodox he was unwilling to enter the clerical profession, though he had the example of two uncles who were clergymen. At the time a commercial career seemed best, and therefore he entered a counting-house in Dublin. How long he lived there, or was thus employed has not been ascertained. But about the time of the Irish rebellion, which broke out in May, 1798, he contributed to Dublin newspapers articles inimical to the government, which, his friends believed, were likely to cause his arrest and punishment. A kinsman furnished the means which enabled him to reach Londonderry and emigrate thence to the United States.

The indiscretion of those publications is manifest in their consequence. It brought expatriation, permanent separation from his kinsfolk and friends. But he was young, only twenty-two years old, sanguine, self-confident, earnest, and though usually cool and judicious in conduct, on critical occasions he acted indiscreetly—on the impulse of the moment.

He arrived in Philadelphia August, 1798, probably on the ship *Rising Sun*, after a passage of eighty-four days.

At that period ships plied directly between Ireland and Philadelphia. There was then quite a colony of people from the north of Ireland settled in this city. The risks many of them had run and escaped in unsuccessful efforts to resist the political oppression which exasperated and harassed them at home probably begot a fellow feeling, stronger than that of race affinity. The fugitive, no doubt, was cordially received, and at once made a welcome member of this Irish circle, which included persons of social influence.

In May, 1799, Mr. P. K. Rogers was appointed a tutor in the University of Pennsylvania, and probably in the same year began to study medicine under the immediate direction of Dr. Benjamin Smith Barton, Professor of Materia Medica, Natural History and Botany.

It is evident that a warm friendship between preceptor and pupil was soon established. In dedicating his thesis he ascribes to Dr. Barton's example, instruction and kindness any happiness he may enjoy, in the course of his life, from his attachment to the sciences connected with medicine, and declares that he cannot help regarding the day on which he became his pupil as truly auspicious.

Mr. Rogers was married by the Rev. George C. Potts,* January 2, 1801, to Hannah Blythe, an intelligent woman, a year older than himself, endowed with a cheerful and affectionate disposition. He is described then as a tall, erect man of grave

*The Rev. George Charles Potts had recently immigrated from Ireland. He had been a licentiate of the Presbytery of New Castle, Del., for some months, when he was ordained and installed the first pastor of the Fourth Presbyterian Church of Philadelphia, May 22, 1800, which was founded by about a score of Irishmen, June, 1799.—*A Historical Discourse, delivered at the Fourth Presbyterian Church, Philadelphia, Nov. 9, 1879, by Rev. George Benaugh.*

deportment, having dark hair well sprinkled with gray, and soft, sleepy eyes. He played the violin and sang well; but never in company or in the presence of strangers, because such performance or display seemed to him inconsistent with the dignity of a gentleman.

That those personal characteristics noted in this paper which are ascribable to heredity may be apparent, a summary of the bride's history seems desirable. It is conjectured that the female organism possesses even more genetic energy than the male—that the child is indebted to the mother as much at least as to the father for its engendered qualities. A distinguished botanist has observed that only the highest types of vitality in plants take the female form. "The law in this instance," he says, "seems clear, that with a weakened vitality comes an increased power to bear male flowers, and that only under the highest condition of vegetative vigor are female flowers produced."* He conjectures that this law of the vegetal also prevails in the animal world.

Hannah Blythe was the youngest daughter of James Blythe, native of Glasgow, but a resident of Londonderry, and his wife Bessie, a daughter of James Bell, an English citizen of Londonderry.

James Blythe was a publisher and stationer. He founded, in 1772, the Londonderry Journal, the first tri-weekly paper printed in the north of Ireland. It became a daily and is still published. No evidence of his right to this honor is recorded in it because, believing himself suspected of opposition to the government, and desiring to obtain the patronage of both political parties, he considered it expedient that his partner, a Mr. Douglas, who was a printer, should publicly appear to be the sole proprietor and editor. This is the reason assigned why his name was not recorded in connection with the enterprise. The paper was printed and issued from the house in which he lived. His daughter, Mrs. Ramsay, who died at the advanced age of ninety-two years, often mentioned among the reminiscences of her early childhood the gathering of a crowd reading a placard on the front of their house, headed, "Bloody News From America," announcing the

* On the sexes of plants. By Thomas Meehan, of Germantown, Philadelphia. Proc. Amer. Assoc. for the Advancement of Science. Salem Meeting, August, 1869, vol. 18, pp. 256–260.

battle of Lexington, April, 1775. She stated also that many Protestant citizens rejoiced over this resistance of Americans to the British administration.

James Blythe died in 1787, leaving a widow and three daughters, Elizabeth, Mary Ann and Hannah. The widow, Bessie Bell, who was an intelligent and energetic woman, removed to Strabane, about fifteen miles southward from Londonderry, took into partnership a foreman from the old establishment, set up and conducted a newspaper till she died, in 1794. The business was unprofitable. The daughters were left without support. They promptly determined to emigrate, and embarked in a ship belonging to their cousin, Adam Crampton, of Londonderry, and after a voyage of three months, arrived in Philadelphia the same year.

They were received by their cousin, wife of Thomas Moore, merchant, who had left Coleraine some time before on account of his affiliation with the "United Irishmen."

They are described as quick, active, intelligent women, and being like most ladies of that period, proficient in the use of the needle, set to work with it and supported themselves respectably and independently.

The city directory for 1802 states that P. K. Rogers, A.M., lived at No. 55 Lombard street, implying that he had established a home for himself very soon after his marriage. Where his degree of Master of Arts was conferred has not been ascertained.

In June, 1802, he received the degree of Doctor of Medicine from the Medical Department of the University of Pennsylvania. His thesis was on *Liriodendron tulipifera*, or poplar tree, in which he records the results of his experimental observations of its chemical and therapeutic properties.

Now he was a householder, with wife, infant son and a profession. He started to maintain and improve his condition. He obtained some practice, had private pupils, lectured to classes of students, demonstrated in public the exhilarating effects of the inhalation of nitrous oxide or laughing gas, which were discovered in 1800, by Sir Humphrey Davy, delivered popular lectures on botany and scientific subjects, and contributed histories of cases to Dr. Barton's Medical and Physical Journal. In successive years he gave a course of lectures upon the

History of Medicine and Medical Philosophy. Subsequently he devoted himself to chemistry, upon which he delivered, it is supposed, the first complete series of popular lectures ever given in this city, or in the country.

The death of his father, who was drowned in a brook which flows on the place, called him to Ireland in 1807. He sold the family seat and settled the bereaved second family on the leased lands. This business, which occupied some time, being completed, he returned to Philadelphia, bringing with him two younger brothers and a sister, and resumed his work.

In 1809 the professorship of chemistry in the University of Pennsylvania was made vacant by the death of Dr. James Woodhouse.

Dr. P. K. Rogers addressed a letter, June 12, 1809, to Dr. Benjamin Rush, from which the following are extracts. They are characteristic of the writer in some degree :

" The chemical chair being vacant, I intend to become a candidate for the professorship. Your influence in my behalf is the favor which I am anxious to obtain. It would bind me in chains of gratitude for life.

" My indigence has compelled me to make some attempts as a medical teacher, and unless some fortunate change should take place in my affairs, the same indigence may still urge me to the same exertions. Arrangements have been made in relation to my library which place it on a permanent foundation. Of course I will be enabled, as far as books can do it, to take a more advantageous stand as a private lecturer, or as a professor."

* * * * * * *

" I could wish to secure your patronage only by deserving it. As neither the professors nor trustees have had any adequate opportunity of judging of the real qualifications of candidates, I would be willing to deliver a series of experimental lectures in competition with others. I venture to mention this, because I hope the appointments are not solely regulated by the partiality of friends."*

Dr. John Redmond Coxe was elected to the vacant chair July 10, 1809.†

* MS. Correspondence of Dr. Benjamin Rush, vol. 22, R to W., Ridgway Library, Philadelphia.

† History of the Medical Department of the University of Pennsylvania. By Joseph Carson, M.D., Professor of Materia Medica and Pharmacy in the University of Pennsylvania. Lindsay & Blakiston, Philadelphia, 1869.

Dr. Rogers attempted to establish a circulating medical library in the city, and spent considerable part of his patrimony in it. The enterprise failed from want of patronage.*

Hoping to obtain better compensation for his toil, he settled in Baltimore about the close of 1812, taking with him his wife and their three boys. Some near kinsmen, who were engaged in trade, had been settled there sometime.

He seems to have been more prosperous in his new abode. At first he lived at Fell's Point, and had an apothecary shop, and subsequently in South Charles street. He was elected physician of the Hibernian Society in 1816. The same year it was charged that "Dr. P. K. Rogers, at Fell's Point, persists in the use of variolous matter in preference to vaccine, against the public remonstrance of Dr. James Smith."†

The controversy on this question, carried on in the newspapers, was detrimental to his professional business. His income was inadequate to his need; still, he worked on zealously. In 1819 his qualifications and capacity to teach were recognized. He was elected Professor of Natural Philosophy and Mathematics in the ancient College of William and Mary, founded at Williamsburg, Va., 1692, in place of Dr. Robert Hare, resigned.

Dr. Rogers was soon settled in the Brofferton house, on the college campus, with his wife and four boys. He was earnest in his work. He made all the apparatus required to illustrate his lectures. In this making and mending he was habitually aided by his sons, who thus acquired unusual facility in the use of tools for working wood and metals. He also prepared and printed a syllabus of his course of instruction.

During the summer of 1820, after the close of the session of the college, July 4, Mrs. Rogers was attacked with malarial fever and died, leaving the four boys, the youngest in his seventh and the eldest in his eighteenth year, to the care of their father. The boys became almost foster children in families of the professors.

To avoid the malarial fever always prevalent in the locality

* At this time the College of Physicians of Philadelphia has a library of 35,000, the Pennsylvania Hospital about 12,000, and the Medical Department of the University of Pennsylvania nearly as many, all accessible to the medical public.

† Medical Annals of Baltimore. By John R. Quinan, M.D. 8vo, pp. 274. Baltimore, 1884.

during summer, Dr. Rogers habitually left Williamsburg, as soon after July 4 as practicable, to pass the vacation. After the close of the college in 1828, he spent several days in Baltimore and then went to Ellicott's Mills. A few days later he was seriously ill. All his children came to his bedside. He died of malarial fever, August 1st, 1828, in the fifty-second year of his age.

This sketch of his trying career is presented because the profound, affectionate respect with which the sons always regarded their father, suggests that this commemoration would be unsatisfactory to them in their graves if he were not associated in it. Besides, he seems to have been the mental type of his sons to a considerable degree, though they were indebted to their mother largely for their moral constitution.

Of their seven children four sons survived them.

The eldest, James Blythe Rogers, was born in Philadelphia, February 11, 1802.* His preliminary education was acquired in Baltimore and Williamsburg, Va., at the College of William and Mary (1820–21). He studied medicine in the office of Dr. Thomas E. Bond, and in 1822 received the degree of Doctor of Medicine from the University of Maryland. Epilepsy was the subject of his thesis. There is a tradition that while he was a student he assisted his brothers, William and Henry, in teaching a school. After graduation, to eke out his too scant income, he taught a class of girls, in conjunction with a Dr. McClellan who had a school for boys in Baltimore. This connection proved to be unsatisfactory and the enterprise was given up. He was needing employment, and thought of seeking the post of surgeon to a colony of free negroes which it was proposed to establish at Cape Mesurado and consulted his father on the subject. He wrote in reply—"What is the use of your complaining of mankind? The world as yet owes you nothing. Up to this time you have been simply a recipient of its benefits. Make yourself worthy of a place *here*, and you will find one." The project of going to Africa was abandoned.

He had formed an intimate friendship with a fellow-student and graduate, Dr. Henry Webster. They became partners to practise medicine at Little Britain, in Lancaster county, Pa., about two miles from the Maryland line.

* His parents then lived at No. 55 Lombard street.

The experience of a few years satisfied him that the career of a practitioner of medicine was uncongenial, repugnant to the sensitiveness of his nature and mental habits. He returned to Baltimore, and was soon appointed superintendent of an extensive manufactory of chemicals. Here he sedulously cultivated scientific and applied chemistry.

While thus employed he accepted, but after some hesitation based on a notion that he lacked fluency of speech, a quality for which he was subsequently distinguished, the professorship of chemistry in the Washington Medical College, of Baltimore. The position was not remunerative. During the same period he lectured on chemistry before the Mechanics' Institute, which was designed for the encouragement of the mechanic arts in imitation of the Franklin Institute of the State of Pennsylvania, and was also occupied in original investigations.

In September, 1830, at the age of twenty-eight, he married Rachel Smith, of Baltimore, who was a birth-right member of the Society of Friends.

During the winter of 1831–32 he lectured twice a week on natural philosophy and chemistry in Baltimore.

When the Medical Department of the Cincinnati College was established in 1835, he was appointed professor of chemistry, and filled the office until the establishment was closed in 1839. The summer vacations of these four years were spent in field work and chemical investigations in connection with the Geological Survey of Virginia, as an assistant of his brother William, who was the State Geologist.

While in Cincinnati he declined the office of melter and refiner in the branch Mint at New Orleans, offered to him by the President of the United States.

He became a permanent resident of Philadelphia in 1840, and in August of the same year he was elected a member of the Franklin Institute. His brother Henry, then Geologist of Pennsylvania, engaged him as an assistant in field and laboratory work. During seasons of leisure he delivered lectures to classes of medical students and examined them. He was appointed lecturer on chemistry, 1841, in the Philadelphia Medical Institute, then a flourishing summer school, founded by Dr. Nathaniel Chapman. August 21, 1844, he was unanimously elected Professor of General Chemistry in the Franklin Institute, and received a vote of thanks for his services when he resigned, October 20, 1847. In conjunction with his brother Robert, he compiled from the works of Dr. Edward Turner and Dr. William Gregory, a volume on inorganic and organic chemistry, designed to be a text-book which was published in 1846. These many occupations yielded him a modest income.

In April, 1846, he was chosen a member of the American Philosophical Society.

In 1847, in the forty-sixth year of his age, he succeeded Dr. Robert Hare as Professor of Chemistry in the University of Pennsylvania. He was a representative of the Franklin Medical College (in which he was at the time Professor of Chemistry), in the National Medical Convention, assembled in Philadelphia, May 5, 1847. This convention then became the American Medical Association, which is still prosperous.

In October of the same year, he was elected a member of the Academy of Natural Sciences of Philadelphia. He was one of the representatives of the University of Pennsylvania in the National Convention for the revision of the Pharmacopœia of the United States, in 1850.

He was never robust. His frame was light and elastic. In latter years his constitution was considered to be delicate. At times he suffered from nervous exhaustion and defective nutrition, ascribable to long and incessant labor. An attack of albuminuria closed his life, June 15, 1852, in the fifty-first year of his age. He left his widow, who died in 1882, with their two sons and a daughter.

He was an eminently efficient, interesting and popular teacher. "Disinterested and generous in his relations with the world, mild and conciliating in deportment, open and affable when approached, urbane to every one, his virtues shone conspicuously within the circle of his friends."*

William Barton Rogers, the second child of his parents, was born in Philadelphia, December 7, 1804.†

*A memoir of the Life and Character of James B. Rogers, M.D., Professor of Chemistry in the University of Pennsylvania. By Joseph Carson, M.D., Professor of Materia Medica and Pharmacy in the University of Pennsylvania. Delivered by request of the Faculty, October 11th, 1852, and published by the Class.

†They resided at the time at No. 262 North Second street, probably between Vine and Callowhill streets.

The middle name is a loving memorial record of his father's respect and friendship for his medical preceptor, Dr. Benjamin Smith Barton.

William B. Rogers obtained his early education in Baltimore and Williamsburg, Va., at the College of William and Mary, of which he was an alumnus 1820–21.

For a time, while a youth, he was employed in Baltimore by a dealer in crockeryware, and acquired such facility in wrapping packages that he subsequently reckoned it among his accomplishments.

About 1821, in conjunction with his brother Henry, he set up a school in the suburbs of Baltimore. How long, or with what degree of success they taught, has not been ascertained.

In 1827, then in his twenty-third year, he delivered a course of lectures on natural science before the Mechanics Institute.

In 1828 he was appointed Professor of Natural Philosophy and Mathematics in the College of William and Mary, to fill a vacancy caused by the death of his father.

His attention was directed to natural science, and especially to geology. In 1830 he contributed to the Messenger of Useful Knowledge, edited by his brother Henry, then a professor in Dickinson College, Carlisle, Pa., articles on Dew. He was elected a correspondent of the Academy of Natural Sciences of Philadelphia in 1833. In June, 1834, and May, 1835, he published in the Farmers' Register three papers on the Green Sand of Virginia.*

About this period he was allowed to advocate before the Legislature the institution of a geological survey of the State of Virginia. March 6, 1835, an act was passed directing "the Board of Public Works to appoint a suitable person to make a geological reconnoissance of the State," provided his compensation shall not exceed $1500.

To him 1835 was an eventful year. He was appointed Professor of Natural Philosophy and Geology in the University of Virginia; chosen a member of the American Philosophical Society July 17, and Director of the Geological Survey of Virginia.

* Contained in a Reprint of the Annual Reports and other papers on the Geology of the Virginias. By the late William Barton Rogers, LL.D., &c., Director of the Geological Survey of Virginia from 1835 to 1841, President of the National Academy of Sciences. 12mo, pp. 832. D. Appleton & Co., New York, 1884.

His report of the geological reconnoissance was presented January, 1836. A note on the fertilizing efficacy of marl, taken from the report of Henry D. Rogers on the Geology of New Jersey, and a plan of the proposed Geological Survey of Virginia are appended to it. Reports of the progress of the survey were made annually from 1836 to 1841. It was discontinued in 1842. All his brothers were among his assistants in field and laboratory work.

He, as well as his brothers Henry and Robert, participated in the organization of the Association of American Geologists and Naturalists in 1840, and presided at the meetings of 1845 and 1847. At the latter it was changed to the American Association for the Advancement of Science.

At the meeting held in Boston, in 1842, he presented, in connection with his brother Henry, a paper on The Laws of Structure of the more Disturbed Zones of the Earth's Crust, embracing what is called the wave theory of mountain chains. This theory was a result of an extensive study of the Appalachian chain in Pennsylvania and Virginia, and was supported by reference to many geological sections and facts. They were first to assert that the structure of mountain chains everywhere is the same in all essential features, an assertion which has been confirmed by the observations of Murchison in the Ural mountains, and by Darwin in the Andes.

The meeting was memorable. Dr. Samuel George Morton presided. Among the distinguished naturalists present were the elder Silliman, Professor Hitchcock, Dr. Charles T. Jackson, the French astronomer, Nicollet, Sir Charles Lyell, and the palæontologist, Hall. Several able and elaborate essays were read and discussed, but the prominent feature of the meeting was the Rogers paper, which was delivered as an oral statement. William B. Rogers first described the physical structure of the mountain chain extending 1500 miles, from Vermont to Alabama, and then Henry D. Rogers followed, explaining the phenomena and expounding the hypothesis deduced from them.

John L. Hays, of Cambridge, Mass., who was present, says, June 1, 1882: "I have frequently read it [the paper] since. To me it is now comparatively tame in expression. It lacks the inspiration of the scene and the man, the illustrative diagrams, the emphasis of voice and finger pointing out the distinguishing phenomena, and the fervor of spontaneous utterance. The impression I have of this exposition as delivered is, that next to the Phi Beta Kappa oration of Wendell Phillips at Harvard, it is the most lucid and elegant effort of oral statement to which I ever listened. It may be true that eloquence is but a secondary quality in the philosopher ; but in respect to the matter of this memoir and the general researches and deductions of the brothers Rogers here named, in their peculiar field of exploration, it may be safely asserted that they have made the most original and brilliant generalizations recorded in the annals of American geology, and have thrown light on the structure of mountain chains generally, which entitles them to a place by the side of the great expositor of this subject, Eli de Beaumont, of France."

"The wave theory of mountain chains was the first important contribution to the dynamical and structural geology which had been brought forward in this country. It excited at the time great interest, as well from the novelty of the views as from the eloquence with which they were set forth ; and to-day it is still regarded as one of the most important advances in orographic geology."*

William B. Rogers was elected an honorary member of the Boston Society of Natural History, June 1, 1842, and a fellow of the Academy of Arts and Sciences, 1845, of which he was Corresponding Secretary from 1863 till 1869.

In 1844–45 he was Chairman of the Faculty of the University of Virginia.†

June 20, 1849, he married Miss Emma, daughter of the Hon. James Savage, of Boston, and with his bride sailed the same day. They visited England and Scotland, passed some days in Paris, a few weeks in Switzerland, and returned in October, when he resumed his vocation at the University of Virginia. Mrs. Rogers became "the promoter of his labors, the ornament and solace of his middle life, and the devoted companion and support of his declining years."‡ Recently she has edited, very

*Josiah Parsons Cooke. Notice of William Barton Rogers, Founder of the Massachusetts Institute of Technology. Proceedings of the American Academy of Arts and Sciences, vol. xviii, p. 428–438.

† A Sketch of the History of the University of Virginia. Charlottesville, Va., 1880.

‡ An address delivered before the Society of the Alumni of the University of Virginia, on Commencement day, June 27, 1883. By William Cabell Rives.

admirably, a reprint of his annual reports and other papers on the geology of the Virginias.

In 1853 he resigned from the University of Virginia, after eighteen years of efficient service, and transferred his domicile to Boston. During the earlier years of his residence here he delivered two or more courses of Lowell lectures, and contributed to the attractions of the Thursday Evening Scientific Club, of which he was president several years.

He was present at a meeting of the British Association in Dublin, 1857, and early in 1859 he began the foundation of the Massachusetts Institute of Technology, which was incorporated in 1862, chiefly through his exertions and influence. He was elected president of it, April 8, 1862. Impaired health caused him to resign the office in the autumn of 1868. He was induced to accept it again in 1878, but infirmity compelled him to relinquish the post in 1881.

He was appointed inspector of gas and gas meters for the State of Massachusetts, in 1861, and, accompanied by Mrs. Rogers, he went to Europe in 1864, to collect models of machinery and apparatus for the use of the Institute of Technology. At the meeting of the British Association for that year, he presented a paper entitled An account of apparatus and processes for chemical and photometrical testing of illuminating gas.

News of the serious illness of his brother Henry, then Regius Professor of the Natural Sciences in the University of Glasgow, hurried him and Dr. Robert E. to Europe in 1866, but his brother died before their arrival. On this sad errand they were absent only a few weeks.

In 1867 he was appointed Commissioner to represent the State of Massachusetts at the Paris Exhibition, and during the summer visited it almost daily.

The Harvard University, Cambridge, Mass., conferred upon him, in 1866, the honorary degree of LL.D., and he was elected President of the National Academy of Science to succeed Joseph Henry, who died May 13th, 1878.

At the meeting of the American Association for the Advancement of Science, at Buffalo, N. Y., in 1876, he was elected President; but he was unable to be present at the meeting of 1877. "Had I been able," he wrote from Newport, August 22, to the permanent Secretary, "to write the address for which I was preparing early in the summer, I should have taken the risk of presenting myself at Nashville, though only for a day or two. But the nerve-exhaustion to which I have for many years been liable, aggravated by the season, compelled me soon to suspend and finally give up the work."*

In 1875–6 he assisted in establishing at the University of Virginia, a Museum of Natural History, and in 1876–7 contributed a thousand dollars to the fund of the institution.†

At the Commencement of the Massachusetts Institute of Technology, May 30, 1882, while delivering an address, he bent forward on the table before him as if to consult notes, then slowly regaining an erect position, he threw up his hands. His life had ended. The last sentence he uttered was, "I remember, that one hundred and fifty years ago Stephen Hales published a pamphlet on the subject of illuminating gas, in which he stated that his researches had demonstrated that 128 grains of bituminous coal ——"

Thus was closed, probably without pain, his bright career. He had fairly won and received all the compliments and honors that a votary of science in this country can win; and he was universally esteemed in private life on account of his probity, urbanity and social accomplishments.

Henry Darwin Rogers, the third son and fourth child, was born in Philadelphia, August 1, 1808.‡

The name Darwin was given to him by his father in token of his admiration of the poetical works of Erasmus Darwin, paritcularly of his Botanic Garden, long passages from which he was often pleased to repeat for the entertainment of the family.

He was educated in Baltimore and Williamsburg, Va.

In his twenty-second year, January, 1830, he was elected Professor of Chemistry and Natural Philosophy in Dickinson College, Carlisle, Pa. "Whilst connected with the College he edited The Messenger of Useful Knowledge, a monthly magazine of scientific character, and also containing essays on educa-

*Proc. Amer. Assoc. for the Advanc. Sc., xxvi, p. 373. 1877.

†See A Sketch of the University of Virginia. Richmond, Va., 1885.

‡His parents lived at No. 205 Mulberry, now Arch street, in 1807 and 1808; and at No. 13 S. Ninth street, in 1810, 1811 and 1812—see City Directory.

tional, literary and political subjects, and valuable information from foreign journals."*

His brother William contributed to it a series of short articles to explain the formation of dew.

When the editor resigned his professorship in the college at the end of the year, the publication of the magazine ceased.

He accompanied R. Dale Owen to England, in 1831, and enrolled himself a student of chemistry in the laboratory of Dr. Edward Turner, and attended the lectures of De la Beche, on geology, and of other teachers of science in London. He returned to Philadelphia in the summer of 1833. The liberal assistance of his brother William placed the opportunity of this course of study in Europe within his reach.

In the winter of 1833–34 he delivered a course of lectures on geology, in the hall of the Franklin Institute, of which he became a member on the nomination of his friend Alexander Dallas Bache, in January, 1834. From January, 1838, till December, 1843, he was a member of the Board of Managers and served on several standing committees. His resignation from the Institute was accepted March 16, 1848.

The University of Pennsylvania conferred upon him the degree of Master of Arts in 1834, and elected him Professor of Geology and Mineralogy the next year. From 1835 until 1846, when he resigned, he gave instruction on the subject, and published "A Guide to a Course of Lectures on Geology, delivered in the University of Pennsylvania." 8vo, pp. 43.

In his twenty-seventh year he was chosen, January 2, 1835, a member of the American Philosophical Society,† and in November he was elected a member of the Academy of Natural Sciences of Philadelphia, and served on its Publication Committee from December, 1835, to December, 1836.

The Legislature of the State appointed him, April 24, 1835, to make a geological and mineralogical survey of New Jersey. His first report (8vo, pp. 175) was made February 12, 1836,

* A sketch of Dickinson College, Carlisle, Penna., including the list of Trustees and Faculty from the foundation, and a more particular account of the Scientific Department. By Charles F. Himes, Ph.D., Professor of Natural Science. Illustrated by engravings and by photographs executed in the laboratory. 12mo, pp. 153. Lane S. Hart, Harrisburg, 1879.

† During 1836–37 he was frequently at the meetings and served on several special committees.

and his final report (8vo, pp. 301, with 2 maps) was presented in 1840.

Chiefly on the recommendation of the Geological Society of Pennsylvania, which was founded in Philadelphia, April, 1832, and ceased in 1836, the Legislature determined, March 29, 1836, to have made a geological survey of the State of Pennsylvania.

The survey was immediately organized. Henry D. Rogers was appointed geologist, James C. Booth and John F. Frazer assistant geologists, and Robert E. Rogers chemist.

Henry D. Rogers was elected an honorary member of the Boston Society of Natural History, June 1, 1842. He participated in discussions at its meetings every year from 1845 to 1858, both inclusive, except the year 1856. All his oral communications relate to geological facts or theories.

In 1844 he delivered a course of lectures on geology in the Masonic Temple in Boston.

He became a resident of Boston in 1846, and was married there in March, 1854, to Miss Eliza S. Lincoln.

He made six annual reports of the progress of the Geological Survey of Pennsylvania; the first December 20, 1836, and the last February 1, 1842. The Legislature of 1841–42 failed to make an appropriation for the continuance of the survey, and it was therefore suspended. Professor Rogers was employed from 1841 till 1851 by coal companies as an expert.

Field-work of the survey was resumed in 1851, and continued through 1852, '53 and '54.

Appropriations made by the Legislature for carrying on the survey were always too narrowly restricted, never liberal. Hence obstacles to the progress of the work intervened and delayed its completion.

Under an act of March, 1855, it was agreed that the publication of the final report of the survey should be confided to Professor Rogers. He was to own the copyright and receive $16,000, on condition that he delivered to the State, within three years, one thousand copies of it. In order to produce the report in an appropriate style for this sum, it was obvious to him that the work must be done where the skilled labor requisite for it could be obtained at rates below those prevailing at the time in Philadelphia. For the sake of such advantage he transferred his domicile to Edinburgh, where the printing of the report and the engravings to illustrate it were executed. This great work was published according to contract, bearing the imprint of J. B. Lippincott & Co., Philadelphia, 1858.

It brought him a harvest of approbation from the scientific community, but no other profit. The cost of the publication exceeded the sum stipulated for it by several thousand dollars. The results of assiduous labor during eighteen years, often embarrassed by anxiety in surmounting difficulties, are admirably presented in this magnificent report.

It consists of two quarto volumes, which together contain 1682 pages, illustrated by 778 intercalated cuts, 69 plates and 18 folded sheets of sections, all executed in the best style of that time. A summary history of the survey, and the names of all the assistants employed in it from beginning to end, are given in the preface, with praise of most of them and grateful mention of assistance in the work from his brother William.

The chief of the Second Geological Survey of Pennsylvania, Professor J. P. Lesley, a qualified judge, commends the work generally, a summary of the contents of which he gives, and says: "But let any one read the special memoirs with which he closes the second volume of his final report, and there can be no sentiment but one of admiration for the breadth of his views and the clearness, force and elegance of his delineations. No geological paper has ever appeared excelling in every good quality his memoir on coal."*

While resident in Edinburgh the University of Dublin conferred upon him, in 1857, the honorary degree of Doctor of Laws; he was elected member of the Geological Society of London, and a fellow of the Royal Society of Edinburgh; became one of the conductors of the Edinburgh New Philosophical Journal, and joined Sir William and A. K. Johnston in the publication of maps of physical geography and geology. In 1858 he was appointed Regius Professor of Natural History in the University of Glasgow. Then he transferred his residence to Shawlands, a suburb of that city. During the last two years of

*Second Geological Survey of Pennsylvania, 1874-5-6. Historical Sketch of Geological Explorations in Pennsylvania and other States. By J. P. Lesley. Published by the Board of Commissioners for the Second Geological Survey. Harrisburg, 1876.

his life he was President of the Philosophical Society of Glasgow.

Accompanied by his wife and daughter he visited the United States in August, 1865, and returned without them to Shawlands early in April, 1866, to be in time to begin his courses of instruction in May.

His physical constitution was not vigorous. His force had been slowly waning for some time. Indeed, hope of restoration to health was among the motives of his voyage to the United States. On returning to his residence, No. 5 Elgin Villas, he tried to resume his duties, but found his power to labor had been so far expended that he could not work. An obscure disease, which probably had been long seated in the brain, terminated his life May 29, 1866, near the close of his fifty-eighth year. The announcement of his death in the newspapers of Glasgow was accompanied by expressions of praise of his character and approbation of his career, mentioning the honors paid to him by learned organizations. "He was," said one, "a quiet, amiable, and thoroughly lovable man, and much admired by all who had the opportunity of knowing him intimately." Another said, among other things, "indeed he actually shone when descanting on the physical conformation of the earth's surface, and the grandeur of the operating forces to produce that conformation. His public lectures were well worth hearing when he confined himself to geology and the allied subjects of climatology and physical geography, and his services thus came to be in requisition in many places beyond the college class-room. He had keen powers of observation, and his power of generalization reached very high. He was likewise possessed of great literary ability, and frequently contributed excellent articles to scientific and other journals."

The career of the youngest and last of these distinguished brothers was as useful and praiseworthy as that of his seniors.

Robert Empie Rogers, the sixth child and fourth son of his parents, was born in Baltimore, March 29, 1813.

He assumed the name of Empie while a youth as a lasting token of his grateful appreciation of parental care bestowed upon him at the College of William and Mary after the death of his mother, in 1820, when he was only seven years old, by the Rev. Adam P. Empie, D.D., and his wife.

His early education was directed by his father. After his death, 1828, it was managed by his brothers James and William.

The intention was that he should be a civil engineer. He started as an assistant to a party making the survey of the route for the Boston and Providence Railroad. When and how long he was so employed is uncertain. His experience, however, was not satisfactory. In a letter, dated New York, May 6, 1833, and addressed to his brother William, at Williamsburg, Va., he says: "Henry asks what are my plans, and broaches the idea of my again embarking for a time in engineering. For me at least—for *me alone*—I fear there is little prospect of success, at any rate in connection with those with whom I have been previously engaged. I do not know how it might be elsewhere.

"In a letter to Henry, some time since, I stated, as I have before done to you, that my favorite desire always has been, and I thought always would be, to follow, if possible, in your career, to become an instructor; and as preparatory to some higher station, I thought I should like to have charge of a school, either of my own or become teacher in some flourishing establishment of the kind. Such an occupation I think would be a useful schooling for myself, for I conceive that at no time could I learn so fast as when teaching, for then I should be making practical application of what I would be myself acquiring, and while occupied I would have also a portion of time altogether apart to myself to devote in my own way to my own improvement. * * * * * *

"Your advice about my studies I think correct. I was doubtful whether it would be prudent to occupy myself with mathematics until I could be under your direction. I will therefore refrain for the present and continue with botany, geology and mineralogy."

These few sentences distinctly imply the character of his mental tone at that period, as well as the scope of his young ambition, and at the same time suggest that his conduct was swayed and moulded by the opinions and example of his brother William.

The project of becoming a civil engineer was abandoned. Probably in the autumn of 1833 he determined to study medicine. He became a pupil of Dr. Robert Hare, Professor of

Chemistry, and worked zealously in his laboratory till the close of his under-graduate course.

He duly submitted a thesis, entitled "Experiments on the blood, together with some new facts in regard to animal and vegetable structures, illustrative of many of the most important phenomena of organic life," etc., and graduated from the Medical Department of the University of Pennsylvania, March, 1836 This thesis, illustrated by many wood cuts, was published in the American Journal of the Medical Sciences.*

The practice of medicine was not to his taste. He devoted himself to chemistry. From 1836 to 1842 he was the chemist of the first Geological Survey of Pennsylvania, of which his brother Henry was the chief.

He became a member of the Academy of Natural Sciences, of Philadelphia, February, 1837. During nearly a half century he evinced interest in the pursuits of the Society. At irregular intervals he was frequently present at its stated meetings of several successive years, participated in discussions, delivered lectures to promote its interest and contributed to its funds.†

Dr. Rogers was elected a member of the Franklin Institute of the State of Pennsylvania, April 18, 1838, and resigned May 18, 1845. He was again elected November 18, 1852, on returning to Philadelphia after several years' absence; became a "life member" in 1855, and one of the Board of Managers in 1857. He was one of the vice-presidents during seventeen years, from January, 1858. In January, 1875, he was elected President. He declined reëlection January, 1879,‡ and was again returned to the Board of Managers, and continued to be a member of it to the close of his life.

* Vol. xviii, 1836.

† In the Proc. Acad. Nat. Sc. Philadelphia, from 1859 to 1862, many of his verbal communications are noted.

‡ On vacating the chair for his successor, at the stated meeting, January 15, 1879, he thanked the members of the Institute for their unvarying kindness towards him during the four years of his presidency. And then, on motion of Mr. J. E. Mitchell, the meeting unanimously adopted the following preamble and resolution:

"WHEREAS, our highly esteemed presiding officer, Dr. R. E. Rogers, having declined a re-election to the office he has so acceptably filled for the past four years, it is therefore,

Resolved, That in parting with Dr. Rogers we desire to place on record our high appreciation of the courteous and impartial manner with which he has presided over our deliberations, as well as our appreciation of the valuable time

He was prominently active in the work of the Institute, delivered courses of lectures on chemistry before its classes, assisted in the management of its public exhibitions, served on several of its standing and on many of its special committees, the most notable of which was one on tests of the efficiency of dynamo-electric machines,* and another on the dangers of electric lighting.†

At the celebration of the semi-centennial anniversary of the foundation of the society, February 5, 1874, in the Musical Fund Hall, he delivered an eloquent address, narrating in a general way a history of scientific discoveries and their practical applications in the half century, and indicating how the work carried on during that period by the Institute had contributed to the progress of science and the diffusion of knowledge.‡

Near the close of his thirtieth year he married, March 13, 1843, Miss Fanny Montgomery, a daughter of Mr. Joseph S. Lewis, a gentleman who was prominent among those who established the city's water-works at Fairmount.

In the session 1841–42, on invitation, he completed the course of chemical instruction at the University of Virginia which had been interrupted by sickness of the professor, Dr. John P. Emmet, from which he did not recover. Dr. Rogers was elected in his place, Professor of General and Applied Chemistry and Materia Medica, in March, 1842, and discharged the duties of the office satisfactorily to all concerned during ten years. In May, 1852, he was a representative of the University of Virginia at the meeting of the American Medical Association in Richmond,

*Journal of the Franklin Institute, p. 1878, lxxv, pp. 303–378.

†Journal of the Franklin Institute, 1881, lxxxii, pp. 401–408.

‡Commemorative Exercises at the Fiftieth Anniversary of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts. Held on Friday evening, February 6, 1874, at the Musical Fund Hall. Hall of the Institute, Seventh street, below Market street, Philadelphia, 1874. 8vo, pp. 96.

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and talents he has devoted to the service of this Institute, and we indulge the hope that in future as in the past, it may have the benefit of his extensive research and great experience "

At the stated meeting, September 7, 1884, the President announced the death of Prof. Robert E. Rogers, and that the Board of Managers had appointed Messrs. J. E. Mitchell, E. J. Houston and Isaac Norris, Jr., a committee to suitably express the sentiments of the Board; and, on motion, appointed Dr. G. M. Ward and Dr. W. H. Wahl, to co-operate with the committee. Their report is published in the Journal, p. 387, lxxxviii, 1884.

Va., and so became a permanent member of the society. At its meeting in New York, 1853, he represented the University of Pennsylvania. He was present when the Association met at Philadelphia, in 1855, and again as a representative of the University of Pennsylvania in 1872. At that meeting, in behalf of the profession of Philadelphia, he welcomed the delegates.*

He was elected Professor of Chemistry in the University of Pennsylvania, August, 1852, in place of his brother James, deceased, and Dean of the Medical Faculty in 1856.

The American edition of Lehmann's great work, Physiological Chemistry, was edited by him and published by Blanchard & Lea, October, 1855.†

He was chosen a member of the American Philosophical Society July 30, 1855, and elected one of its Council January 7, 1859. He was frequently present at the meetings of the Society, often took part in discussions, and served on several committees.

He was elected a Fellow of the College of Physicians of Philadelphia April 1, 1857, but was rarely present at its meetings. At one of them, 1858, he related a case of arsenical poisoning in which he appeared in Court as an expert. The victim had been taking, for some time, subnitrate of bismuth by prescription. He found that a remnant of the same contained a small quantity of arsenic, and also that samples of subnitrate of bismuth, obtained from ten druggists' shops, were contaminated in like manner, but not sufficiently to render the quantity ordinarily prescribed dangerous. On this testimony the jury acquitted the accused, although circumstances strongly implied his guilt.‡ Arsenical contamination of the subnitrate of bismuth of the shops had not been previously suspected.

While the war of rebellion was in progress Dr. Rogers was appointed an Acting Assistant-Surgeon in the army, July 8,

*Trans. Amer. Med. Assoc., pp. 9-11, xxiii, 1872.

†Physiological Chemistry. By Professor C. G. Lehmann. Translated from the second edition. By George E. Day, M.D., F.R.S., Fellow of the Royal College of Physicians, and Professor of Medicine in the University of St. Andrews. Edited by R. E. Rogers, M.D., Professor of Chemistry in the Medical Department of the University of Pennsylvania. With illustrations, selected from Funke's Atlas of Physiological Chemistry, and an Appendix of Plates. Complete in two volumes. [8vo, vol. i, pp. 648, vol. 2, pp. 547.] Blanchard & Lea, Philadelphia, 1855.

‡Amer. Jour. Med. Sc., p. 99, vol. xxxvi, 1858.

1862, for duty at the West Philadelphia Military Hospital, and served till June 18, 1863. At his suggestion and under his supervision, a steam mangle was set up in West Philadelphia—Chestnut street, east of Thirty-first street—to accelerate the laundry work of the great hospital. The day the machine was ready to be set to work, January 10, 1863, he was present to see it started. It is related that while benevolently showing a woman who was to feed it the dangers to which the work exposed her, his own right hand was caught and crushed betwixt the very hot [180° F.] revolving iron cylinders. With characteristic alertness he reached out his left hand and instantly threw the leather band off from the revolving drum which gave motion to the machine, and stopped it. Then, in lifting the heavy cylinder [800 pounds] for his release, it slipped from the end of a crowbar in the hands of a workman and fell back upon the hand, thus aggravating the injury already inflicted.

In his suffering he was considerate of another. He conjectured that his wife might be too profoundly shocked, should he appear before her with the hurt hand concealed in bloody wraps, immediately after the sound of rattling wheels in their quiet street had ceased in front of the house. To convey to her an impression that his injury was less than it really was, he gallantly alighted from the carriage in which he was at the street corner nearest his residence and walked home.

His colleague in the University, Dr. Henry H. Smith, Professor of Surgery, amputated the injured extremity above the wrist at night, January 24. The result of the operation was entirely satisfactory. For some time he wore an artificial hand, admirably made for him by C. W. Kolbè, a well-known cutler of the city.

One day, very soon after the stump had healed, as Professor Smith was about to begin his lecture, Dr. Rogers entered the arena and begged leave to interrupt him for a moment. Then, resting his left hand upon the Professor's shoulder, he addressed the assembled class in his eloquent way, and expressed his grateful sense of obligation to the eminent skill and kind attention of their Professor of Surgery. His speech was received with rounds of tremendous applause. The scene is not likely to be forgotton by any who was present.

Almost ambidextrous, prior to the accident, he speedily learned to write with his left hand and to use the right arm, beneath the shoulder, in prehension with notable skill in his experiments while lecturing.

Soon after the loss of his hand a greater sorrow came to him. His happy married life of twenty years was ended. His wife died February 21, 1863.

Under an attraction of speculative chances in petroleum, which at the time shrewd men believed to be excellent, many friends, relying upon his scientific judgment in the premises, were induced to join Dr. Rogers in organizing the Humboldt Oil Company, February 17, 1864. They contributed a quarter of a million of dollars. Land supposed to be richly stored with oil was purchased, wells were sunk and work carried on for some time without profit. The assets of the company were publicly sold, February 4, 1873, for a sum not more than sufficient to return the stockholders one cent a share. Dr. Rogers owned one-fifth of all the shares, and lost more than any one who had stock in the unhappy enterprise he had prompted.

Miss Delia Saunders became his second wife, April 30, 1866.

May 10, 1872, the Secretary of the Treasury of the United States appointed Drs. H. R. Linderman and Robert E. Rogers a committee to examine the Melter and Refiner's Department of the Mint at Philadelphia, and ascertain the extent and sources of an alleged "waste of silver in excess of the amount tolerated by law." The processes of assaying and refining the bullion and converting it into coin were carefully investigated and tested by numerous experiments at the Mint, and at the Assay Office in New York. About two months were spent in the examination. The result of it was presented July 25, 1872, in a well considered and elaborate "Report on the wastage of silver bullion in the Melter and Refiner's Department of the Mint."

This investigation, valuable in itself, was also valuable in its consequences. His experimental trials to apply the principles of chemical science to the improvement of an industrial process of great importance, suggested modifications in the methods of refining the precious metals which were subsequently adopted.*

*"Some important questions of a chemical and metallurgical character having arisen with regard to various mint manipulations of the precious metals, a series of experiments to determine the same were made at the Philadelphia Mint, in the latter part of the fiscal year, under the supervision of Professor R. E. Rogers. The results obtained were conclusive of several points, and will be of value in future minting operations." Report of the Director of the Mint, November 1, 1873, p. 12.

He visited the Mint at San Francisco, in 1873, departing from Philadelphia August 5, and returning September 20, carefully studied its working, and submitted reports upon it to the Director of the Mint in October and December.

September 4, 1874, he reported the successful result of his experiments made at the Assay Office in New York, in August, to rid the establishment of inconvenience from acid vapors. Prior to that time nitrous acid fumes, arising from the nitric acid used in refining silver, were allowed to escape, through the chimney, into the open air, sometimes seriously annoying neighbors. To correct the evil, Dr. Rogers had constructed in the attic of the building a furnace for burning coke, into which the fumes were conveyed and burned. Instead of extinguishing the fuel these fumes promote its combustion, which is an interesting chemical fact.

He visited Washington by request in January and March, 1875, to confer with the authorities about plans which he had proposed for the equipment of a refinery in the Mint at San Francisco. Those plans, which included the sulphuric acid process recommended by him October 15, 1873, were adopted May 3, 1875. They included the erection of additional buildings.

He arrived at San Francisco May 19. The actual work of construction and equipment of the refinery was begun May 24, and finished July 26, and placed in charge of the Superintendent, in working order, August 25, 1875.

At the suggestion of Dr. Rogers, during the progress of the work, an artesian well was sunk within the hollow square of the Mint which supplies 100,000 gallons of excellent water daily for all the uses of the establishment.

In reference to this enterprise, the Director of the Mint, in his annual report, November 20, 1875, says: "The arranging of the plan of the refinery and its equipment was intrusted to Robert E. Rogers, Professor of Chemistry in the University of Pennsylvania, whose eminent qualifications as a chemist and metallurgist, rendered him peculiarly qualified for this service, and who performed the duty assigned him in an entirely satisfactory manner. The refinery has been in successful operation since the 26th day of August last, and with much advantage to the public interests."

Under instructions of the Director of the Mint he made, in November, 1875, "a careful and laborious investigation" of the consolidated Virginia and California Mine in Nevada, for the purpose of estimating "their probable total yield of gold and silver based upon their present explored extent and the quality of their ores as ascertained by assays." And after due consideration of the chances of over-estimation he places the production "at not less than $150,000,000," which is one-half of the sum indicated by the assays.

Besides doing the work just mentioned, Dr. Rogers served as a member of the Annual Assay Commission every year from 1874 to 1879, both years included.

From June, 1872, till his death, he was one of the chemists, employed by the Gas Trust of Philadelphia, to make analyses and daily photometrical tests of the gas. He was succeeded in the office by his assistant, Dr. George M. Ward.

Very soon after the University of Pennsylvania was transferred to the buildings which it now occupies in West Philadelphia, it was suggested that the scheme of medical teaching which had been long followed ought to be improved. During the evolution of the plan adopted and the transition from the old to the new ways, personal discussions of the subject were frequent and often warm. The Board of Trustees, it was supposed, did not rightly appreciate the injury which the proposed changes might work to its medical faculty. The professors were ready for and in favor of such reform as would make the diploma significant of qualifications higher than obtainable in any other medical school; but they were not prepared to sacrifice their pecuniary interests to effect at once what might be achieved gradually without much loss. The Trustees seemed to differ from them more about the time and methods of proceeding than the object desired.

With comparatively few exceptions, medical education is sought as a means of livelihood where it may be had at least cost of labor, time and money. The diploma, which carries with it license to practise, the public generally accepts as a certificate of qualification. Rivalry and competition of the many medical schools are strong, each striving to attract as many students as possible, because, as a rule, the emolument of the professors is contingent upon the number; and large classes, in common estimation, vouch for the excellence of the school as well as of the qualification of its graduates.

The circumstances of medical teaching suggested that to immediately prolong the course of study, thus augmenting the expenses of the student and increase the requirements of graduation to what they should be, must be instantly followed by great reduction of the classes, and consequently of the remuneration of the professors.

The aspect of affairs was to them unpromising. Discontent was prevalent.

While matters were still in an uncertain state, Dr. Rogers, without application, was elected, May 2, 1877, Professor of Medical Chemistry and Toxicology in the Jefferson Medical College, a chair just vacated by resignation. He accepted the office and resigned his position in the University, which he had held during a quarter of a century. The transfer added to his emolument without increase of labor and relieved his anxiety. It was understood that several of his old colleagues expressed at that time willingness to accept position elsewhere under like conditions.

The Trustees managed affairs wisely. They established the excellent scheme of medical education now in operation, which, followed thoroughly by the student, places him beyond the necessity of seeking further instruction after graduation in post-graduate courses, which many to whom diplomas may have been prematurely granted consider essential to properly qualify them for general practice. Discontent has disappeared. The professors receive annual salaries in place of fees from students. The prosperity of the Medical Department of the University seems to be assured.

The reception of Dr. Rogers into the Jefferson Medical College was cordially manifested at his lecture introductory to the course of 1877–78. It was estimated that not less than 1200 physicians, students and others were crowded into the hall. At the conclusion of the lecture a silver vase was presented to him as a token of the respect felt for him by the great class of medical students.

In addition to his own work in the college he completed the course of instruction on Materia Medica in the session of 1878, left unfinished by the professor of that branch, Dr. John B. Biddle, who died January 19, 1879.

The degree of Doctor of Laws, LL.D., was conferred upon him June, 1883, by Dickinson College, Carlisle, Pa.

His second wife died January 9, 1883. This loss made a profound impression. Abated energy and impaired health followed. He resigned his office, July, 1884, and was elected emeritus professor.

He died September 6, 1884, in his seventy-second year.

The part given to Dr. Rogers to enact in this world has been well performed. He employed all his time advantageously in one direction or another. He was never idle. Besides his routine official work, he was sometimes engaged as an expert in criminal trials; often delivered lectures, illustrated by experiments, for the benefit of institutions; helped to release many a student from difficulties ascribable to his own heedlessness, and always had several decent poor people, old or enfeebled, depending upon his bounty, whom he cheered by familiar counsels and substantial gifts—little stipends to eke out their meagre earnings. He was ever ready to render aid in any emergency, small or great.

Late one summer evening, in 1863, strolling, as was then his wont, in the outskirts of the city, he was overtaken by a market-man slowly driving his wagon and horses in a south-westerly direction towards Gray's Ferry. The man asked if he was on the right road to the Indian Queen, on North Third street. The Doctor perceived that he was too much bewildered to take care of his charge, and with his consent at once took a seat beside him, and with his one hand drove the team to the tavern named.

One Sunday, at Long Branch, years ago, a gentleman who was bathing got beyond his depth and was borne seaward by the undertow. Two young men who were bathing at the same time saw his danger and hastened to his assistance; but when they reached him they were able to do little more than care for themselves. They could only now and then give him a little support and encourage him to continue his exertions to save himself.

Dr. Rogers saw their peril from the hotel and instantly started for the beach, undressing and throwing his clothes, containing his watch, money, &c., on the ground as he ran, and reached it just in time to jump on board of a boat putting off to the rescue. The boat had proceeded only a short distance when it was swamped. Dr. Rogers seized an oar, swam to the drowning persons, gave it to them and urged them to sustain themselves till aid should arrive. The drifting boat was flung against one of the gentlemen and the oar was wrenched from him. Seeing this, Dr. Rogers placed himself in a manner under him, and thus bearing him up, brought him, as well as those holding fast to the oar, safely ashore.

And this was the third time he had heroically saved persons from drowning.

He had a remarkable facility in the use of tools of all kinds, and a respectable talent for mechanical contrivance. He was author of many inventions—notable among them the Rogers and Black steam boiler—and of several modifications and improvements of electric apparatus. This ability was early manifested, 1835–36, in his original experiments on osmosis, in which he demonstrated how changes in the blood are produced by respiration.

The tenderness of his nature may be discerned in the following sentences from the postscript of a letter to his brother William, May 6, 1833: "My Dear Brother—What can be more grateful to an affectionate heart than to find in others a sympathy and reciprocation of the same warm feelings it proffers. How doubly blessed do I consider myself when I feel that in my brothers I have found such beings.

"I had sealed this letter at home, but thinking it well before delivering it to the mail to inquire for letters, I have been rejoiced to find yours of the 2d of May, and thus I am enabled to acknowledge its receipt and, let me assure you, with a thousand thanks for its contents."

The Chairman of the Executive Committee, Dr. Samuel Ashhurst, of the Society of the Alumni of the Medical Department of the University of Pennsylvania, in the annual report for 1885, says: "Highly endowed with the qualities which make an attractive lecturer, Dr. Rogers was always popular with the large classes who for so many years obtained their elementary knowledge of chemistry from his instruction, while his genial manners and his amiability of heart made him beloved by very many. Dr. Rogers took an active part in the formation of this Society, and acted as its Treasurer for several years. He left the record of a life in which integrity and gentleness were united with courtesy and energy in a high degree, and one of which this Society can affectionately take notice by these few memorial words."

When Margaret Rogers installed the lame boy whom she had trained to be master in the clay-walled school hut on the Edergole estate, she was probably conscious of doing rightly; but she did not foresee the benefit she was conferring on future generations of the house. The crop, the outcome of her planting, has been larger and better than she possibly could have dreamed. The inborn desire, the disposition of Patrick to learn, was quickened and fostered there. He imparted it to his sons, the brothers Rogers. All came to be professors, all were recognized by the educational classes to be among the efficient and eminent, and all were prominent among the votaries of science.

When their father died their means were insufficient. The appointment of William in the College of William and Mary was a god-send. He generously helped his brothers from the income of his office. Indeed, until all had placed themselves beyond need, the full purse, no matter who of the four held it, was regarded to be a common resource. They helped each other as occasion required.

Their published writings, a list of which is appended, imply industry, as well as harmony of purpose and pursuit.

Besides published books and reports, William contributed to scientific serials and periodicals forty-nine, and Henry thirty-four papers. James and Robert were co-laborers. William and Henry were joint authors of eight, and Robert and William of nineteen papers.

The brothers were full of zeal for the growth and diffusion of knowledge; and, habitually scanning German, French, English and American scientific periodicals, they were ever informed of the last step of its progress. Whenever they met, after more or less prolonged separations, the scientific topic of the day was sure to be a chief subject of conversation.

In blood and lineage the brothers Rogers were Irishmen; but the locality of their birth and education made them loyal Americans, and exemplary citizens.

It is related that at a dinner party, in Glasgow, just at the close of the rebellion, a guest, who was somewhat enthusiastic in predicting the success of the rebels, in a taunting tone called upon Professor H. D. Rogers, at the opposite end of the table, to tell the company his opinion of the chance of preserving the Union. Thus interrupted while speaking with a guest seated next to him, he quietly replied, "We shall see, sir," and resumed his conversation.

The next morning the papers announced Lee's unconditional surrender, and collapse of the rebellion.

Professor Rogers saw the gentleman approaching him from a distance, but, as if he wished to avoid a meeting, he crossed to the opposite side of the street and bestowed his whole attention upon a shop window. Professor Rogers was soon at his side and said emphatically, "Good morning, Mr. ———. We have seen, sir." Then, without waiting for a reply, walked on.

The brothers Rogers were highly gifted. They possessed a vigorous and quick understanding, invincible diligence happily combined with those moral and intellectual attributes which are essential to a truly manly character. They were efficient teachers. The conception of the subject of their lessons was always clearly defined in all its details and relations, which were presented with nicely devised experimental illustrations and apt fluency of speech rarely excelled. They imparted their knowledge to thousands of pupils, many of whom in turn imparted it to others. Within the limits of the field which they cultivated, few have wrought more acceptably or more usefully than the brothers Rogers.

> "Who kindly shows a wanderer his way,
> Lights, as it were, his torch from his own torch—
> In kindling others' light, no less he shines."

Life—the incomprehensible, intrinsic, conservative force of every organism which imparts motion to its structures without essentially changing their composition or altering their relations during an indefinitely limited period—that earthly life has departed from the brothers. Their tasks have been completed, and their value computed; but their names without a dimmed spot or smirch upon them are fixed along paths of knowledge and may still help to light others on the way, as long as their sheen is discernible. And thus, the influence of their lives may be prolonged through their example and work.

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"The man who discovers one valuable new medicine is a more important benefactor to his species than Alexander, Cæsar or an hundred other conquerors. Even his glory, in the estimation of a truly civilized age, will be greater and more lasting."—Professor Barton.

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On a new Process for obtaining Formic Acid, and on the preparation of Aldehyde and Acetic Acid by the use of the Bichromate of Potassa. Silliman, Journ., ii, 1846, pp. 18–24.

On the Volatility of Potassa and Soda, and their Carbonates. Amer. Assoc. Proc. 1848, pp. 36–38.

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On a new Process for analyzing Graphite, natural and artificial. Brit. Assoc. Rep., 1848 (pt. 2), pp. 59–60; Edin. Journ. Prak. Chem., l, 1850, pp. 411–413; Journ. de Pharm., 1851, pp. 67–68.

Oxidation of the Diamond in the liquid way. Brit. Assoc. Rep., 1848, (*pt.* 2), pp. 60–61; Edinb. New Phil. Journ., xlv, 1848, pp. 388–389; Silliman, Journ., vi, 1848, pp. 110–111.

On the Absorption of Carbonic Acid by Water, Saline Solutions and various other Liquids [1847]. Silliman, Journ., v, 1848, pp. 114–115.

New Method of Determining the Carbon in native and artificial Graphites, &c. Silliman, Journ., v, 1848, pp. 352–359.

On the Decomposition and Partial Solution of Minerals, Rocks, &c., by pure Water, and Water charged with Carbonic Acid. Silliman, Journ., v, 1848, pp. 401-405. Brit. Assoc. Rep., 1849 (pt. 2), pp. 40-42; Edinb. New Phil. Journ., xlv, 1848, pp. 163–168; Froriep. Notizen, ix, 1849, col. 49–53; xi, 1849, col. 305–309.

On the Absorption of Carbonic Acid by Liquids. Silliman, Journ., vi, 1848, pp. 96–110.

On the Absorption of Carbonic Acid by Acids and Saline Solutions. Amer. Assoc. Proc., iv, 1850, pp. 298–308.

On the Use of Hydrogen Gas, to displace Sulphuretted Hydrogen in the analysis of Mineral Waters, &c. Silliman, Journ., xviii, 1854, pp. 213–216.

By Robert E. Rogers and Martin H. Boyé.

On the Analysis of Limestones, especially the Magnesian Kind, and a method of completely separating Lime from Magnesia when both are present in large quantity. Journ. Franklin Inst., xxv, 1840, pp. 158–162; Sturgeon. Ann. Elec., v, 1840, pp. 203–208.

By Dr. H. R. Linderman and Prof. Robert E. Rogers

Report upon the Wastage of Silver Bullion in the Melter and Refiner's Department of the Mint of the United States, July 25, 1872. 8vo, pp. 82. Government Printing Office, Washington, 1872.

Report of the Committee [Franklin Institute] on Dynamo-Electric Machines. Journ. Franklin Institute, lxxv, 1875, p. 289–303.

Report of the Committee [Franklin Institute] on the precautions to be taken to obviate the dangers of Electric Lighting. Journ. Franklin Institute, Dec., 1881. lxxxii, pp. 401–408.

Note.—In the preparation of the above lists, the Catalogue of Scientific Papers, 1800–1873, compiled and published by the Royal Society of London, has been consulted and used.

Report on the Coal Deposits near Zacualtipan, in the State of Hidalgo, Mexico. By E. D. Cope.

(*Read before the American Philosophical Society, Oct. 16, 1885.*)

Having obtained in the City of Mexico favorable information as to the coal of Zacualtipan, in the State of Hidalgo, I resolved to devote some time to an investigation of that locality.

On my arrival at Zacualtipan, I was informed by my friend, Dr. Santiago Bernad, a French physician, who practices in the town and its surrounding region, that the coal beds extend throughout a distance of five leagues north and south, and two and a half leagues east and west. They are owned in large tracts called quadras by different persons. I examined sixteen exposures within a distance of five miles of Zacualtipan, north-east, south-east and south, with the following results:

The geological structure of the country is as follows: The town of Zacualtipan is situated on the border of the plateau of Mexico, where it begins to break off to the lower level, which two days' journey on horseback eastward becomes the Tierra Caliente of the State of Vera Cruz. The plateau is, therefore, much broken by ravines which open to the eastward. The high plateau just east of Zacualtipan is about 7000 feet above sea-level. The eastern border of the plateau is supported and protected by the lines of several trap-dykes, whose faces form precipitous walls which bound the ravines, generally on one side. To the east and west of the town the high lands consist of a silicious limestone, which looks a good deal like that of subcarboniferous age in the United States, but, is said by M. Barcena, of the National Museum of Mexico, to be of Cretaceous age. This limestone lies elevated at a high angle against the trap-dyke, at a point on the San Miguel creek; showing, first, that the trap formation is a dyke which has been thrust up from below, and is not an outflow; and second, that the age of the elevation of the dyke is later than the Cretaceous period. This conclusion is all important in the determination of the age, and, therefore, probable quality of the coal, and in the determination of its quantity.

The coal formation lies horizontally bedded in the intervals between the trap-dykes and the hills of limestone, etc. It consists of regularly stratified beds of clay, of volcanic ash, of clay or carbonaceous shales, more or less finely bedded, and of thicker and thinner beds of a frequently very good lignite coal. There are no beds of stone in them, but the carbonaceous shales are frequently very tough. The bedding has not been affected by the dykes, and indeed sometimes inclines downwards towards them at a low angle, instead of upwards towards them as would have been the case had they been older than the dykes. Further evidence that the coal formation is newer or of later age than the dykes is seen in the fact that beds of coal are found in some localities on top of them. It follows from these facts that although there are beds above the dykes, there *is no coal* below the precipices which constitute the parts of the dykes which are visible; or, in other words, that the coal only occupies the spaces between the dykes. Fossil mammalian remains found in the beds of clay near the coal prove that the formation is of Upper Miocene Tertiary age, and perhaps identical with the epoch known in North America as that of the Loup Fork.*

The properties which I examined bear the following names: Galiana, Hulla, Juarez, Concha, Providencia, Capa Rosa, Sausz, San Miguel and San Rafael. I take them up in order. I premise by saying, that the coal beds have been rendered accessible by the erosion of the middle parts of the valleys which they occupy, into deep ravines. The coal outcrops are on the sides of these ravines, and extend underground to a line which descends vertically continuous with the faces of the trap precipices, at which point they are cut off by the concealed part of the dyke. The amount of coal is of course to be determined from this dimension, *i. e.*, the distance from the dyke multiplied by the extent of the formation parallel to the dyke, by the thickness of the bed.

The coal beds are best exposed on the Galiana property. From the top of the trap dyke to the bottom of the valley at this point, the vertical depth is about one thousand feet. At a depth of about 100 feet from the summit of the hill is a short, open cut in which can be seen a bed of good coal of eighteen inches in thickness. From its position, this bed probably extends entirely across the summit of the hill, and crops out on the other side, forming the San Rafael mine. Below this open cut the summit of the trap precipice is soon

*See American Naturalist, May, 1885, where this fact is stated. See also description of fossils at end of this article.

reached. The foot of the precipice is perhaps 400 feet below the coal bed, and at its foot is a gently sloping plateau of perhaps a quarter of a mile in width. The slope than becomes more abrupt, and descends to the bottom of the ravine-like valley, 500 feet below. At a depth of fifty feet vertically below the foot of the precipice at the beginning of the steeper slope, the upper bed of this part of the Galiana crops out. It is one foot in thickness, and is of good quality. Some eighteen inches of clay intervene between it and a second bed of coal of about three feet in thickness. About forty feet below their level is a bed of impure lignite eighteen inches thick ; and below three or four feet of clay is a bed of better lignite which varies from two to six inches in thickness. Below this are about eighteen feet of carbonaceous clay and shale, and below this fifteen feet of clay with thin seams of lignite. Below this succeed white slates and clay with vertebrate fossils, chiefly three-toed horses, but no more coal.

The workable beds of coal in this property are the eighteen inch bed above the precipice, and the eighteen and thirty-six inch beds below the precipice. At present these beds are only exposed in open cuts. Those below the precipice have a quarter mile (English) extent to the trap dyke, while their extent parallel to the dyke is probably considerable. In fact, the coal formation follows the borders of the dykes at varying distance, and the outcrop thus has many miles of extent. The workings on the Galiana property consist of nothing but the open cuts mentioned. The clay is of excellent quality, and is manufactured by the owner into roofing tile.

The Hulla and Juarez mines are on the other sides of the same trap plateau. The highest coal outcrop of the Hulla is above the dyke precipice on the opposite side from the highest exposure on the Galiana, and is probably the same bed. This will therefore be about a third of a mile between the two outcrops. The bed is, however, thinner on the Hulla side, being only six inches in depth. The same is true of the other outcrops on the Hulla side. The second one is perhaps 500 feet lower down towards the bottom of the valley. There are open cuts, but the principal exposure is clay, carbonaceous and otherwise, with a bed of pure lignite of six inches thickness. At the Juarez outcrop, several hundred feet lower down, the lignite bed is only an inch in thickness.

The Concha and Providencia mines lie south-east of Zacualtipan, and below the trap precipice already described. They are, however, near to another mass of trap which may be a part of a different, or a branch of the same great dyke. The Concha is developed by both an an open cut and a timbered drift. The bed of coal varies from thirty to eighteen inches in thickness, and lies between more or less shaly beds of clay. They all dip at a low angle towards the trap. This coal looks well, but the extent of the bed *in one direction* is probably reduced by the not far-distant dyke. Lower down the hill we sought for another outcrop on the Concha property, but it had been covered up. An eighth of a mile round the hill from this lower level, in the side of a ravine is a cut, which displays the bed of the Providencia mine. This varies in thickness from eighteen to thirty inches. In one direction it is limited by a trap dyke at a distance of about 100 yards, whose exposed face is less than 100 feet in height.

South of Zacualtipan are situated the Guadalupe, Capa Rosa, Sausz and San Miguel mines. At the Guadalupe are two timbered drifts, whose length I did not explore, as they contained much water, and were more or less dangerous. The cuts at their mouths in the hillsides reveal their structure and general value. The rock consists of clay and clay shales more or less carbonaceous, not hard, but tough. The lignite proper is from six to ten inches in thickness. This cut is near the base of the trap precipice. The second cut is 150 feet off, and is that much further from the trap. It displayed much the same structure and quantity of lignite.

The Capa Rosa exposure is on another side of the same hill, and is a quarter of a mile from the precipice, thus giving promise of greater dimensions of the deposit in one direction. It is at nearly the same horizon as the Gaudalupe, and may be the same bed. It is developed by an open cut which shows as follows: Below fifteen feet of soil there are twelve feet of clays and slates. These alternate between more and less carbonaceous layers, and in the bottom there are in sight ten inches of lignite, and how much more I could not ascertain without excavations. Further down the same hill, about 100 feet vertical, is the Sausz mine. The beds are here exposed by an open cut and a drift; the latter in a ruinous condition. In the bottom of the openings is a foot of good looking lignite, and above it is a bed of clay three feet in depth; above that, six inches of carbonaceous clay slate.

A mile farther along the same valley is the San Miguel mine. Its bed is exhibited in one open cut, and in an exposure along the bank of the San Miguel creek at the water level. There are here eight inches of lignite like that of the Capa Rosa and the Sausz.

It is now easy to perceive that the aggregate quantity of coal in the country is large, but that it is spread over considerable space. It is also evident that the mining is easy, as the beds all crop out conveniently on the sides of valleys, and the drainage is also easy. There being no secure roof or hanging wall to the beds, all workings will have to be well timbered. This will not be expensive, as timber of excellent quality of oak, pine, etc., covers the hills everywhere, in close proximity to the coal openings. The localities which exhibit the greatest thickness of the beds are the Galiana and Concha properties. Those which promise the greatest horizontal extent of the bed in the direction of the dyke are the Galiana, the Capa Rosa, the Sausz and the San Miguel. The property which combines the two advantages is then the Galiana.

This region is accessible by rail as far as Pachuca, sixty miles distant. From Pachuca to Zacualtipan a railroad could be built by Tulancingo and Apulco, where is now a wagon road. Of this I am informed by various persons, among them by Professor Castillo of the School of Mines of Mexico. A direct line of road from Pachuca to Zacualtipan is impracticable or very expensive, owing to the great inequalities of the country. It is not unlikely that at some future day, this coal will have an outlet to Tuxpan on the coast, which is due east from Zacualtipan.

Finally I refer to Dr. F. M. Endlich for information as to the quality of the coal and its availability for industrial purposes.

I add that several of the properties are in the state of Vera Cruz just over the line. The Galiana property is near the small village of Tehuichila, Vera Cruz.

Description of fossils.

Hippotherium peninsulatum, sp. nov.

Crown of superior molar long, curved. Grinding face with anteroposterior diameter considerably exceeding the transverse. Internal column large, its section a narrow anteroposterior oval, with both borders convex. Internal enamel borders of internal crescents with a prominent loop at junction, the posterior one with its posterior loop much smaller than the column. A subquadrate area between the internal parts of the lakes, is connected by an enamel ridge with the anterior lake. Opposite and adjacent enamel borders of the lakes, with several close and deep plications, which nearly cut off the adjacent horns. In like manner the posterior horn of the posterior lake, and the anterior horn of the anterior lake are almost cut off by the deep complex infolding of the anterior and posterior borders respectively. The median and anterior external ribs of the crown are well developed, and there is but little cement on the grooves.

Measurements.		M.
Length of root, less crown		.050
Diameters of grinding face	anteroposterior	.018
	transverse	.015

This superior molar tooth indicates a small species of the genus, and one which is entirely typical in form. The plication of the enamel is greater than in any other species excepting the *H. gracile*. It resembles most of all the *H. venustum* of Leidy, which is of similar dimensions. In that species the style has a nearly circular section according to Leidy, which distinguishes it satisfactorily.

From the Loup Fork Shales of Tehuichila, Vera Cruz.

Protohippus castilli, sp. nov.

This horse is represented by a superior molar tooth of a larger animal than the species last described, and one only a little smaller than the zebra. It possesses the internal loops of the two internal crescents as in Hippidium and Protohippus, and without the bones of the feet it is impossible to determine to which genus it should be referred. The indication that it is a Hippidium, is derived from the relative proportions of the internal loops. The anterior of these is much larger than the posterior, and occupies the median position of the internal edge of the crown like the column in Hippotherium. Further approach to that genus is made by the contraction of its connection with the corresponding crescent. The section of this loop is a rather wide oval. The posterior loop has half the size, and if isolated would present the same form.

The crown of the tooth is of median length and is strongly curved inwards. Its grinding surface is a little wider than long, and is worn into two transverse angles, which pass through the concavities of the borders of the crown and lakes. It is not certain that this grooving in wear is a constant character.

The lakes are strongly convex inwards and their horns are wide and obtuse. Their borders are simple, there being no folds on the remote sides, and on the adjacent borders only one on the posterior and two on the anterior, of no great depth. There is no loop at the junction of the inner edges of the internal crescents. External ribs of crown prominent. Excepting these, the entire crown is enclosed in cementum.

Measurements.		M.
Length of crown		.040
Diameters of grinding face	anteroposterior	.021
	transverse	.023

This species differs from the *P. insignis*, *P. perditus* and *P. mirabilis*, with which it agrees in size, in the posterior production and angulation of the posterior border of the anterior inner column, and in the absence of plication of the borders of the lakes which are remote from each other. In this species the internal loops are of nearly equal size. I have dedicated it to my distinguished friend, Prof. Antonio de Castillo, Director of the School of Mines of the City of Mexico, to whom I am indebted for a knowledge of the locality described in the present paper.

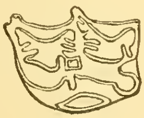


Fig. 1.

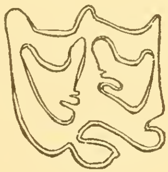


Fig. 2.

Fig. 1. Superior molar tooth of right side of *Hippotherium peninsulatum* Cope grinding surface from below; natural size.
Fig. 2. The same of *Protohippus castilli* Cope; same view; natural size.

Stated Meeting, August 21, 1885.

Donations for the Library were received from the Department of Mines, Melbourne; the New Zealand Institute; the Asiatic Society of Japan; the Geological Committee of St. Petersburg; the K. K. Central-Anstalt für Meteorologie und Erd-Magnetismus, Vienna; the Deutsche Anthropologische Gesellschaft, Munich; Prof. C. D. E. Weyer of Kiel; the Zoölogischer Anzeiger, Leipzig; the Deutsche Geologische Gesellschaft, Berlin; the Académie Royale de Copenhague; the K. Akademie von Wetenschappen and the K. Zoölogisch Genootschap at Amsterdam; the Société Botanique, Luxembourg; the Nederlandsche Botanische Vereeniging; the Académie Royale de Belgique; the Sociétés de Geographie, Americaine de France, Annales des Mines, Maisonneuve frères et Ch. Leclerc, Editeurs, Paris; the Société Linnéene de Bordeaux; the R. Accademia dei Lincei, Rome; the Royal Institution of Great Britain; the Zoölogical Society, the Royal Astronomical Society and Society of Antiquaries of London, the Meteorological, London Nature, Journal of Forestry, Messrs. John Kinnersley Smythies, Joseph Prestwich, Benjamin Ward Richardson and John Hampden and Charles Ellis, publishers, London; the Geological Society of Glasgow; the Geological and Natural History Survey and Museum of Canada; the Canadian Institute; the Natural History Society of Montreal; the American Academy of Arts and Sciences, Boston; the Bostonian Society; the American Philological Society, American Academy of Arts and Sciences, Museum of Comparative Zoölogy and Drs. Samuel Abbott Green and H. A. Hagen of Cambridge; the Essex Institute; the American Journal of Science, Connecticut Academy of Arts and Sciences, American Oriental Society at New Haven; the New York Academy of Sciences, American Chemical Society, Meteorological Observatory, New York; Mr. John B. Smith, editor, Brooklyn; the Young Men's Association, Buffalo; the New Jersey Historical Society; the Franklin Institute, College of Pharmacy, Mercantile Library, the Real Estate Title Insurance and Trust Company, American Naturalist, Drs. Richard B. Westbrook and Persifor Frazer, and Messrs. R. S. Culin, Henry Phillips, Jr., H. Carvill Lewis and Richard Meade Bache of Philadelphia; the Bookmart Publishing Company, Pittsburgh; the American Chemical Institute, and Johns Hopkins University; the Naval Institute; the War Department, Bureau of Education, United States National Museum, Department of State, United States Geological Survey, and Smithsonian Institution; Mr. J. Hotchkiss of Staunton, Va.; the Cincinnati Society of Natural History and Cincinnati Observatory; the Chicago Historical Society; Rev. Stephen D. Peet, and the Kansas Academy of Science.

Stated Meeting, September 18, 1885.

Donations for the Library were received from Prof. Ferdinando de Mueller of Melbourne; the Geological Survey of India; Mr. N. R. Pogson, Government Astronomer at Madras; L'Institut Egyptien; the Académie Impériale des Sciences de St. Petersbourg; the Société Impériale des Naturalistes de Moscow; the Ungarische Akademie de Wissenschaften; the Anthropologische Gesellschaft; the K. K. Geologische Gesellschaft in Wien; the K. K. Sternwarte at Prag; the Zoölogische Anzeiger from Leipzig; the Oberlausitze Gesellschaft der Wissenschaften at Görlitz; the K. Akademie der Wissenschaften, and the Deutsche Geologische Gesellschaft at Berlin; the Académie Royal Suédoise des Sciences at Stockholm; Prof. J. C. Wulff, Rektor of the University at Stockholm; the Vereins für vaterländische in Würtemberg; the Offenbach Verein für Naturkunde; the Académie Royale de Belgique; the Société Royale des Sciences de Liege; the Reale Accademia dei Lincei at Rome; the Comitato Geologico d'Italia; the Ministero di Agricoltura at Rome; Société Zoologique de France; the Société de Gèographie at Paris; the Musée Guimet; the Société d'Emulation d'Abbeville; the Instituto y Observatorio de Marina de San Fernando; the Royal Society of London; the Linnean, the Royal Astronomical and Royal Geographical Societies, the Geological and the Society of Antiquaries; London Nature; the Journal of Forestry; Prof. J. Bennet Lawes; the Royal Cornwall Polytechnic Society; the Scientific Students' Association of Manchester; the American Antiquarian Society at Worcester; the Boston Society of Natural History; the American Journal of Science; Prof. Daniel Draper of New York; the New York Entomological Club; the Entomologica Americana, published in Brooklyn; the College of Pharmacy, Engineers' Club, the American Naturalist, Mr. Henry Phillips, Jr., Mr. Philip H. Law; the Philosophical Society of West Chester; the Johns Hopkins University; the American Journal of Philology; the American Journal of Archæology; the Departments of State and of the Interior, the War and Navy Departments; the Smithsonian Institution; the United States National Museum; the United States Fish Commission; the Library of the Surgeon-General's Office; the Catalogue of United States Publications; the Women's Anthropological Society; Mr. J. Hotchkiss of Staunton; the State Historical Society at Iowa City; the Wisconsin State Historical Society, and the University of Minnesota.

Stated Meeting, October 2, 1885.

Present, 4 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Donations for the Library were received from the Adelaide and Hong-Kong Observatories; Geological Survey of India; K. K. Zoölogisch-botanischen Gesellschaft, Wien; Zoölogischer Anzeiger, Leipzig; Dr. G. vom Rath of Bonn; Universitetet, Lund; Archives Néerlandais; Académie Royale de Belgique; École des Mines, Paris; Zoölogical Society of London; Nature; Cambridge University; Leeds Philosophical and Literary Society; Dun Echt Observatory; Essex Institute; American Journal of Science; New York Meteorological Observatory; Franklin Institute; the American Naturalist; Mr. Henry Phillips, Jr.; Prof. H. Carvill Lewis; Mr. Philip C. Garrett; Johns Hopkins University; United States Naval Institute;

United States National Museum; Department of State; and Mr. William Harden of Savannah.

Letters of acknowledgment were received from the K. Zoölogisch Genootschap, Amsterdam (116) and Register; South Kensington Museum (117, 118, 119); Musée Royale d'Histoire Naturelle de Belgique (92–95, 97–119) and Register; Zoölogical Society of London (117–119), Society of Antiquaries, London (116–119) and Register; Mr. Archibald Geikie of Edinburgh (117, 118, 119); Royal Institution (117, 118, 119); Académie Royale, Amsterdam (112, 114, 115); K. Danske Videnskabernes Selskab (115); Université Royale de Norvège (113–116) and Register; Virginia Historical Society (115, 116); University Library, Cambridge, Eng. (117, 118, 119); Dr. L. G. de Koninck of Liège (116–119); Observatorio Astronómico Nacional Mexicano (116) and Register; Peabody Institute (118); Verein für vaterlandische Naturkunde in Würtemberg (115, 116) and Register; Königliche Bibliothek, Berlin (116) and Register; Smithsonian Institution (116) and Register; K. Sächsische Gesellschaft der Wissenschaften (117, 118, 119); Université Royale, Lund (109–115); Mr. J. F. Garrison of Camden, N. J. (119).

Letters of envoy were received from the Musée Royale d'Histoire Naturelle de Belgique; Verein für Vaterlandische Naturkunde in Württemberg; Université Royale, Lund; American Oriental Society; Colonial Museum of New Zealand; Bataviaasch Genootschap van Kunsten en Wetenschappen; United States Geological Survey; Académie Royale des Sciences, Amsterdam; Sir J. B. Lawes of London; United States Naval Institute; Royal Cornwall Polytechnic Society; Königlich Preussische Akademie der Wissenschaften; Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne; Brooklyn Entomological Society; Geological and Natural History Survey of Minnesota; Manchester Scientific Students' Association; Académie Royale des Sciences, Stockholm; Musée Guimet; Adelaide Observatory; Madras Observatory; University Library, Cambridge, Eng.; Société Hollandaise des Sciences.

Letters were read from the Delaware County Institute of Science, Media, Pa., requesting a copy of No. 119, which was ordered to be sent; from Mr. Joseph Lesley (Princeton, Mass.), dated July 28th, 1885, presenting his resignation from membership on account of ill-health, which was, on motion, accepted; from Josef Menges, Dresden, offering for sale a collection of East African animals; from the Comité Geologique, St. Petersburg, sending its Bulletin and requesting exchanges. On motion the request was granted, to begin with Proceedings No. 117.

From George W. Hough, announcing that his address would be Dearborn Observatory, Chicago; from Prof. T. M. Drown (Easton, Pa.), announcing change of address to Boston, Mass.

Mr. Henry Phillips, Jr., deposited in the Library, the London Numismatic Chronicle, 1885, Part II.

The following deaths were announced:

M. Emile Malezieux (Paris), May 20, 1885, æt. 63.

M. Henry Milne-Edwards (Paris), July 29th, 1885.

M. J. J. A. Worsaae (Copenhagan), August 15, 1885, æt. 64.

George Leib Harrison (Philadelphia), September 9, 1885, æt. 74.

On motion the President, in his discretion, was authorized to appoint a suitable person to prepare the usual obituary notices.

The following papers were presented:

Dr. F. A. Genth, "Contributions from the Laboratory of the University of Pennsylvania. No. XXIV. Contributions to Mineralogy."

Dr. Daniel G. Brinton, "On Polysynthesis and Incorporation as characteristics of American Languages."

Dr. F. S. Krauss (Vienna), "Aus Bosnien und der Hercegovina."

Prof. E. D. Cope, "Catalogue of the Species of Batrachians and Reptiles contained in a collection made at Pebas, Upper Amazon, by John Hauxwell."

Dr. Fr. Meinert, "Myriopoda Musei Cantabrigensis. I. Chilopoda."

Pending nominations Nos. 1049–1063 were read, and the Society was adjourned by the presiding officer.

Stated Meeting, October 16, 1885.

Present, 16 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Donations for the Library were received from the Mining Department, Melbourne; Geological Survey of India; Kongliga Vetenskaps Societeten, Upsala; Kongelige Nordiske Oldskrift Selskab, Copenhagen; Königlich Sächsische Gesellschaft der Wissenschaften, Leipzig; Kaiserliche-Königliche Geologische Reichsanstalt, Wien; Naturhistorische Gesellschaft, Nürnberg; Physikalisch-Ökonomische Gesellschaft, Königsberg; Naturhistorische Gesellschaft and Messrs. Oberlehrer L. Mejer and Fr. Reinhold of Hannover; Musée Royal d'Histoire Naturelle and Académie Royale des Sciences, &c., de Belgique; Institution Ethnographique and Prof. Leon de Rosny of Paris; Royal Asiatic Society of Great Britain and Ireland; the Royal Society, Forestry and Mr. William Blades of London; Rev. C. W. King of Cambridge, England; the Brooklyn Library and Mr. J. B. Smith, Editor of Entomologica Americana; College of Pharmacy, Prof. E. D. Cope and Messrs. Henry Phillips, Jr., and E. A. Gieseler of Philadelphia; the United States National Museum, Dr. A. S. Gatschet and Mr. J. H. Hickcox, publisher, of Washington; Mr. Charles C. Jones, Jr., of Augusta; Chicago Historical Society; Rev. Stephen D. Peet; State Historical Society, Iowa, and the State Historical Society of Wisconsin.

Letters of envoy were read from the K. Sächsische Gessellschaft, Leipzig; Naturhist. Gesellschaft zu Hannover; Société Royale des Sciences à Upsal; Meteorological Office, London, U. S. Naval Observatory, Washington, D. C.; Elliott Society of Science, Charleston, S. C.

Letters of Acknowledgment were read from K. K. Central Anstalt fur Meteorologie und Erdmagnetismus, Vienna (117, 118, 119); Naturforschende Gesellschaft, Emden (117, 118, 119); Société Royale des Sciences, Upsal (113, 114, 115, 116 and Register); R. Accademia dei Lincei, Rome (116 and Register), and requesting certain old numbers of Proceedings and Transactions (Procs. I—VI, XII, Trans. O. S., I—IV, N. S.

I—XI, XIII);* Chemical Society of London (117, 118, 119); Geological Survey of India (117, 118, 119); Kon. Zoolog. Genootschaf, Amsterdam (117, 118, 119); Société Hollandaise des Sciences, Harlem (117, 118, 119); Fondation de P. Teyler van der Hulst, Harlem (116); Horatio Hale, Clinton, Ontario (119); Geological Survey of Canada, Ottawa (116, 119); Numismatic and Antiquarian Society of Philadelphia; University of the City of New York (N. Y.); American Antiquarian Society, Worcester (Mass.); New York Hospital (N. Y.); Yale College Library (New Haven, Conn.); Essex Institute (Salem, Mass.); U. S. Military Academy (West Point, N. Y.); Wyoming Historical and Geological Society (Wilkes-Barre, Pa.); Cincinnati (Ohio) Observatory; Leander McCormick Observatory (University of Virginia); University of Toronto (Canada); Vassar Brothers Institute (Poughkeepsie, N. Y.); Boston Athenæum; Cornell University Library (Ithaca, N. Y.); University of California; Surgeon-General, U. S. A. (Washington, D. C.); Public Library (Boston Mass.); California Academy of Sciences (San Francisco, Cal.); Museum of Comparative Zoölogy (Cambridge, Mass.); Pennsylvania, Connecticut, Virginia, Georgia, Wisconsin, New Hampshire, New Jersey, Chicago (and all previous numbers), Maryland, and Kansas State Historical Societies; Prof. John J. Stevenson, New York (N. Y.); Prof. J. W. Moore, Easton (Pa.); Prof. J. M. Hart, Cincinnati (Ohio); Henry Phillips, Jr. (Philadelphia); J. H. C. Coffin (Washington, D. C.).

Mr. William Morris Davis presented to the Cabinet ten French bronze Medals, of which he furnished the following description:

MEDALS.

No. 1. The dead Napoleon. Reverse, the Arch of reception at Rouen, and draped steamer. Struck in 1840 in commemoration of the removal of Napoleon's remains from St. Helena, and restoration to France.

No. 2. Napoleon le Grand. Reverse, arch of triumph, motto, "A l'Armée Française."

No. 3. Ferdinand Philippe Louis, Duc d'Orleans. Obverse, commemorative, "Chapelle Saint Ferdinand.

No. 4. Marie d' Orleans. Obverse, "Statue de Jeanne d'Arc."

* Referred to Secretaries with power to act.

No. 5. "Cathedrale de Paris." Reverse, "ground plan with details of dimensions," &c.

No. 6. Liberty enlightening Justice, with Despotism prostrated. Motto, "Revolution de 1848." Reverse, "Gouvernement Provisoire," with names of the ministers, &c.

No. 7. Head emblematic, surrounded with heavy wreath of oak and laurel. Motto, "Republique Francaise." Reverse, three figures, "Liberté, Egalité, Fraternité, 24 Fevrier, 1848."

No. 8. A figure of Liberty, looking back, hand supporting a tablet, inscribed, "Droit de l' Homme et du Citoyen." Motto, "Republique Francaise." Reverse, arraignment of royal government, and sustaining the three revolutions, 1789, 1830 and 1848.

No. 9. The three heads of Adam Mickiewicz, Jules Michelet and Edgar Quinet. Reverse, motto, "Ut omnes unum sint," "La France et les auditeurs du college de France, 1844, 1845."

No. 10. Head of Pierre Jean de Beranger. Reverse, is remarkable for its fine lettering of the titles of songs of Beranger. The design is an antique harp, surrounded by rays as from a sun ; alternating with the rays is the following list (enclosed in a circle of two inches) :

1. Adieu Chansons.
2. Le Roi d'Yvetot.
3. Maudit Printems.
4. Le Vieux Drapeau.
5. Vieux habits vieux galons.
6. Louis XI.
7. Prediction de Nostradamus.
8. La bonne vieille.
9. Le Dieu des bonnes gens.
10. Le Juif errant.
11. Les etoiles que filent.
12. Le Senateur.
13. Les enfans de la France.
14. Le Grenier.
15. Le tailleur et la fée.
16. L'echelle de Jacob.
17. L' aveugle de Bagnolet.
18. Les Hirondelles.
19. Les esclaves Gaulois.
20. Brennus.
21. Les tombeaux de Juillet.
22. Les Bohemiens.
23. Le Marquis des Carabas.
24. La Vivandiere.
25. Les Souvenirs du peuple.
26. Les Vendanges.
27. A mês amis devenues Ministres.
28. Les Gueux.
29. Les deux sœurs de charite.
30. Le Champ D'asile.
31. Les Contrabandiers.
32. Roger Bontemps.

[in all 487 letters].

The death of James McFarlane, Towanda, Pa., October 12, 1885 (born Sep. 2, 1819), was announced and on motion the President was authorized to appoint at his discretion a suitable person to prepare an obituary notice.

Prof. Cope presented for the Transactions a paper "On the Species of Iguaninæ," which was referred to Messrs. Koenig, Horn, and Harrison Allen.*

* Reported on favorably, Nov. 20, 1885.

Prof. Cope presented for the Proceedings the following papers:

1. On the Structure and Affinities of three Species of Fishes from the Eocene of Wyoming Territory.*

2. Report on the Coal deposits near Zacualtipan, Hidalgo, Mexico.

3. On the Structure of the Brain and Auditory Apparatus of a Theromorphous Reptile, for which a plate was desired.

Prof. Houston presented his views on the origin of earthquakes as shown by the late great explosion of dynamite (285,000 lbs.), at Flood Rock, Hell Gate, upon which a discussion ensued, participated in by Messrs. Davis, Koenig, and Cope.

This being the stated evening for balloting for candidates, the following gentlemen were declared duly elected members of the Society:

1049. William John Potts, Camden, N. J.

1050. Prof. Scheele de Vere, University of Virginia.

1051. Prof. Edwin North, Hamilton College, Clinton, N. Y.

1052. W. J. A. Bonwill, M. D., 1721 Locust St., Philadelphia.

1053. Thos. M. Cleemann, C. E., 2125 Spruce St., Philadelphia.

1054. Horace Jayne, M. D., 1836 Chestnut Street, Philadelphia.

1055. Dr. Hermann Rollett, Stadt-Archivär, Baden bei Wien.

1056. Tommaso Cannizzaro, Messina, Italy.

1057. Everard F. im Thurn, M. A., Pomeroon river, Georgetown, British Guiana.

1058. Prof .John Pomialowsky, Secretary of La Société Imperiale d'Archeologie Russe, St Petersburg.

1059. Dr. Ernest Haeckel, Jena.

1060. Prof. Dr. Josef von Lenhossek, Buda Pesth, Hungary.

1061. Prof. Louis Pasteur, Paris.

1062. Prof. Giuseppe Sergi, Università Roma, Rome, Italy.

1063. Prof. Dr. Leopold von Ranke, Berlin.

Nominations Nos. 1064, 1065, 1066, were read, and the meeting was adjourned by the presiding officer.

* Withdrawn by consent, Nov 6, 1885.

ERRATA IN PAPER BY AUGUSTUS R. GROTE.

In the Proceedings American Philosophical Society, No. 114.

Page 136, line 30 for "are quite highly" read "are often quite highly."
" 137, " 8 for "one" read "our."
" 142, " 11 for "Andela" read "A*u*dela."
" 142, " 17 for "Derideus" read "Deride*n*s."
" 145, " 9 for "Trabulis" read "Trab*a*lis."
" 145, " 26 for "Euthea" read "E*n*thea."
" 148, " 18 for "Tota" read "*F*ota."
" 150, " 5 for "Viasica" read "Via*t*ica
" 150, " 37 for "Bettumei" read "Be*thun*ei."
" 151, " 33 for "Sarena" read "S*u*rena."
" 153, " 1 for "Hulotia" read "Hul*s*tia."
" 153, " 12 for "Adrena" read "Ad*v*ena."
" 153, " 34 for "Trileuca" read "**Trileuca**;" this is a generic title proposed for *Rectifascia* and allies.
" 154, " 39 for "was then" read "*h*as the*m*."
" 159, " 10 for "Scole" read "*I*cole," and for "Sole" read "*I*ole."
" 164, " 24 for "nine" read "more."
" 168, " 35 for "W. W. Hall" read "W. W. H*i*ll;" the genus is named for my friend Mr. Hill, of Albany, the well-known Lepidopterist.
" 169, " 26 for "Tota" read "*F*ota."
" 169, " 2 from bottom for "Arnata" read "Ar*m*ata."

There are a few other errata to be noticed, but they will have been readily detected by students using the article of which I regret not to have been able to read the proofs.

A. R. G.

and propriety of these explanations. Thus I was led to examine the foundation of the whole view of the subject, and when neither Savigny nor any of his school appeared to me to have taken the

Nominations Nos. 1064, 1065, 1066, were read, and the meeting was adjourned by the presiding officer.

* Withdrawn by consent, Nov 6, 1885.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

Vol. XXIII. April, 1886. No. 122.

MYRIAPODA MUSEI CANTABRIGENSIS, Mass.

Part I. Chilopoda.

By Fr. Meinert, Copenhagen.

(*Read before the American Philosophical Society, October 2, 1885.*)

Several years since Mr. Alexander Agassiz, the director of the Museum of Comparative Zoölogy, Cambridge, Mass., through Dr. Hermann A. Hagen, offered to place in my hands the Myriapoda of that museum for examination and description. It was thought necessary at the same time to include the Myriapoda of the Museum of the University of Copenhagen, by which the work certainly gained as to completeness, but was on the other hand not a little delayed. When my report on the first part of the Myriapoda, the Chilopoda, was so far advanced that preparations for the press had to be commenced, there arose some difficulty as to a joint publication. I shall therefore begin with the Chilopoda of the Cambridge Museum, while the report upon that class in the Copenhagen Museum will appear in the "Naturhistorisk Tidsskrift," in which the greater part of my previous papers on the Myriapoda are to be found.

In the years 1866–1872, I treated both groups of Myriapoda in a series of essays, in all of which, in regard to the parts of the mouth, I accepted Savigny's explanation and used terms agreeing with it. Subsequently my studies of the different classes of the Arthropoda raised doubts in my mind as to the correctness and propriety of these explanations. Thus I was led to examine the foundation of the whole view of the subject, and when neither Savigny nor any of his school appeared to me to have taken the right starting point, I rejected the old explanation altogether and based my views on a more general and, I hope, a more correct explanation of the parts of the mouth. I have, in later years, several times attempted to develop them and to apply them to these organs. At present, I shall limit myself to referring to the last of my essays "Caput Scolopendra," of which both a Danish and an English edition was published in 1883.* In this essay, by means of three plates, I have attempted to demonstrate the propriety of my new views with regard to the Chilopoda in general and Scolopendra in particular. In consequence of this also, several new terms were introduced; but Latzel and Haase had already, by their demonstration of the incorrectness of the explanation of the first and second pair of maxillæ, which Savigny and I also had supported, made some alteration necessary on this point. For the rest such alterations are only made when the old terms refer to an incorrect explanation. No reason was found for altering such terms as *mandible* for example, although formerly I reckoned these organs with the first segment or metamer, and now with the third metamer; for in the true Insects I consider the mandibles to be the third pair of the parts of the mouth. (That the mandibles of the Myriapoda and of the true Insects are not completely homologous is of no importance here).

I will now draw up the two series of terms; the old ones which I have used hitherto, and the new, which I proposed in my lately published "Caput Scolopendræ."

OLD TERMS.	NEW TERMS.
Lamina cephalica.	Lamina cephalica (head-plate).
Labrum.	Labrum (upper lip).
Maxillæ primi paris.	Labium (under lip) p. p.
Maxillæ secundi paris.	Labii processus interiores.
Pedes maxillares primi paris.	Maxillæ *or* palpi maxillares.
Mandibulæ.	Mandibulæ.
Pedes maxillares secundi paris.	Sternum (metameri quarti) cum pedibus prensoriis.
Coxæ (p. maxill.).	Sternum (metameri quarti).
Dentes pedum maxillarium, secundi paris.	Dentes prosternales, seu dentes prosterni metameri quarti.

* The complete title of the English edition is "Caput Scolopendra: The head of the Scolopendra and its musculatory system." With 3 plates. Copenhagen, 1883.

Furthermore, I ought to remark that at present I reckon the "lamina dorsalis" as scutum dorsale to the fourth metamer (the ventral part of which is the raptorial legs or pedes prensorii with their sternum), and the "lamina præbasalis" as scutum dorsale to the third metamer (of which the mandibles are the exponents). In the "Myriapoda Musæi Hauniensis, I. Geophili," p. 9, I have explained the "lamina basalis" in the same manner as here; but there I referred the "lamina præbasalis" to the maxillæ, or the "pedes maxillares primi paris" as I then named them, because the ventral part of the true third metamer was, at that time, quite overlooked, not by me alone, but by all authors. But the alteration of the explanation is no reason for altering the term.

With regard to the classification of the Myriapoda or of the Chilopoda generally, there is but little reason for inquiring into the matter more extensively, particularly as no species of the aberrant genera Scolopendrella, Polyzonium (and Peripatus), are among those which are the object of my present investigations. I will only refer to my previous papers, in which I have strenuously opposed the views of Alex. Brandt, when he regards the genus Scutigera to be a special type of no less systematic value than all the other Chilopods together. For this reason also, I united the Scutigerini and Lithobiini in one single family, the Lithobii, regarding their systematic value as not being greater than that of the Scolopendræ and the Geophili. At present I willingly admit that I have rather exaggerated, in my endeavors to prove the intimate relation between Scutigera and Lithobius, and that I have thus in some degree underrated the systematic value of Scutigera; and, therefore, I prefer now to consider the genus Scutigera to be a separate family, of similar value to the other families of the Chilopoda. But, on the other hand, I must maintain that Scutigera and Lithobius are much more closely related reciprocally, than to either Scolopendra or Geophilus, and therefore I prefer, according to Erich Haase, to unite the four families into two groups, the Anamorpha and the Epimorpha, rather than, according to Latzel, to arrange them into a straight line.

I. Tribus Anamorpha.

Segmenta corporis pedifera 15, inter se inæqualia.

Pedes longi vel longissimi; omnes coxis magnis, manifestis, tarsis bi- vel- multi-articulatis.

Antennæ articulis multis vel plurimis.
Oculi ocellis paucis vel plurimis, aggregatis vel compositis.
Pedes prensorii articulo secundo et tertio manifestis, integris.
Spiraculorum paria nulla vel maxime 6.
Genitalia feminea forcipe externo armata.

Pullus ex ovo nuper exclusus pedum paribus 7 modo instructus.

The tribus Anamorpha thus corresponds with the family Lithobii, as I have proposed this family in "Danmark's Scolopendrer og Lithobier." Naturh. Tidsskr. 3 R., 5 B., p. 246, and the alterations which I have made in the characters here are rather insignificant, although I will remark upon the following.

By the addition of "corporis" to the first characters, I intended to argue that the pedes prensorii or raptorial legs, together with their segment or metamer, cannot be reckoned with the true segments and the true limbs of the body; and I must particularly urge this point, as I have given up the denomination "pedes maxillares" in which an explicit reference to the head was contained. To the second character I have added "omnes coxis magnis, manifestis," by which I maintain that the last pair of legs has large coxæ of the same shape as those of the other legs, and with or without excretorial pores. In the next place I have determined the characters concerning the spiracles more exactly, but for further explanation I must refer to the characters of the family (or genus) Scutigera. The characters concerning the raptorial legs will be treated of more minutely under the second principal group, the Epimorpha. In conclusion I have added the last two characters of Haase.

As to the rest, with regard to my character "tarsis bi- vel-multi-articulatis," I must make the following remark. The typical number of joints of the limbs, both in the Chilognatha and the Chilopoda is seven, and it is thus stated by recent authors,* and particularly by Latzel, in his most valuable work on the Austrian Chilopods.† According to the rule, these seven

* Newport, on the contrary, reckons only six joints in the limbs of the Myriapods, overlooking, or not regarding as a joint the trochanter. "Monogr. Class. Myriap. Trans. Linn. Soc. London," xix, p. 283. Wood has also in this point followed Newport. "Myriap. North Amer. Trans. Amer. Phil. Soc.," xiii, p. 141-142.

† "Die Normal zahl der Fussglieder ist sieben," so he writes in spaced types. "Myriap. Oesterr, Ung. Mon,, p. 11."

joints are regarded as homologous with corresponding joints of the limbs of the Insects, in this manner :—the first joint is explained to be the coxa, the second the trochanter, the third the femur, the fourth the tibia, and the last three joints to be the tarsus or the foot. (Compare also Latzel, l. c., p. 12.) As far as number goes, this explanation is very excellent, particularly as most insects have the same number of divisions, five, and a great multitude of insects precisely three joints in the foot, but in reality it is very superficial and incorrect. Thus, when we regard the limbs of insects as the props which support the body and carry it over the ground, four divisions are necessary, viz: *the first*, by which the prop is fastened to the body, *i. e.* the coxa; *the second*, which extends the prop beyond the median line of the animal, *i. e.* the femur (and the trochanter); *the third*, by which the body is raised from the ground, *i. e.* the tibia; and *the fourth* which supplies the necessary hold upon the ground, *i. e.*, the tarsus. Yet it will clearly appear that the matter depends on the arrangement and not on the number or the series of the joints; for the number varies not only in the fourth division, the tarsus, but also in the second (the femur). But still, no one has ever regarded the femur as a tibia, when, the trochanter being bipartite, as in many Hymenoptera, the femur became the fourth and not, as is usual, the third joint in the limb, nor the tibia as the first joint of the tarsus, in the same case. Yet of these four divisions, the second is usually divided into two, the fourth into from two to five joints, beside the claw or claws. The third division, the tibia, is unipartite, or whole, in the true Insects, but in the Spiders, it is bipartite, and the joints here are denominated "patella" and "tibia"; so also in the Chilopoda. Among the Chilopoda, however, no genus can prove more clearly than Scutigera that the fifth and fourth joints are of one set, and that the fifth joint cannot be referred to the tarsus, as well as the sixth and the seventh. for in this genus, the fifth and sixth joints are bent into an angle, and are also very different in structure; furthermore, the fifth joint is, like the tibia of the true Insects, formed with distinct, although small, calcars. The two joints of which the tarsus of the Chilopods thus consists, are most frequently separated, more or less distinctly, but often, as in the Geophili and in some Scolopendrini (Cryptops), they are coalesced, or on the contrary, as in the Scutigera, they are both divided into a great number of joints. I have already suggested this explanation in "Danmark's Geophiler," where it is said in the diagnosis of the Geophili, l. c. p. 81, "tarsis integris," and immediately after: "Det normale Antal Led i Myriapodernes Been kan antages at vaere syobaacte hos Chilognather og Chilopoder;" with regard to the Scolopendrini and Lithobii (Anamorpha), in "Danmark's Scolopendrer og Lithobier," p. 242 and 244, I have maintained this view, and in the "Myriapoda Musæi Hauniensis, I. Geophili," p. 7, I have reiterated my former explanation of the limbs of the Geophili. In the following table, I will set forth the terminology which I shall use in this paper, together with that which some other authors have used.

	1st Joint.	2d Joint.	3d Joint.	4th Joint.	5th Joint.	6th–7th Joint
Newport,	Coxa,	. . . .	Femur,	Tibia,	Tarsus,	Metatarsus.
L. Koch,*	1. Hüftenglied,	2. Hüftenglied,	Oberschenkel.	Unterschenkel,	1 Tarsalglied [da,	2-3 Tarsalglied.
Torath,†	Coxa,	. . . . . .	Femur,	Tibia prima	Tibia secun-	Tarsus.
Latzel,	Hüfte,	Schenkelring,	Schenkel,	Schiere,	1 Tarsalglied	2-3 Tarsalglied.
Author,	Coxa,	Trochanter,	Femur,	Patella,	Tibia,	Tarsus.

With regard to the denominations of Newport, I will call to mind a correction, which, for the rest, Newport himself has made in the second part of his monograph, saying, l. c., p. 351, footnote:

"In the first part of this paper, page 283–4, the joint that articulates with the tibia has been described by a mistake as the *metatarsus* instead of the *tarsus*, and the remaining joints as *tarsal* instead of *metatarsal*."

In the dissertation "Schlesiens Chilopoda I. Chilopoda anamorpha," 1880, Haase seems to have followed me, at least, he says in the character of his subordo prior, the Chilopodo anamorpha, "tarsis bi- vel multi-articulatis," l. c., p. 6, but in the paper published immediately afterward, "Beiträge zur Phylogenie und Ontogenie der Chilopoden," he must have joined Latzel's side, for he says, l. c., p. 11, "Die Beine der Chilopoden lassen sich stets auf das typische Insectenbeine zurückführen

* "Die Myriapodengattung Lithobius," 1862.

† "Myriapoda Africæ australis, in Musæo Regio Holmiensi asservata," 1872.

und bestehen normal wie dieses aus Coxa, Trochanter, Femur, und einem 3-gliedrigen Tarsus."

1. Fam. SCUTIGERINI.

Laminæ dorsales alternæ manifestæ, in medio incisæ, alternæ evanidæ.

Pedes longissimi, tarsis multi-articulatis, unguis singuli, processus binis setiformibus instructi.

Antennæ setaceæ, articulis plurimis compositæ.

Oculi ocellis plurimis compositi.

Spiracula nulla. Stomata septem.

Palpi maxillares quadriarticulati ungue nullo.

Laminæ dorsales segmenti septimi atque octavi coalita.

Sternum metameri quarti bipartitum ; setis octo longis armatum.

Coxæ pedum posteriorum simplices (poris execretoris nullis).

The fifteen segments of the body have each one pair of limbs and differ but very little among themselves with regard to the size of the laminæ ventrales ; but, on the contrary, the difference between the dorsal part of the segments is very great, the laminæ dorsales of six segments, i. e., the 2d, 4th, 6th, 9th, 11th and 13th, not being fully developed, but only represented by a membranous fold which is attached to the front edge of the lamina dorsalis of the following segment, while the laminæ dorsales of the eighth and ninth segments coalesce into a common large plate. Thus the number of distinct, well-developed segments in the Scutigerini is only eight. With regard to the second family of this tribus, the Lithobiini, I must remark that the same six laminæ dorsales, which in the Scutigerini are evanescent, in the Lithobiini become abruptly smaller than the remaining laminæ, while the two large well-defined laminæ dorsales of the seventh and eighth segments in the Lithobiini correspond with the large coalesced lamina of the same segments in the Scutigerini.

The posterior edge of the first seven well-developed laminæ dorsales is deeply excavated in the median line, and in this excavation a narrow chitinous ring encloses the orifice (stoma) of a duct into which a number of glandular tubes open from both sides. A controversy of some length has lately taken place with regard to the function of these stomata and of the glandular organs situated behind them, which are either supposed to be spiracles and tracheæ, or regarded only as mere glands. The second view has been several times supported by the author, and I will only refer to my last paper in the controversy: " De formeentlige Aarde draetsredskaber og deres Mundinger (Stomata) hos Slaegten Scutigera " (" The supposed respiratory organs and their orifices (stomata) in the genus Scutigera"). Vid. Medd. Naturh. Foren. Kjobenhavn, 1882, p. 88.

At present, I will only point out that the number of stomata is seven, and that of the pairs of spiracles in Lithobius six, and that if the stomata were homologous with the spiracles in the other Chilopods, certainly the first segment of the body in Scutigera should have spiracles or coalesced spiracles, while that segment in the other Chilopods should be without these respiratory organs.

The limbs are very long, or much elongated, the different joints being all, except the trochanter, elongated, and the last two, the tarsus, being, besides, divided into a great number of little joints. The first seven pairs of legs are nearly of the same length, but each following pair increases in length, and the hindmost pair, particularly in the male, is abruptly elongated into a fine hair. The two joints of the tarsus are each divided into a great number of badly defined little joints, but the length and thickness of the first joint is always greater than that of the second ; on the contrary the number of little joints is much greater in the second tarsal joint than in the first, and we find here even four or five hundred such joints (Latzel, l. c., p. 27). The length of these little joints varies very much in the same species, nay, even in the same specimen, and, besides, no established order can be detected, so that we cannot possibly follow Newport, when he makes use of the proportion between the lengths of the first two of these little joints as characters of species. I have found the proportion varying in the same species from 1 : 1 to 1 : 6, but never have I seen the second joint larger than the first; also, in the same specimen, I have found the proportion 3 : 1 in one leg, but 1 : 1 in the other. Without going further, the circumstance that the different authors who have used this character have mentioned a different proportion in the same species demonstrates that the proportion is not so fixed as Newport intimates (l. c., p. 351).

Each leg has a single claw, but this claw has two long setiform processes, which run along the inner side of the claw, from the base; the length of the processes seem to be from one-half to four-fifths of the length of the claw. The anal legs seem to be clawless.

The antennæ are setiform, very long, and consist of several hundreds of very minute joints, which are, however, united into two or three fully distinguishable principal joints.

The eyes are large, very prominent and composite, the number of ocelli may be some two hundred or more.

In the preceding pages I have already mentioned the want of spiracles.

The palpi maxillarics are long, slender, four-jointed; the first three are furnished on the front edge with long stout bristles. The fourth or last joint has preserved the same shape as the preceding ones, and has not, as in the Lithobiini and the other Chilopoda, taken the shape of a claw. The two halves of the sternum of the (fourth) metamer are not united; each part bears four long stout bristles on the front edge.

The coxæ are all plain, without glands or glandular pores.

The forceps of the female organs of generation consists of a pair of styli, the first joints of which are nearly joined together with the posterior half of their inner edge, while the forward part is separated and often furnished with a small brush of hair at the corner. As these styli are bent against each other, the shape of the forceps and of the sinus between the two styli is altered and therefore no characters of great value can be drawn from this organ.

Most of the characters in use to-day are valueless, except the color and the proportions of the length of the legs and of the antennæ to the body; we seldom find true characters used, but ordinarily the descriptions are drawn now from one part of the body, now from another. Even the characters employed by such accurate observers as Torath and Latzel are partly due either to a fortuitous want, or are characters common to the whole genus. It is evident that a very great number of different species are needed, before we can hope to find the true special characters. Yet it is far from my intention to claim that I have been more fortunate than my predecessors, and although I believe I have shown many deficiencies in the characters in use, I do not mean that I myself have found the right ones; but I also have had too little material and this must be my excuse.

Although the genus Scutigera is very interesting, the different species of the genus are but little so; and the characters which they offer are, as I have just asserted, often very few and without value. Besides, the antennæ and the legs, particularly the anal legs, are excessively fragile and are often wanting, even in living specimens; and thus many of the specimens which are preserved in museums are more or less destitute of the organs from which the chief characters are drawn. Frequently we find specimens deprived of all their external organs. Species founded on such organs are indeed of no great value, but nevertheless they are distinguishable, and I myself have proposed such a new species.

1. Scutigera serratipes.

Scutigera serratipes Gervais, Walckenær Hist. Nat. Ins. Apt. iv, p. 221.

? *Scutigera Templetoni* Humbert, Essai Myriap. Ceylan, p. 8, pl. i, fig. 1, 1a–1b.

Latiuscula, ante et post paulum angustata, convexa (,) livida, vittis duabus lateralibus latissimis griseis mediaque post paulum angustata rufo-livida notata, antennis tarsisque flavis, cingulis patellarum manifestius, tibiarum binis obsoletius cœrulescentibus; manifesto tuberosa, spinulis in dorso (extra lineam mediam glabram) subseriatis granulisque perminutis scabriuscula.

Lamina cephalica fere æque longa ac lata, post late minus profunde impressa, ante canaliculata, sulcis duobus rectis transversis atque sulco singulo antico curvato exarata; alte marginata (,) margine læviuscula, fimbriata.

Antennæ corpore sesqui longiores.

Laminæ dorsales alte marginatæ, margine densissime spinuloso, margine postico in angulum obtusum producto, obscure flexuoso, in medio late sinuato; lamina ultima latiuscula, lateribus paulum flexuosis, sat angustata, post late rotundata, obscure emarginata.

Stomata in æquum porrecta, longa, stomate primo quam linea media laminæ dorsalis manifesto breviore.

Carinæ pedum alte expressæ, densissime spinulosæ.

Pedes paris ultimi tenuissimi, corpore plus duplo longiores (fere 11 : 5); tibia a tarso bene discreta, manifesto clavata, aculeis binis longiusculis, subæqualibus armata.

Forceps feminæ longiusculus, articulo altero quam priore multo breviore (fere 3 : 4).

Long. 35 mm.

Hab. At Pennaculum, South India, Mr. Scudder; the Isle of St. Mauritius, Mr. Pike.

2. Scutigera castanea, n. sp.

Angustiuscula, ante multum, post paulum angustata, valde convexa; castanea, concolor; tuberosa, spinis in dorso medio subseriatis granulisque perminutis dense scabricula.

Lamina cephalica multo longior quam latior (5 : 4), in crucem impressa, margine læviusculo.

Antennæ desunt.

Laminæ dorsales alte marginatæ, margine manifesto crenulato, margine postico in triangulum obtusum producto, in medio late sinuato; lamina ultima lata, lateribus rotundatis, valde angustata, post integra.

Stomata in æquum porrecta, longa, stomate primo quam linea media laminæ dorsalis fere sesqui breviore.

Pedes desunt.

Forceps feminæ longiusculus, angulo interiore articuli prioris longius penicillato.

The type of this species was deprived of all its legs and the antennæ.

Hab. Koolloo, Mr. Carleton (the specimen was found in a box together with the last mentioned species of this genus, Scut. microstoma).

3. Scutigera forceps.

? *Selista forceps* Raffinesque, Ann. of Nature, i, p. 7.?

Cermatia coleoptcrata Say, Journ. Acad. Nat. Sc. Philada., ii, p. 5.

Cermatia floridana Newport, Trans. Linn. Soc. Lond., xix, p. 353.

Scutigera floridana Gervais, Walck. Hist. Nat. Ins. Apt., iv, p. 225.

Cermatia forceps Wood, Journ. Acad. Nat. Sc., new ser., v, p. 132.

Wood, Trans. Amer. Philos. Soc. xiii, p. 145, pl. iii, fig. 1, 1a.

? *Cermatia Mexicana* Saussure et Humbert, Etud. s. Myriap., p. 112, tab. v, fig. 3, 3a, b. p.

Latiuscula, ante vix post paulum angustata, minus convexa vel convexa; supra viridi-lutea, vittis tribus angustis, fuscis vel cœrulescentibus notata, patellis tibiisque cingulis binis cœrulescentibus, per paria sensim latioribus atque manifestioribus ornatis; obscure tuberosa, spinulis sparsis subseriatis (extra lineam mediam longitudinalem lævem) scabriuscula.

Lamina cephalica post late, minus profunde impressa, ante canaliculata, carina media obscuriore in transversum notata, minus alte marginata, margine læviusculo, sparse fimbriato; manifesto latior quam longior (fere 8 : 7).

Antennæ pertenues, corpore plus sesqui longiores (feminæ 11 : 7; mari 5 : 3).

Laminæ dorsales minus alte marginatæ, margine sparse spinuloso, margine postico late rotundato, in medio latissime sinuato ; lamina ultima angustiuscula, lateribus rotundatis, sat angustata, post breviter rotundato, in medio obscure sinuato.

Stomata præter primum in æquum fere porrecta, parva vel mediocria, stomate primo quam linea mediæ laminæ dorsalis bis vel ter (fere 2 : 5), breviore.

Carinæ pedum minus alte expressæ, sparse spinulosæ.

Pedes paris ultimi pertenues, corpore bis vel ter longiores (fere 5 : 2), tibia a tarso bene discreta, obscure clavata, aculeis binis longiusculis, inæqualibus armata.

Forceps feminæ breviusculus, angulo interiore articuli prioris penicillato, articulo altero quam priore multo breviore (fere 3 : 4).

Long. 28 mm.

I have compared typical specimens of Mr. Wood.

Hab. Beaufort, N. C.; Texas, Mr. P. W. Putnam ; Boston, Mass., Mr. Corbett (another specimen from Boston was labeled "found Dec'br 27 living in a tobacco store in Boston importing tobacco from the Southern States, perhaps imported ").

4. Scutigera Argentina.

Cermatia Argentina Humbert et Saussure, Rev. et Mag. Zool. 2 sér. xxii, p. 202.

Saussure et Humbert, Etud. s. Myriap. p. 113. Tab. v, fig. 2, 2a.

Angusta, ante et post vix angustata, compressa vel compressiuscula; obscure brunnea, pedibus flavis, sanguineo-plagiatis ; parum tuberosa, spinulis in series subdigestis scabriuscula.

Lamina cephalica in foveam parum altam impressa, in medio sat profunde canaliculata, sulco transverso, valde arcuato obscure impressa ; minus alte marginata, margine læviusculo, sparsissime fimbriato ; vix latior quam longior.

Antennæ desunt.

Laminæ dorsales minus alte marginatæ, margine dense crenulato, margine postico rotundate angustato, in medio in angulum acutum inciso ; lamina ultima angustiuscula, lateribus rotundatis, angustata, post integra.

Stomata fere propendentia, perparva, stomate primo quam linea media laminæ dorsalis multoties breviore.

Carinæ pedum minus alte expressæ, sparsissime spinulosæ.

Pedes paris ultimi desunt.

Forceps feminæ breviusculus, angulo interiore articuli prioris aculeo penicilloque brevibus armato, articulo altero quam priore paulo breviore.

Long. 18 mm.

Hab. Cordova, Argent., Mr. Davis (one single specimen).

5. Scutigera nigro-vittata, n. sp.

Latiuscula, ante et post paulum angustata, convexiuscula ; flava, vittis duabus latis, nigris, lateralibus prætereaque vittis duabus interioribus capiti notata, femoribus patellis tibiisque infra fasciis binis nigris, per paria sensim manifestioribus atque latioribus signatis, stomatibus nigris ; obscure tuberosa, spinulis sparsis, in series subdigestis (extra lineam mediam longitudinalem glabram) granulisque perminutis scabriuscula.

Lamina cephalica post profunde impressa, ante canaliculata, sulcis duobus in transversum impressa ; minus alte marginata, margine sparsius fimbriato ; fere æque longa ac lata.

Antennæ tenues, truncatæ.

Laminæ dorsales minus alte manginatæ, margine densius fimbriato, margine postico sat breviter rotundato, in medio late sinuato ; lamina ultima angustiuscula, valde angustata, post brevissime rotundata.

Stomata paulum declivia, parva, stomate primo quam linea media laminæ dorsalis bis vel ter breviore.

Carinæ pedum minus alte expressæ, spinis sparsis vel sparsioribus setisque serratæ.

Pedes paris ultimi desunt.

Forceps feminæ longiusculus, latere interiore articuli prioris sparsius hirsuto, articulo altero quam priore plus sesqui breviore (fere 3 : 5).

Long. 25 mm.

Hab. Panama.

6. Scutigera microstoma, n. sp.

Latiuscula, ante et post paulum angustata, parum convexiuscula ; flava, vitta media, lata, gemina, fusca, marginibus laminarum obscurioribus ; læviuscula, sparsissime hirsuta, granulis perminutis aspera.

Lamina cephalica post in figuram ypsiliformem obscure impressa, ante leviter sulcata, parum alte marginata, margine sparse, brevius fimbriato ; multo longior quam latior (6 : 5).

Antennæ tenues vel pertenues, corpore paulo longiores (fere 11 : 10).

Laminæ dorsales parum alte marginatæ, margine obscure crenulato, margine postico rotundate angustato, in medio late sinuato ; lamina ultima angustiuscula lateribus flexuosis, paulum angustata, post latissime rotundata, in medio obscurissime sinuata.

Stomata declivia, parva, stomate primo quam linea media laminæ dorsalis bis vel ter breviore.

Pedes paris ultimi desunt.

Forceps feminæ breviusculus, angulo interiore articuli prioris breviter penicillato, articulo altero quam priore vix breviore.

Long. 21 mm.

Hab. A place 70 miles from Amballa, India, Mr. Carleton (10 specimens) ; Koolloo, Mr. Carleton (4 specimens in a box together with Scut. castanea).

2. Fam. LITHOBIINI.

Laminæ dorsales omnes manifestæ (alternæ minores), integræ.

Pedes longi, tarsis biarticulatis (in pedibus prioribus sæpe indistincte); ungues bini (in pedibus posticis sæpe singuli), ungue majore processu simplice, parvo armato.

Antennæ articulis multis vel permultis.

Oculi ocellis paucis vel multis, aggregatis.

Spiracula manifesta (sena).

Palpi maxillares triarticulati, ungue armati.

Laminæ dorsales segmenti septimi atque octavi discretæ.

Sternum metameri quarti integrum; prosternum ante integrum vel indentes incisum.

Pori excretorii in coxas quaternas (vel quinas) ultimas intrusi.

For further explanation of the characters of this family I refer to my preceding essays on the Lithobii ("Danmarks Scolopendrer og Lithobier," Naturh. Tidsskr. 3 R. 5 B., p. 247, and "Myriapoda Musæi Hauniensis ii, Lithobiini," ibid. 3 R. 8 B., p. 281) and to the preceding pages of this paper.

1. Gen. **Lithobius.**

Labrum liberum, in medio profunde incisum, dentatum, lateribus fimbria lata et densa, e laciniis setiformibus, racemosis facta, instructis.

Labium setis racemosis et simplicibus instructum, processibus labii sat magnis.

Palpi maxillares ungue tri- vel quinque-partito armati.

Mandibulæ seric abbreviata setarum minorum, racemosarum pone setas majores crenulatas armatæ.

Oculi ocellis paucis vel multis.

Pedes omnes vel plurimi calcaribus armati, maxime unguibus binis armati.

Genitalium femineorum unguis intus excavatus, integer aut bi- vel trilobus.

The characters which are here given of the genus Lithobius for the most part conform with those I have proposed in Myriap. Mus. Haun. ii, Lithobii, p. 283, and the apparent great difference arises solely from the introduction of my new terminology and from the altered order of the parts of the mouth, both of which my late investigations have made necessary.

Lamina dorsalis 6, 7, 9, 11, 13 angulis productis.
Pedes anales ungue singulo armati.
Pori coxales in series plures digesti.
Genitalium femineorum unguis tripartitus.
Pedum analium coxæ calcare armatæ.

1. Lithobius multidentatus.

Lithobius multidentatus Newport, Trans. Linn. Soc. Lond., xix, p. 365.
Gervais, Walck., Hist. Nat. Ins. Apt., iv, p. 236.
Bothropolys nobilis Wood, Journ. Acad. Nat. Sc., new ser., v, p. 15.
Bothropolys multidentatus Wood, Trans. Amer. Phil. Soc., xiii, p. 152.

Dilute brunneus, plagis binis magnis laminarum dorsalium, capite antennisque præter summam apicem fuscescentibus; robustus vel sat robustus, ante obsolete, post manifesto rugulosus; capite subobcordato, vix latiore quam longiore, sublævi. Antennæ longiores, articulis longis, 20–22 articulatæ.

Oculi ocellis 20–30, in series 4–6 digestis.

Dentes prosternales septeni vel octoni.

Pori coxales numerosi, in series 3–4 subdigesti.

Pedes corporis primi paris calcaribus 2, 2, 1; pedes anales calcaribus 1, 3, 2, 1 armati.

Pedes postici sat longi.

Genitalium femineorum unguis latus, manifesto tripartitus, aculeis interioribus quam exterioribus multo brevioribus.

Long. 22–25 mm.

Hab. Warwick, Mass. (3 typical specimens of Dr. Wood); Marlow, N. H.; near to the Mammoth Cave, Ky., Mr. Putnam; Michigan, Mr. E. P. Putnam.

Lamina dorsalis 7, 9, 11, 13 angulis productis.
Pedes anales ungue singulo armati.
Pori coxales pauciores, in seriem singulam digesti.
Pedes penultimi unguibus binis armati.
Pedum analium coxæ calcare singulo, parvo armatæ.

2. Lithobius Latzelii, n. sp.

Castaneus vel rufo-brunneus, laminis ventralibus pedibusque flavescentibus; robustus, sublævis, capite lato, multo latiore quam longiore (fere 4 : 3), vix punctato. Antennæ breviusculæ, paulum attenuatæ, 34-articulatæ.

Oculi ocellis 45–48, in series 8–9 obliquas digestis.

Dentes prosternales octoni.

Pori coxales 5, 7, 6, 4—5, 6, 6, 5, magni, plerique transversales.

Pedes corporis primi paris calcaribus 2, 3, 1; pedes anales calcaribus 1, 3, 3, 2 armati.

Pedes postici breviusculi, vix inflati.

Long. 23 mm.

Mas: Pedum analium femur patellaque infra sulco longitudinali excavata.

Hab. Crandall, Virginia.

Lamina dorsalis 9, 11, 13 angulis productis.
Pedes anales ungue singulo armati.
Pori coxales pauciores, in seriam singulam digesti.
Pedes penultimi unguibus binis armati.
Pedum analium coxæ calcare nullo.

3. Lithobius forficatus (Linn.).

Lithobius forficatus Newport, Trans. Linn. Soc. Lond., xix, p. 367.
Lithobius Americanus Newport, ibid, xix, p. 365, tab. xxxiii, fig. 29.
Lithobius multidentatus Wood, Journ. Acad. Nat. Sc., new ser., v, p. 13.
Lithobius Americanus Wood, ibid., p. 14.
Wood, Trans. Amer. Phil. Soc., xiii, p. 148.

Castaneus vel brunneus, laminis ventralibus pedibusque flavis, robustus, sat rugulosus, sæpissime subglaber, interdum hirsutulus, præsertim post, capite magno, subquadrato. Antennæ sat longæ, 36–48-articulatæ.
Oculi ocellis 22–35, in series 5–8 digestis.
Dentes prosternales quini vel septeni.
Pori coxales 6, 6, 6, 5—12, 10, 9, 8, plerique transversales.
Pedes corporis primi paris calcaribus 2, 3, 2; pedes anales calcaribus 1, 3, 3, 2 armati.
Pedes postici longiores, paulum inflati.
Genitalium femineorum unguis trilobus.
Long. 14–26 mm.

For the characteristics of the not fully developed Lithobius forficatus I refer to my Myriap. Mus. Haun., ii, p. 315 and 316, and to the elaborate essay of Latzel, l. c., p. 57; also for the table of synonymys I refer to Ant. Stuxberg, who in his "Lithobioidæ Americæ Borealis" (Ofvers. Kgl. Vet. Akad. Förh., 1875, No. 3, p. 27), gives a list of the synonyms of this animal perhaps complete to his time.

The species is doubtless the most common of all Lithobii in the eastern part of North America, and the Museum of Comparative Zoölogy also possesses numerous specimens not alone from Massachusetts, but also from other places, as Halifax, N. S.; Britain Island, N. S.; Amherst, N. H., Mr. A. M. Edmands; Bee Spring, Ky., Mr. F. G. Sanborn; Anticosti.

Lamina dorsalis 11, 13 angulis productis.
Pedes anales unguibus binis armati.
Pori coxales pauciores, in seriem singulam digesti.
Pedes penultimi unguibus binis armati.
Pedum analium coxæ inermes.

4. LITHOBIUS CANTABRIGENSIS, n. sp.

Flavus, capite paulo obscuriore; gracilis, sublævis, subglaber, capite subobcordato, fere æque longo ac lato. Antennæ breves, 35-articulatæ, articulis perbrevibus.

Oculi ocellis 8, in series 2 digestis.

Dentes prosternales bini.

Pori coxales 2, 3, 3, 2—3, 4, 3, 2.

Pedes corporis primi paris calcaribus 0, 0, 1; pedes anales calcaribus 1, 3, 1, 0—1, 3, 2, 1 armati.

Pedes postici longiusculi, paulum inflati.

Genitalium femineorum unguis trilobus, aculeis brevibus, acutis, interioribus quam exterioribus manifesto brevioribus.

Long. 10.5 mm.

Hab. Cambridge, Mass., Mr. H. H. James.

Laminæ dorsales omnes angulis rectis.

Pori coxales pauciores, in seriem singulam digesti.

Pedum analium coxæ calcare singulo armatæ.

5. LITHOBIUS JOWENSIS, n. sp.

Brunneus, capite cum antennis obscuriore, laminis ventralibus pallidioribus, pedibus flavis; sat gracilis, sublævis, pedibus densius pilosis, capite subobcordato, manifesto latiore quam longiore (fere 8 : 7). Antennæ breviusculæ, 23 articulatæ, articulis pluribus brevibus.

Oculi ocellis 12–15, in series 3–4 digestis.

Dentes prosternales quaterni.

Pori coxales 4, 5, 5, 4, rotundati.

Pedes corporis primi paris calcaribus 2, 1, 1; pedes paris antepenultimi (pedes anales penultimique desunt) calcaribus 1, 3, 3, 1 armati.

Pedes postici breviusculi.

Genitalium femineorum unguis integer, aculeis minus tenuibus, longitudine subæqualibus.

Long. 13.5 mm.

The specimen which I had to examine was in a bad condition, and particularly the last pairs of legs were lost.

II. Tribus EPIMORPHA.

Segmenta corporis pedifera pauciora vel numerosa, inter se subæqualia vel æqualia.

Pedes sat longi vel breves, coxis parvis vel evanidis, tarsis integris vel articulatis.

Antennæ articulis paucioribus.

Oculi nulli vel ocellis paucis.

Pedes prensorii articulo secundo atque tertio parvis vel nimis, in latere exteriore evanidis vel interruptis.

Spiraculorum paria segmentis pediferis numero subæqualia, vel saltem 9–10.

Genitalia feminea externa nulla.

Pullus ex ovo nuper exclusus pedibus secundum speciem normatis instructus.

1. Fam. SCOLOPENDRINI.

Segmenta pedifera 21–23, inter subæqualia.

Pedes sat longi, tarsis, saltem ultimis binis, articulatis.

Antennæ 17–30 articulatæ.

Oculi nulli vel ocellis paucis.

(Pedes prensorii articulo secundo atque tertio (sæpissime) in latere exteriore evanidis vel interruptis.)

Lamina basalis sæpissime evanida.

Spiraculorum paria plerumque 9 vel 10.

The number of the joints of the antennæ is seldom more than 22 or 23; yet in some true Scolopendræ, as in Sc. heros, I have found a greater number, and thus I have been compelled to place the limit as high as 30 joints.

As a rule, the second and the third joint of the raptorial legs (pedes prensorii) are very small. Furthermore, regularly the rings of these joints are not whole but interrupted at their dorsal or outermost side; yet, in the genus Cryptops the ring of the third joint is whole, and thus in this genus the dorsal side of the first and of the fourth joint of the raptorial legs is not as in the other genera united or confined.

Gervais, in his tables of the genera of the Scolopendrini, l. c., p. 243, proposes a genus Monops, and in the description of the Cryptops nigra, l. c., p. 294, he retains this name, but without giving a real description of the genus he only indicates that a pair of eyes is found by him. Now it would be of great interest to have a more full investigation of this new genus; I do not dare to say that the eyes are wanting, but on the other hand the family Scolopendrini forms such a compact and distinct group of animals, either wanting eyes, or having them to the number of four pairs, that it is not likely that in this family one species alone would have one pair; and, therefore, I believe that the genus Monops must be in many other characters different from the genus Cryptops, if the eyes in reality exist.

In the lately published genus Plutonium* the number of spi-

* Cavanna, Bull. Soc. Ent. Ital., xiii, p. 169, ff. tab. 1. I have not seen this paper, but, according to Bertkau, the genus seems to relate to Opisthemega.

racles is said to be 19 on each side, but in the other genera no more than 10 pairs are found.

I. *Segmenta pedifera* 23.

1. Gen. **Scolopocryptops.**

Scolopocryptops Newport.* Trans. Linn. Soc. Lond., xix, p. 407.

Lamina cephalica laminam primam dorsalem partim obtegens.

Oculi nulli.

Antennæ tenuiusculæ, subfiliformes, 17-articulatæ.

Labri fimbria longa, intus e setis ad apicem fissis facta.

Labii processus subteretes, barba e setis partim fissis facta instructi; palporum fimbria e setis paulum uncinatis vel clavatis facta.

Palporum maxillarium unguis in latere interiore dentibus 13–15 manifestis armatus; fimbria digitalis unguem procul explens, setis parum uncinatis.

Mandibulæ ante pectinibus 8 juxta et pone lamellam singulum, latam, dentatam coarctatis instructæ.

Metameri quarti sternum integrum, robustum; prosternum parum prominens subtruncatum, vel in angulos breviores productum; pedes prensorii articulo secundo et tertio minimis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula profunda, magna, subrotunda vel breviter ovalia, perpendicularia.

Pleuræ posticæ infra porosæ, in spinam longam post productæ.

Pedes anales elongati, quinquearticulati, articulo primo (femorali) spinigero, ungue minus curvato, subgracili, ad basis unguiculis binis minimis armato.

1. Scolopocryptops sexspinosus.

Cryptops sexspinosus Say, Journ. Acad. Nat. Sci. Philad., ii, p. 112.

Scolopocryptops sexspinosa Newport, Trans. Linn. Soc. Lond., xix, p. 407.
Gervais, Walckenaer Ins. Apt., iv, p. 297.
Wood, Journ. Acad. Nat. Sci. Philad., new ser., v, p. 37.
Wood, Trans. Amer. Phil. Soc., xiii, p. 172.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 54.
Porath, So. Vet. Akad. Handl. Bih., B. 4, p. 26.

Scolopocryptops spinicauda Wood, Journ. Acad. Nat. Sci. Philad., new ser., v, p. 39.
Wood, Trans. Amer. Phil. Soc., xiii, p. 174.

* This name is formed by Newport against the chief rules of nomenclature; yet it has always been received, and therefore I also shall make use of it.

? *Scolopendropsis helvola* C. L. Koch, Die Myriap., ii, p. 34, tab. lxxvi, fig. 156.

Flavo brunneus vel rufescens, subtus pallidior, capite cum lamina prima dorsali rubro-castaneo, antennis pedibusque flavis; minus robustus, sublævis; capite manifesto marginato, suborbiculari. Antennæ breviusculæ, breviter parcius hirsutæ, 17 articulatæ, articulis ultimis longis vel perlongis.

Metameri quarti prosterni margo anterior medius manifesto callosus, leviter productus, subrectus vel obscure sinuatus.

Pedes anales glabri, longi, spina inferiore magna, interiore parva.

Laminæ dorsales præter priores in lateribus manifesto marginatæ.

Pleuræ posticæ scabrosæ, poris majoribus atque minoribus, numerosis perforatæ, in spinam robustiorem, breviorem productæ.

Lamina ultima ventralis latiuscula, valde angustata, post subrecta.

Long. 65 mm.

Having compared typical specimens, both of the Sc. sexspinosus and of the Sc. spinicauda Wood, I cannot perceive any true or specific difference between them.

This species is very common and spread over the greater part of North America; I have seen specimens, preserved in the Museum of Comp. Zoöl., from Frederick county, Md., P. R. Uhler; Massachusetts, Miss A. M. Edmands, Cambridge, Mass.; Berkshire, Tioga county, N. Y.; Centre county, Pa., Shaler; Virginia, Crandall; Pennington's Gap, Lee county, Va.; Rosswell, Ga., Mr. King; Yellow Springs, Ohio; Rocky creek, Grayson county, Ky., F. W. Putnam; Macgregor, Iowa, Davis; Ritchie county, W. Va., N. E. Ingersen; San Mateo, Cal., A. Agassiz (Sc. spinicauda, the type of Mr. Wood).

2. Scolopocryptops Georgicus, n. sp.

Fulvus, capite rufescente, pedibus flavis; gracilis, sublævis, capite obscure marginato, subovato. Antennæ subglabræ, breves vel breviusculæ, 17-articulatæ, articulis prioribus transversalibus, anterioribus breviusculis.

Metameri quarti prosterni margo medius obscure callosus, productus, in angulum incisus, dentibus duobus armatus.

Pedes anales glabri, breviusculi, spina inferiore maxima, interiore parva vel perparva.

Laminæ dorsales præter sex priores marginatæ.

Pleuræ posticæ sublæves, integræ, magnam partem obtectæ, in spinam breviorem, acutam productæ.

Lamina ultima ventralis lata, parum angustata, post brevissime sinuata.

Long. 35 mm.

Hab. Georgia; I have seen two specimens.

3. Scolopocryptops Miersii.

Scolopocryptops Miersii Newport, Trans. Linn. Soc. Lond., xix, p. 405.
Gervais, Walckenaer Ins. Apt., iv, p. 298.

? *Scolopocryptops melanostoma* Newport, Trans. Linn. Soc. Lond., xix, p. 406.

? *Scolopocryptops melanosoma* Gervais, Walckenaer Ins. Apt., iv, p. 298.

Scolopocryptops sexspinosus p.p. Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 54.

Castaneus, subtus fulvus, antennis pedibusque flavis, posterioribus sæpe majorem vel maximam partem cœruleis ; robustus, sublævis, capite vix marginato, orbiculari. Antennæ longiusculæ, longius, dense hirsutæ, 17-articulatæ, articulis omnibus longis.

Metameri quarti prosterni margo anterior medius valde callosus, productus, manifesto sinuatus, sinu dentibus duobus majoribus vel minoribus armatus.

Pedes anales longi vel perlongi (maris ? manifesto pilosi), spina inferiore maxima, interiore majore vel minore.

Laminæ dorsales præter sex priores atque duas posteriores vel saltem ultimam immarginatæ.

Pleuræ posticæ scabrosæ atque porosæ, in spinam longam, acutam (vel maris ? longissimam, acutissimam) productæ.

Lamina ultima ventralis perlata, manifesto angustata, post sat profunde sinuata.

Long. 70 mm.

Hab. This species seems to prefer the more southern parts of North America, and I have also seen other specimens from the larger Islands of West India; from Jeremie, Hayti, Dr. D. F. Wienland; Grande Anse, Hayti, Uhler; Kingston, Jamaica, Garman; Monn (?) Rouge, Martinique, Garman. It is also found in South America.

II. *Segmenta pedifera* 21.

A. Segmentum septimum spiraculis instructum.

2. Gen. **Heterostoma.**

1. Heterostoma trigonopoda.

Scolopendra trigonopoda Leach, Zool. Miscell., iii, p. 36.

Heterostoma trigonopoda Newport, Trans. Linn. Soc. Lond., xix, p. 413.

? *Heterostoma sulcidens* Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 59, tab. iv, figs. 5–7.

One specimen of this genus, from Monrovia in Africa, is referred by me to the above named species; but the specimen is so badly preserved, that no further or closer investigations have been possible either of the characters of the genus or of those of the species.

3. Gen. **Branchiostoma.**

Branchiostoma Newport, Trans. Linn. Soc. Lond., xix, p. 411.

Lamina cephalica a lamina prima dorsali partim obtecta.

Oculi ocellis 4.

Antennæ longiusculæ, tenuiusculæ, manifesto attenuatæ, 18–21-articulatæ.

Labri fimbria brevis, setis simplicibus.

Labii processus subconici, barba e setis brevibus, densis, uncinatis facta; palporum fimbria e setis brevibus, densis, uncinatis facta.

Palporum maxillarium unguis in latere interiore dentibus binis longis, acutis armatus; fimbria digitalis setis parum uncinatis, unguem nullo modo explens.

Mandibulæ ante pectinibus 10–12 juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum integrum, sat robustum; prosternum longe prominens, ante in dentes majores incisum; pedes prensorii articulo secundo et tertio minimis, interruptis.

Segmentum septimum spiraculis instructum.

Spiracula sat profunda, magna, subovalia vel post subtriangula, fere perpendicularia; antica abrupte majora minusque profunda.

Pleuræ posticæ infra porosæ, in spinam longam productæ.

Pedes anales elongati, quinquearticulati, articulo primo (femore) spinigero vel inermi, ungue minus curvato, subgracili ad basin unguiculis binis longioribus, rectis armato.

1. Branchiostoma affine.

Branchiostoma affine Kohlrausch, Beit. z. Kenntn. d. Sc., p. 22.
Arch. f. Naturg. Jahrg., 47, p. 68.

Fusco-griseum vel flavum, in dorso medio linea angusta, pallida notatum, pedibus antennisque flavis; sat gracile, manifesto sparse punctatum, laminis ventralibus integris, capite subovali, immarginato. Antennæ breviusculæ, 18-articulatæ, præter articulos ternos priores dense, brevissime hirsutæ, articulis mediis longiusculis.

Dentes prosternales quaterni, obtusi, per paria approximati, exteriores minores vel evanidi; dens coxalis obsolete trilaciniatus.

Pedes anales perlongi, graciles, in latere interiore femoris spinis parvis 3–5 in seriem singulam, in latere inferiore spinis 4–7 in series binas digestis armati.

Laminæ dorsales quatuor priores omnino, 5–7 fere immarginatæ, ceteræ manifesto marginatæ.

Pleuræ posticæ sublæves, porosæ, in angulum longe productum, spinis ternis parvis armatum desinentes, in latere postico obliquo spina singula armatæ.

Lamina ultima ventralis angustiuscula, rotundate angustata, post manifesto sinuata.

Long. 62 mm.

Hab. Pegu, Burmah, C. H. Carpenter; 70 miles from Ambala, E. India, Mr. Carleton; Mauritius, Mr. Pike; Zanzibar, Mr. C. Cooke; and also Basseterre, St. Cristophori.

2. Branchiostoma celer.

Branchiostoma celer Humbert et Saussure, Rev. et Mag. Zoöl., 2 ser., xxii, p. 202.
Saussure et Humbert, Etud. s. Myriap., p. 122, tab. vi, fig. 16, etc.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 69.

Viride vel viridi-olivaceum, subtus flavo-brunneum vel ochraceum, pedibus præter posteriores antennisque præter articulos ternos priores vel totis flavo-brunneis; sat gracile vel robustius, sublæve, capite suborbiculari, immarginato, margine postico plus vel minus obtecto. Antennæ breviusculæ, 20-(18–21-)articulatæ, præter articulos ternos priores dense, breviter hirsutæ, articulis mediis longis vel longiusculis.

Dentes prosternales quaterni, per paria paulum approximati, obtusiusculi; dens coxalis sublævis.

Pedes anales perlongi, graciles, inermes.

Laminæ dorsales præter quatuor priores marginatæ.

Pleuræ posticæ manifesto scabrosæ, dense porosæ, in angulum lævem, acutum, spinis binis armatum productæ.

Lamina ultima ventralis latiuscula, rotundate angustata, post manifesto sinuata.

Long. 70 mm.

Hab. Kingston, Jamaica, Mr. Garman; Polvon, Occidental Dept. Nicaragua, Mr. McNiel.

B. Segmentum septimum absque spiraculis.

4. Gen. **Otostigma.**

Otostigmus Porath, Sv. Vet. Akad. Handl. Bih., B. 4, p. 18.
Branchiotrema Kohlrausch, Beitr. z. Kenntn. d. Scol., p. 22.
Arch. f. Naturg. Jahrg., 47, p. 70.

Lamina cephalica a lamina prima dorsali partim objecta.

Oculi ocellis 4.

Antennæ longiusculæ, crassiusculæ, manifesto attenuatæ; 18–23-articulatæ.

Labri fimbria brevis, setis paucioribus, simplicibus.

Labii processus subteretes, barba e setis brevibus, densis, uncinatis facta; palporum fimbria e setis brevibus, densis, uncinatis facta.

Palporum maxillarium unguis in latere interiore dente singulo, longo, acuto armatus; fimbria digitalis setis parum uncinatis, unguem superans.

Mandibulæ ante 10–12 juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum integrum, robustum; prosternum longe prominens, ante in dentes magnos incisum; pedes prensorii articulo secundo et tertio minimis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula sat profunda, magna, subovalia vel post subrotunda, obliqua, per paria sensim magis perpendicularia, antica abrupte majora minusque profunda.

Pleuræ posticæ infra porosæ, in spinam longam post productæ; vel truncatæ.

Pedes anales elongati vel valde elongati, quinquearticulati, articulo primo (femore) spinigero vel inermi, ungue minus curvato, subgracili, ad basin unguiculis binis parvis, subrectis armato.

1. Otostigma Luzonicum.

Branchiotrema Luzonicum, calcitrans, ? astenon Kohlrausch, Beitr. z. Kenntn. d. Scol., p. 23.

Arch. f. Naturg. Jahrg., 47, p. 73 and 72.

Ochraceum, plus vel minus olivaceum, antennis pedibusque flavescentibus; subgracile vel gracile, laminis dorsalibus sulcis pluribus plus vel minus manifestis exaratis, laminis ventralibus ad latera profunde bisulcatis, in medio obscure bifoveolatis vel sulcatis; capite subovali, post truncato. Antennæ longiusculæ, ad basin paulum incrassatæ, 18-articulatæ, præter articulos binos vel ternos priores manifesto hirsutæ articulis breviusculis vel brevibus.

Dentes prosternales quaterni majores, per paria approximati (exteriore sæpe evanidi); dens coxalis in latere carinatus.

Pedes anales longi, graciles, teretes, in margine sup. interiore femoris spinis binis minoribus, uniseriatis, angulo apicali evanido spina singula minore instructo, in latere interiore spinis ternis minoribus, uniseriatis, in margine inf. interiore spinulis binis majoribus uniseriatus, in margine exter. inferiore spinulis ternis majoribus uniseriatis armati.

Laminæ dorsales præter sex priores marginatæ.

Pleuræ posticæ sat amplæ, compressiusculæ, sublæves, sparsius, grossius porosæ, in angulum longum, trifidum, in latere superiore spinula parva singula, in latere exteriore interdum spinula parva instructum productæ, margine postico in obliquum levissime sinuato, spinula minore armato.

Lamina ultima ventralis latiuscula, lateribus rotundatis, valde convergentibus, post manifesto sinuata.

Long. 45 mm.

Hab. Koolloo Valley, East India, Mr. Carleton (4 spec.).

2. Otostigma carinatum.

Otostigmus carinatus Porath, Sv. Vet. Akad. Handl. Bih. B. 4, p. 20.
Branchiotrema multicarinatum Kohlrausch, Beitr. z. Kenntn. d. Scol., p. 22, fig. 5.
Arch. f. Naturg. Jahrg., 47, p. 71, tab. v, fig. 12.

Ochraceum vel fusco-griseum, capite cum lamina prima atque ultima dorsali brunneo; subgracile, laminis dorsalibus prioribus (2–7) sublævibus, mediis atque posterioribus plus vel minus manifesto septemcarinatis, ad latera rugulosis, laminis ventralibus obscure bisulcatis, capite subcordiforme, lateribus manifesto marginatis, post truncato. Antennæ longiusculæ, ad basin paulum incrassatæ, 20–23-articulatæ, præter articulos binos vel ternos priores hirsutæ, articulis pluribus vel omnibus breviusculis vel brevibus.

Dentes prosternales quaterni, majores, per paria approximati; dens coxalis in latere nodulis ternis parvis instructus.

Pedes anales perlongi, pergraciles, in margine sup. interiore femoris spinulis minutis, sæpissime ternis, angulo apicali non producto spinula singula minuta instructo, in latere interiore spinulis 2–6 minutis, in series binas digestis, in latere inferiore spinulis 4–8 parvis, in series binas digestis armati.

Laminæ dorsales præter quatuor vel sex priores marginatæ.

Pleuræ posticæ sat amplæ, compressiusculæ, densius, grossius porosæ, in angulum longum, ad apicem spinulis ternis vel quaternis minoribus instructum productæ, margine postico in obliquum subtruncato, spinulis binis minoribus armato; anguli pleurarum plus vel minus approximati.

Lamina ultima ventralis latiuscula, lateribus valde rotundatis, valde convergibus, post manifesto sinuata.

Long. 66 mm.

Hab. Shanghai, Mrs. A. P. Chamberlain.

3. Otostigma occidentale, n. sp.

Ochraceum, ante et post plus vel minus virescens, linea media dorsali angusta pallida; subgracile, ante sublæve, post manifesto hirsutum, in lateribus rugulosum, laminis ventralibus sublævibus; capite subcordiforme, post truncato. Antennæ longiusculæ, ad basin paulum incrassatæ, 21-articulatæ, præter articulos binos vel ternos priores manifesto hirsutæ, articulis breviusculis.

Dentes prosternales terni vel quaterni minores, acutiusculi; dens coxalis acutiusculus, simplex.

Pedes anales longiusculi, vix incrassati, articulis binis prioribus vix clavatis, femore inermi, post restricto.

Laminæ dorsales præter 12–13 priores marginatæ.

Pleuræ posticæ amplæ, sparse grossius porosæ, area antica glabra, majore, angulo apicali nullo, margine postico leviter arcuato.

Lamina ultima ventralis angustiuscula, lateribus rotundatis, valde convergentibus, post obscure sinuata.

Long. 45 mm.

The spiracles of this species are much smaller than the spiracles of most other species of the genus; yet, as to their construction, they all conform with the scape which ordinarily is found in Otostigma. Also with regard to the pedes anales and to the pleuræ, this is not a little different from the two others here described, perhaps, a new genus ought to be formed.

Hab. Grande Anse, Hayti, Mr. Uhler.

5. Gen. **Cupipes.**

Cupipes Kohlrausch, Beitr. z. Kenntn. d. Scol., p. 23.
Arch. f. Naturg. Jahrg., 47, p. 78.

Lamina cephalica a lamina prima dorsali partim obtecta; scuta dorsalia metameri tertii manifesta.

Oculi ocellis 4.

Antennæ breviusculæ, crassiusculæ, manifesto attenuatæ, 17-articulatæ.

Labri fimbria longa, setis paucioribus, simplicibus.

Labii processus subteretes, barba e setis brevibus, densis, uncinatis facta; palporum fimbria e setis brevibus, densis, uncinatis facta.

Palporum maxillarium unguis in latere interiore dentibus binis longis, acutis armatus; fimbria digitalis, setis uncinatis, ad apicem dentatis, unguem longe superans.

Mandibulæ ante 13 pectinibus juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum integrum, minus robustum; prosternum longe prominens, ante in dentes magnos incisum; pedes prensorii articulo secundo et tertio parvis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula profunda vel sat profunda, parva vel minima, subtriangula, priora longitudinalia, posteriora per paria sensim brevius triangula vel rotundata, minus profunda, magnitudine decrescentia.

Pleuræ posticæ infra porosæ, truncatæ.

Pedes anales breves vel perbreves, deplanati, quinquearticulati, articulo primo (femore) spinigero, ungue crasso, parum arcuato, absque unguiculis, infra carina longa, densissime crenulata instructo.

1. Cupipes ungulatis, n. sp.

? ? *Cormocephalus Brasiliensis* Humbert et Saussure, Rev. et Mag. Zool., 2 ser., xxii, p. 203.
Etud. s. Myriap., p. 124, tab. vi, fig. 17, etc.

Flavus, ante et post fulvescens ; sat gracilis, sparse, brevissime hirsutus, laminis dorsalibus posteribus præter sulcos ordinarios sulcis binis obsoletis, laminis ventralibus sulcis binis profundis exaratis; capite subovali, immarginato, obsolete longitudinaliter bisulcato, post in transversum arcuato, sulcato. Antennæ breviusculæ, tenuiusculæ, paulum attenuatæ, 17-articulatæ, præter articulos senos vel octonos priores dense, breviter hirsutæ, articulis breviusculis, subteretibus.

Dentes prosternales bini (interiores bifidi vel trifidi, exteriores minores, acuti) ; dens coxalis sat magnus, acutiusculus, nodulis binis in latere armatus.

Pedes anales breves vel perbreves, percrassi, fere contigui, in latere sup. interiore femoris spinulis ternis parvis, in seriem arcuatam digestis, in latere interiore spinulis quaternis parvis vel perparvis, in series binas digestis, in latere inter. inferiore spinulis binis parvis vel perparvis, uniseriatis, in latere inferiore sæpe spinulis binis armati ; articulus priore tarsali infra nodo majore instructo.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ angustæ, subrugosæ, porosæ, truncatæ, in angulo interiore spinula perparva, nodiformi armatæ.

Lamina ultima ventralis latiuscula, lateribus rotundatis, manifesto convergentibus, post rotundate truncata.

Long. 40 mm.

Hab. Grande Anse, Hayti, Mr. P. R. Uhler ; Port au Prince, Mr. W. Wilson ; Pernambuco.

2. Cupipes quadrisulcatus, n. sp.

Purpurascente-olivaceus, capite rufescente, pedibus antennisque flavescentibus ; minus robustus, laminis dorsalibus medis manifesto quadrisulcatis, anterioribus et posterioribus obsoletius exaratis, laminis ventralibus mediis profunde, anterioribus atque posterioribus obsolete bisulcatis. Antennæ breves, crassæ, attenuatæ, 17-articulatæ, ad apicem obsolete hirsutæ, articulis brevibus vel breviusculis.

Dentes prosternales bini (interiores truncati e ternis confluentes) ; dens coxalis minus productus, acutiusculus.

Pedes anales perbreves, percrassæ, contiguæ, in margine interiore femoris post spinulis ternis perparvis, in latere sup. interiore spinula singula perparva armati.

Laminæ dorsales præter undecim priores (obsolete) marginatæ.

Pleuræ posticæ angustæ, subrugosæ, porosæ, rotundate truncatæ.

Lamina ultima ventralis lata, brevis, valde angustata, post rotundate truncata.

Long. 40 mm.

Hab. Ascension Island, South Sea (one single specimen).

6. Gen. **Rhoda,** n. gen.

Lamina cephalica a lamina prima dorsali partim obtecta.

Oculi ocellis 4.

Antennæ breviusculæ vel breves, ad basin incrassatæ, valde attenuatæ, 19-articulatæ, articulis præter ultimum brevibus vel perbrevibus, prioribus transversalibus.

Labri fimbria....

Labii processus....

Palporum maxillarium unguis in latere interiore dentibus binis longis-acutis armato ; fimbria digitalis....unguem medium procul complens.

Mandibulæ....

Metameri quarti sternum integrum, robustum ; prosternum perlonge productum, ante in dentes magnos incisum ; pedes prensorii articulo secundo et tertio parvis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula profunda, longa, linearia vel paulum triangula, longitudinalia, per paria sensim longitudine paulum decrescentia.

Pleuræ posticæ infra porosæ, truncatæ.

Pedes anales breves vel perbreves, deplanati, quinquearticulati, articulo primo (femore) spinigero, ungue crasso, parum arcuato, absque unguiculis, infra carina longa, densissime crenulata instructo.

As I have had but one single specimen of this new genus to study, I have not been able to give such full characteristics as I wished.

1. Rhoda Thayeri, n. sp.

Flava, ante et post paulum fulvescens ; minus gracilis, sublævis, laminis dorsalibus atque ventralibus profunde bisulcatis, capite subovali, immarginato. Antennæ breves, crassæ, 19-articulatæ præter articulos senos priores dense, brevissime hirsutæ, articulis præter ultimum brevibus.

Dentes prosternales terni, validi, truncatæ ; dens coxalis productus acutiusculus.

Pedes anales breves, crassæ, contiguæ, in margine sup. interiore femoris spinulis ternis (postica majore, bicuspide) in latere interiore spinulis binis perparvis, in margine inf. interiore spinulis binis parvis armati.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ angustæ, subrugosæ, porosæ, truncatæ.

Lamina ultima ventralis longa, angusta, paulum angustata, post late arcuata.

Long. 58 mm.

Hab. Santarem, Thayer Exped.

7. Gen. **Asanada,** n gen.

Lamina cephalica libera vel a lamina prima dorsali partim obtecta.

Oculi ocellis 4.

Antennæ perbreves, ad basin incrassatæ, valde attenuatæ, 17-articulatæ, articulis brevibus vel perbrevibus, prioribus transversalibus.

Labri fimbria brevis, maxime obtecta, setis paucioribus simplicibus.

Labii processus breves, subconici, barba evanida ; palporum fimbria e setis perbrevibus, sparsis, uncinatis facta.

Palporum maxillarium unguis simplex ; fimbria digitalis brevis, setis paucioribus, uncinatis, ad apicem dentatis, unguem medium procul complens.

Mandibulæ ante 12 pectinibus juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum in medio canaliculatum, robustum ; prosternum longe prominens, ante in dentes majores incisum ; pedes prensorii articulo secundo et tertio perparvis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula sat profunda, perparva, producte triangula, longitudinalia, per paria sensim longitudine paulum descrescentia.

Pleuræ posticæ læves, magnam partem obtectæ, truncatæ.

Pedes anales breves, crassi, paulum complanati (mari perbreves, percrassi, deplanati), quinquearticulati, articulo primo (femore) inermi, ungue brevi, crasso, parum arcuato, simplice.

1. Asanada brevicornis, n. sp.

Flava vel fulva, subtus pallidior ; gracilis, lævis, laminis dorsalibus bisulcatis, anterioribus obsolete, mediis atque posterioribus manifesto, laminis ventralibus manifesto bisulcatis, capite subovato, immarginato. Antennæ perbreves, ad basin incrassatæ, valde attenuatæ, 17-articulatæ, subnudæ, articulis prioribus transversalibus.

Dentes prosternales terni, acuti (mediis maximis) ; dens coxalis parvus, acutiusculus.

Pedes anales breves, crassi, paulum complanati, ad basin distantes (maris perbreves, percrassi, deplanati, supra profundissime sulcati, fere contigui), inermes.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ triangulæ, læves, perparvæ, fere obtectæ, truncatæ.

Lamina ultima ventralis lata, brevis, lateribus rotundatis, valde convergentibus, post breviter rotundata.

Long. 35 mm.

Hab. Koolloo, Mr. Carleton.

8. Gen. **Scolopendra.**

Scolopendra Newport, Trans. Linn. Soc. Lond., xix, p. 377.

Lamina cephalica laminam primam dorsalem partim sæpissime obtegens.

Oculi ocellis 4.

Antennæ plerumque longiusculæ, tenuisculæ, ad basin manifesto incrassatæ, attenuatæ, 17–30-attenuatæ, articulis plerisque longiusculis vel longis.

Labri fimbria longa, setis plus vel minus densis, simplicibus.

Labii processus subconici, barba e setis brevibus, densis, uncinatis facta; palporum fimbria e setis brevibus, densis, manifesto uncinatis facta.

Palporum maxillarium unguis in latere interiore dentibus binis validis, acutiusculis armatus; fimbria digitalis brevior, setis longis, densis, parum uncinatis, unguis basin plus vel minus superans.

Mandibulæ ante 10–13 pectinibus juxta et pone lamellam dentatem coarctatis instructæ.

Metameri quarti sternum integrum, robustum; prosternum longe prominens, in dentes majores vel minores incisum; pedes prensorii articulo secundo et tertio parvis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula sat profunda, magna, angusta, post paulum dilatata, longitudinalia, per paria longitudine decrescentia.

Pleuræ posticæ sat amplæ, infra porosæ, post in angulum plus vel minus productum desinentes.

Pedes anales plerumque longiusculi vel longi, rare incrassati, quinque-articulati, articulo primo (femore) sæpissime spinigero, ungue sat magno, minus curvato, ad basin unguiculis binis armato.

Conspectus speciorum:

I. Femora pedium penultimorum (saltem) ad apicem exteriorem spinulis armata.

  A. Lamina prima marginem pone dorsalis anticum profunde sulcatum in transversum.

   1. *Sc. gigas.* 2. *Sc. cristata.* 3. *Sc. prasina.*

  B. Lamina prima dorsalis integra.

   4. *Sc. alternans.* 5. *Sc. crudelis.*

II. Femora pedum penultimorum ad apicem exteriorem inermia.

  A. Lamina prima dorsalis pone marginem anticum in transversum profunde sulcatum.

    a. Pedum ultimorum articulus primus tarsalis calcare armatus.

   6. *Sc. heros.* 7. *Sc. viridis.*

    b. Pedum ultimorum articulus primus tarsalis inermis.

   8. *Sc. occidentalis.* 9. *Sc. Woodii.*

  B. Lamina prima dorsalis integra.

    a. Pedum omnium articulus primus tarsalis inermis.

10. *Sc. longispina.* 11. *Sc. Chilensis.*

b. Pedum plerorumque articulus primus tarsalis calcare armatus.

12. *Sc. morsitans.* 13. *Sc. rugosa.* 14. *Sc. subspinipes.* 15. *Sc. De Haanii.* 16. *Sc. Indica.*

I. Femora pedum penultimorum (saltem) ad apicem exteriorem spinulis armata.

A. Lamina prima dorsalis pone marginem anticum in transversum profunde sulcata.

1. Scolopendra gigas.

Scolopendra gigas Leach, Trans. Linn. Soc. Lond., xi, p. 383.
Newport, Ann. and Mag. of Nat. Hist., xiii, p. 98.
Trans. Linn. Soc. Lond., xix, p. 399.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 119.
Scolopendra insignis Gervais, Ann. Soc. entom. de France, p. xxix.
Walckenaer Ins. Apt., iv, p. 278.
Scolopendra gigantea Porat, Soc. Vet. Akad. Handl. Bih., B. 4, No. 7, p. 5.
? *Scolopendra gigantea* Linné, Syst. Nat., ed. x, p. 638.
Newport, Trans. Linn. Soc. Lond., xix, p. 400.
Gervais, Walckenaer Ins. Apt., iv, p. 279.
Scolopendra prasinipes, epileptica Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 11.

Castanea, subtus pallidior, pedibus prioribus in articulis ternis ultimis sæpissime olivaceo balteatis, antennis viridi-olivaceis; valde robustus, sublævis, laminis ventralibus obscure bisulcatis; capite suborbiculari, immarginato. Antennæ longiusculæ vel longæ, 17–(18-)articulatæ, articulis septenis vel octonis anterioribus dense brevissime gilvo-hirsutæ, articulis præter priores longis.

Dentes prosternales quaterni (bini vel terni interiores maximam partem coaliti), magni; dens coxalis magnus, obtusiusculus, in latere nodulo instructus.

Femora præter prima vel bina priora ad apicem exteriorem spinulis ternis (quinis) armata. Pedum articulus primus tarsalis, pedibus ultimis (analibus) exceptes, calcare armatus.

Pedes anales longiusculi, in latere sup. interiore femoris spinulis majoribus novenis vel duodenis, in series ternas vel quaternas digestis, in angulo exteriore tumido spinulis octonis vel denis, in series binas vel ternas obliquas digestis, in latere inf. interiore spinulis minoribus ternis (binis), in latere inferiore spinulis ternis vel quinis, in series binas digestis, armati.

Laminæ dorsales præter tres vel quatuor priores marginatæ.

Pleuræ posticæ amplæ, sublæves, densissime tenuiter porosæ, in angulum obtusum, spinulis quaternis vel quinis instructum, productæ, margine postico in obliquum fere truncato vel leviter sinuato, inermi.

Lamina ultima ventralis longa, angusta, lateribus sinuatis manifesto convergentibus, post rotundate truncata vel latissime rotundata.

Long. 220–280 mm.

Hab. Santarem, Chas. Linden; Near Santarem, Brazil; Obidos, Brazil, James & Hunnewell (Thayer Exped.); Villa Bella, Brazil, J. C. Hetcher.

2. Scolopendra cristata.

Scolopendra cristata Newport, Ann. and Mag. of Nat. Hist., xiii, p. 98.
Trans. Linn. Soc., Lond., xix, p. 398.
Porat, Sv. Vet. Akad. Handl. Bih., B. 4, No. 7, p. 6.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 117.

Castanea vel olivacea, antennis pedibusque pallidioribus, concoloribus vel partim balteis olivaceis in articulis omnibus vel exterioribus pedum posteriorum plus vel minus manifestis ornatis, robusta, sublævis; capite subovali. Antennæ breviusculæ vel longiusculæ, ad basin multum incrassatæ, 17-articulatæ, præter articulos quaternos priores brevissime hirsutæ, articulis præter priores longiusculis vel longis.

Dentes prosternales quaterni (terni interiores plus vel minus coaliti) magni; dens coxalis in latere nodulo armatus.

Femora terna vel quina posteriora (ante pedes anales) ad apicem exteriorem spinulis binis vel spinula singula armata. Pedum articulus primus tarsalis, pedibus ultimis (analibus) exceptis, calcare armatus.

Pedes anales breviusculi vel breves, incrassati vel crassi, in latere superiore femoris spinulis parvis binis vel spinula singula, in margine sup. interiore spinulis magnis binis vel ternis, angulo apicali in acu forte, acutum, in latere spinulis binis armatum producto, in latere inferiore spinulis senis, in series ternas digestis, armati.

Laminæ dorsales præter quatuor priores marginatæ. Lamina ultima in medio alte carinata.

Pleuræ posticæ sat amplæ, sublæves, densissime tenuiter porosæ, in angulum minorem, ad apicem spinula singula armatum, productæ, margine postico paulum obliquo, subrecto, inermi.

Lamina ultima ventralis breviuscula, angustiuscula, multum angustata, post late rotundata.

Long. 145–175 mm.

Hab. Brazil?, Charles Linden; Amazon river, Brazil, Rev. J. C. Hetcher.

3. Scolopendra prasina.

Scolopendra prasina C. L. Koch, Die Myriap., ii, p. 23, tab. lxxi, fig. 146.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 122.

? *Scolopendra puncticeps* Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 14.

?? *Scolopendra punctiscuta* Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 14.

Flava vel flavo-brunnea, laminis dorsalibus præter laminam primam et ultimam in margine postico virescentibus, articulis exterioribus pedum posteriorum virescentibus ; sat robusta, tenuiter sparse punctata, laminis ventralibus lævibus ; capite suborbiculari. Antennæ breviusculæ ad basin paulum incrassatæ, 17-articulatæ, præter articulos quaternos priores dense gilvo hirsutæ, carinulatæ, articulis breviusculis.

Dentes prosternales quaterni (bini interiores approximati vel coaliti, externi discreti), majores, truncati ; dens coxalis in latere nodulo majore instructus.

Femora bina posteriora (ante pedes anales) ad apicem exteriorem spinulis binis, femora antecedentia spinula singula armata. Patellæ binæ posteriores (ante pedes anales) ad apicem exteriorem spinula singula armata. Pedum articulus primus tarsalis, pedibus ultimis (analibus) exceptis, calcare armatus.

Pedes anales breviusculi, sat incrassati, in latere superiore femoris spinulis binis parvis, in margine sup. interiore rotundato spinulis senis majoribus, uncinatis, in margine inf. interiore rotundato spinulis binis minoribus, in latere inferiore spinulis septenis majoribus, in series ternas digestis, armati, in latere interiore articuli sequentis (patellæ) spinulis quaternis minoribus, angulo apicali spinula singula instructo, armati.

Laminæ dorsales præter sex priores marginatæ.

Pleuræ posticæ amplæ, sublæves, densissime tenuiter porosæ, in angulum brevem, spinulis ternis magnis hamatis instructum, productæ, margine postico leviter arcuato, spinula singula armato.

Lamina ultima ventralis breviuscula, latiuscula, multum angustata, post late rotundata.

Long. 90–105 mm.

Hab. Grenada, W. I., Peter Gelliman.

B. Lamina prima dorsalis integra.

4. Scolopendra alternans.

Scolopendra alternans Leach, Trans. Linn. Soc., Lond., xi, p. 383.

Scolopendra alternans, Grayi, complanata, incerta, multispinosa (*multispinata*) Newport, Trans. Linn. Soc., Lond., xix, p. 402–405.

Scolopendra Sagræa Gervais, Walckenaer Ins. Apt., iv, p. 281.

? *Scolopendra torquata* Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 13.

Flavo-brunnea vel præsertim ante et post castanea, margine postico laminarum dorsalium, antennis vel totis vel solummodo in latere inferiore articulorum priorum articulisque pedum exterioribus interdum obscure virescentibus ; robusta vel valde robusta, sublævis, laminis ventralibus sat obscure bisulcatis, capite suborbiculari. Antennæ longiusculæ vel longæ, ad basin paulum incrassatæ, attenuatæ, 17-articulatæ, præter articulos quinos priores dense brevissime hirsutæ, carinulatæ, articulis longis.

Dentes prosternales terni (interiores lati, obtusi), validi; dens coxalis magnus, obtusiusculus, in latere interiore nodo vel denticulo obtuso armatus.

Femora pedum penultimorum angulo, spinulis quinis vel senis armato, instructa; pedum antepenultimorum ad apicem exteriorem spinulis binis vel spinula singula armata. Pedum articulus primus tarsalis, pedibus ultimis (analibus) exceptis, calcare armatus.

Pedes anales longiusculi, crassiusculi, in latere superiore femoris spinulis ternis vel senis, majoribus vel minoribus, in series binas subdigestis, in latere sup. interiore spinis quaternis vel senis subseriatis, angulo postico acutiusculo spinis septenis vel octonis instructo, in latere interiore spinis senis vel novenis subseriatis vel in series binas digestis, in latere inferiore spinis septenis vel duodenis, in series ternas digestis, armati.

Laminæ dorsales præter quinque vel septem priores marginatæ.

Pleuræ posticæ minus amplæ, sublæves, densissime tenuissime porosæ, in angulum acutiusculum, spinulis senis vel octonis parvis instructum, productæ, margine postico in obliquum subtruncato, paulum flexuoso, in medio atque ad apicem exteriorem spinulis parvis armato.

Lamina ultima ventralis breviuscula, angustiuscula, valde angustata, post rotundate truncata.

Long. 110–170 m.m.

Hab. This species seems to be a very common one in the West India; yet in the collection of the Museum of Comp. Zoöl., I have found only five specimens, viz: from Cuba, Mr. Trey, and also from Brazil.

5. Scolopendra crudelis.

Scolopendra crudelis Koch, Syst. d. Myriap. p. 170;
Die Myriap., ii, p. 36, tab. lxxvii, lxxviii, fig. 158, 159.
Porat, Sv. Vet. Akad. Handl. Bih., B 4, No. 7, p. 7.
Scolopendra longipes Wood, Journ. Acad. Nat. Sc. Philad., 2 ser., v, p. 26.
Trans. Amer. Philos. Soc., xiii, p. 163.

Castanea vel fulva, antennis pedibusque flavescentibus, margine postico laminarum dorsalium interdum virescente; robusta, sublævis, laminis ventralibus obscure bisulcatis; capite subovali, immarginato. Antennæ longiusculæ vel longæ, ad basin paulum incrassatæ, attenuatæ, 17-articulatæ, præter articulos quinos priores dense brevissime hirsutæ, carinulatæ, articulis longis, teretibus.

Dentes prosternales quaterni (bini interiores coaliti, truncati), validi; dens coxalis magnus, in latere interiore denticulo majore armatus.

Femora pedum penultimorum angulo spinulis quaternis vel senis instructo, in latere superiore spinulis parvis ternis vel spinula singula armata; pedum antepenultimorum ad apicem exteriorem spinulis binis armata. Pedum articulus primus tarsalis, pedibus ultimis (analibus) exceptis, calcare armatus.

Pedes anales longi, tenuiusculi, in margine sup. interiore femoris rotundato spinulis majoribus sedenis vel vicenis, in series quaternas subdigestis, nodo apicali sat producto, spinulis septenis vel octonis majoribus instructo, in latere inferiore spinulis tredenis vel quatuordenis, in series ternas digestis, armati.

Laminæ dorsales præter septem priores marginatæ.

Pleuræ posticæ minus amplæ, sublæves, densissime tenuissime (poris majoribus intermixtis) porosæ, in angulum majorem, obtusiusculum, spinulis senis instructum productæ, margine postico in obliquum subtruncato, paulum flexuoso, spinulis binis majoribus armato.

Lamina ultima ventralis brevisucula, latiuscula, valde angustata, post rotundate truncata.

Long. 150 mm.

Hab. Florida, Mr. Wurdemann; Double-headed-shot Key (U. S. Coast Survey. Gulf Stream Exped.); Jeremie, Hayti (F. C. Gray's fund).

II. Femora pedum penultimorum ad apicem inermia.
 A. Lamina prima dorsalis pone marginem anticum in transversum profunde sulcata.
  a. Pedum ultimorum articulus primus tarsalis calcare armatus.

6. Scolopendra heros.

Scolopendra heros Girard, Marcy Rep. Explor. Red Riv., p. 272, tab. xviii.
Wood, Trans. Amer. Philos. Soc., xiii, p. 155.
Porat, Sv. Vet. Akad. Handl. Bih., B. 4, No. 7, p. 8.

Scolopendra castaneiceps Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 11.
Trans. Amer. Philos. Soc., xiii, tab. i, fig. 7.

Scolopendra polymorpha Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 11.
Trans. Amer. Philos. Soc., xiii, p. 158.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 114.

Scolopendra Copeana Wood, Journ. Acad. Nat. Sc. Phil., 2 ser., v, p. 27.
Trans. Amer. Philos. Soc., xiii, p. 165.

? *Scolopendra mysteca* Humbert et Saussure, Rev. et Mag. Zool., 2 sér., xxi, p. 157.
Saussure et Humbert, Etud. s. Myriap., p. 130.

? *Scolopendra Azteca, Otomita, Maya, Talteca* Saussure, Mém. Mex. Myriap., p. 124–126, tab. 5–6, fig. 41–43, 45.
Saussure et Humbert, Etud. s. Myriap., p. 128–129, tab. v, fig. 9, 10, 12, 14.

Brunnea vel flavo-olivacea, capite cum lamina prima dorsali plus vel minus rufescente, pedibus antennisque flavescentibus, margine postico laminarum dorsalium sæpe virescente, in medio latius vel manifestus; robusta vel sat robusta, sublævis, laminis ventralibus manifesto bisulcatis; capite suborbiculari, immarginato. Antennæ longiusculæ vel longæ, ad basin paulum incrassatæ, attenuatæ, 24–29 articulatæ, præter articulos senos vel denos brevissime hirsutæ, articulis pluribus anterioribus brevibus vel breviusculis.

Dentes prosternales quaterni (bini vel terni interiores plus vel minus coaliti), majores, obtusi; dens coxalis magnus, acutiusculus, subinermis.

Pedes anales longiusculi vel breviusculi, paulum incrassati, in latere sup. interiore femoris spinulis quaternis vel senis majoribus, in series binas digestis, angulo apicali in nodum longiorem, angustiorem, spinulis ternis vel septenis instructum, producto, in latere interiore spinulis binis vel ternis, in latere inf. interiore spinulis binis vel ternis, in latere inferiore spinulis quaternis vel septenis, in series binas digestis, armati.

Laminæ dorsales præter octo priores marginatæ.

Pleuræ posticæ amplæ, sublæves. dense tenuiter porosæ, in angulum breviorem vel longiorem, obtusiusculum, ad apicem spinulis ternis vel senis instructum, productæ, margine postico sinuato, spinula parva armato.

Lamina ultima ventralis brevis, lata, valde angustata, post subtruncata vel latissime sinuata.

Long. 100–130 mm.

Hab. This species seems to be common through the most parts of North and Central America; thus I have seen specimens from Westfield, N. York; near Mammoth Cave, Ky.; Key West; Alexandria, Ga., Anderson; Seabrook Isl., Ga.; Mobile, Ala.; Springhill, Ala.; Cap Florida, Wurdemann; Galveston, Tex., Boll; Monteviaz, Mex., Palmer; mountain near St. Louis Potosi, Mex., E. Palmer; Panama; Guatemala, Van Patten; Porto Rico, Cardoge; San Diego, Cal.; Guaymas, Gulf of California; Ft. M'Pherson, Neb.; Riley, Kansas, H. Bravat.

7. Scolopendra viridis.

Scolopendra viridis Say, Proc. Acad. Nat. Sc. Philad., ii, p. 110.
Wood, Journ. Acad. Nat. Sc. Philad., 2 ser., v, p. 22.
Trans. Amer. Philos. Soc., xiii, p. 159.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 112.

Scolopendra punctiventris Newport, Ann. and Mag. of Nat. Hist., xiii, p. 100.

Trans. Linn. Soc., Lond., xix, p. 386.

Scolopendra parva Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 10.

Ochracea vel brunnea, lamina cephalica atque vitta lata dorsali sæpe viridibus ; sat gracilis, manifesto sparse punctata, laminis ventralibus profunde bisulcatis ; capite subrotundata. Antennæ longiusculæ, ad basin sat incrassatæ, angustatæ, 23-24 articulatæ, præter articulos senos priores brevissime hirsutæ articulis pluribus brevibus, longioribus interpositis.

Dentes prosternales quaterni (bini interiores fere coaliti, exteriores magis discreti), minores ; dens coxalis sat magnus, obtusiusculus, inermis.

Pedes anales brevinsculi, paulum incrassati, in margine sup. interiore femoris rotundato spinulis quaternis majoribus, in series binas digestis, angulo apicali brevissimo, bifido vel spinulis ternis vel quaternis instructo, in latere interiore ante spina singula, in latere inferiore spinulis senis vel octonis, in series quaternas digestis, armati.

Laminæ dorsales præter duodecim vel tredecim priores marginatæ.

Pleuræ posticæ amplæ, dense grossius porosæ, in angulum brevem, spinulis ternis vel quaternis instructum productæ, margine postico leviter sinuato, inermi vel spinula minima armato.

Lamina ultima ventralis longiuscula, angustiuscula, multum angustata, post latissime sinuata.

Long. 60 mm.

Hab. Georgia, A. S. Allanson (an original specimen of this species).

b. Pedum ultimorum articulus primus tarsalis inermis.

8. Scolopendra occidentalis, n. sp.

Ochracea vel brunnea, laminis dorsalibus præter primam atque altimam plus vel minus virescentibus ; subgracilis, sublævis, laminis ventralibus profunde bisulcatis ; capite suborbiculari. Antennæ longiusculæ, ad basin valde incrassatæ, attenuatæ, 23-articulatæ, præter articulos quinos vel senos priores obscure hirsutæ, articulis breviusculis.

Dentes prosternales quaterni (bini interiores approximati), majores ; dens coxalis mediocris, acutus, inermis.

Pedum articulus primus tarsalis, pedibus binis posterioribus exceptis, calcare armatus.

Pedes anales longi, graciles, in margine sup. interiore femoris spinulis quinis vel septenis minoribus, in series binas digestis, angulo apicali vix prominente, spinulis ternis vel quaternis instructo, in latere interiore spinulis ternis parvis, in latere inferiore spinulis quatuordenis vel sedenis, in series ternas digestis, armati.

Laminæ dorsales præter sedecim priores marginatæ.

Pleuræ posticæ angustiusculæ, subrugosæ, sparse tenuiter porosæ, in angulum longius, ad apicem spinulis quaternis parvis in latere spinula singula instructum, productæ, margine postico leviter sinuato, spinulis binis parvis armato.

Lamina ultima ventralis brevis, lata, valde angustata, post rotundate truncata.

Long. 50 mm.

Hab. West Coast of Mexico, Capt. Goff (a single specimen).

9. Scolopendra Woodii.

Scolopendra inæquidens Wood, Trans. Amer. Philos. Soc., xiii, p. 162.

Ochracea vel brunnea, antennis laminisque dorsalibus præter primam atque ultimam sæpe olivaceis vel virescentibus, linea media dorsali pallida, obscure marginata; subgracilis, sublævis, laminis ventralibus profunde bisulcatis; capite subovali. Antennæ breviusculæ, ad basin paulum incrassatæ, 17-articulatæ, præter articulos octonos priores manifesto hirsutæ, articulis brevibus.

Dentes prosternales quaterni (bini interiores plus vel minus coaliti), minores; dens coxalis mediocris, ad apicem obscure carinatus.

Pedum omnium articulus primus tarsalis inermis.

Pedes anales breviusculi, sat incrassati, in margine sup. interiore femoris spinulis quinis majoribus, in series binas digestis, angulo apicali in spinam acutum, breviorem, simplicem vel bifidum producto, in latere inferiore spinulis senis vel septenis magnis, in series ternas digestis, armati.

Laminæ dorsales modo tres vel quatuor posteriores marginatæ.

Pleuræ posticæ sat amplæ, rugosæ, sparsius grossius porosæ, in angulum longum, angustum, ad apicem spinis binis vel quaternis instructum productæ, margine postico in obliquum profunde sinuato, inermi.

Lamina ultima ventralis breviuscula, latiuscula, valde angustata, post latissime sinuata.

Long. 60 mm.

Mr. Wood has determined this species as Sc. inæquidens Gervais, but I do not believe that this determination is right, and although the description of Gervais is very incomplete or incertain, yet his original specimen is said to exist in the museum at Paris, and so we may be sure that at some time this same specimen will be more completely described, and then Gervais' name will be attached to another species and not to that of which I am here treating. Therefore it might be better to alter the name at this time, and so I propose the name of Scolopendra Woodii in honor of Dr. Wood, the first man who has made it clear how much the species of Scolopendra vary in the greater part of the characters, which we have been accustomed to believe to be the most characteristic.

Hab. Hilton Head, S. C., Dr. Greene; Beaufort, N. C., J. G. Shute; Pennington's Gap, Lee Co., Va.; I have seen specimens besides from Massachusetts, and other places in the United States.

B. Lamina prima dorsalis integra.

a. Pedum omnium articulus primus tarsalis inermis.

10. Scolopendra longispina, n. sp.

Ochracea vel brunnea, supra plus vel minus olivacea, linea media dorsali angusta pallida; subgracilis, sublævis, laminis ventralibus manifesto bisulcatis; capite subovali. Antennæ breviusculæ, ad basin sat incrassatæ, 17–19-articulatæ, præter articulos quaternos vel quinos priores brevissime hirsutæ, articulis breviusculis.

Dentes prosternales quaterni (bini interiores approximati vel coaliti), majores; dens coxalis in latere nodulis binis vel nodulo singulo armatus.

Pedes anales breviusculi, plus vel minus incrassati, in margine sup. interiore femoris supra fere planiusculi spinulis ternis vel quinis majoribus vel magnis, in series binas digestis, angulo apicali in spinam longiorem, bi- vel quadrifidam producto, in latere interiore spinulis quaternes vel septenis majoribus, in series binas digestis, in latere inferiore spinulis septenis vel novenis majoribus, in series binas digestis, ad basin spinulis ternis vel quinis, in seriem obliquam digestis, armati.

Laminæ dorsales modo tres vel sex posteriores marginatæ.

Pleuræ posticæ sat amplæ, subrugosæ, densius grossius porosæ, in angulum longum, angustum, ad apicem spinulis quaternis vel quinis, in latere superiore spinulis binis vel quaternis, in latere exteriore spinulis binis vel spinula singula instructum productæ, margine postico subtruncato, spinula singula minore armato.

Lamina ultima ventralis brevis, perlata, valde angustata, post late rotundata.

Long. 60 mm.'

Hab. Maldonado, Brazil, Mr. T. G. Carey.

11. Scolopendra Chilensis.

? *Scolopendra Chilensis* Gervais, Walckenaer Ins. Apt., iv, p. 285.

Ochracea, plus vel minus olivacea, pedibus pallidioribus; gracilis, sublævis, laminis ventralibus leviter vel obscure bisulcatis; capite subovali. Antennæ longiusculæ, ad basin paulum incrassatæ, 17–18-articulatæ, præter articulos senos priores breviter hirsutæ, articulis præter priores longiusculis.

Dentes prosternales quaterni (bini interiores approximati), minores; dens coxalis mediocris, simplex.

Pedes anales longi vel elongati, graciles, teretes, in latere interiore femoris spinulis undenis minoribus, in series ternas digestis, angulo apicali in spinam brevem, bifidam producto, in latere inferiore ad marginem exteriorem spinulis undenis minoribus, in series binas digestis, armati.

Laminæ dorsales modo quatuor vel sex posteriores marginatæ.

Pleuræ posticæ amplæ, subrugosæ, sparsius tenuiter porosæ, in angulum longum, angustam, subteretem, ad apicem spinulis quinque in latere exteriore spinulis binis instructum productæ, margine postico in obliquum subtruncato, spinula singula parva armato.

Lamina ultima ventralis brevis, perlata, valde angustata, post brevius rotundata.

Long. 50 mm.

Dr. Kohlrausch, l. c., p. 125, has suggested that the Sc. Chilensis of Gervais may be a Cormocephalus; in reality the present species very nearly approaches that genus, but the structure of the lamina cephalica does not permit such a reference.

Hab. Zalcuhana, Chili, Hassler Exped.; Cordova, Argent., Mr. Davis.

b. Pedum plerorumque articulus primus tarsalis calcare armatus.

12. SCOLOPENDRA MORSITANS.

Scolopendra morsitans Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 104.

Scolopendra morsitans, angulipes, ? varia, platypoides, tigrina, Leachii, angusta, formosa, longicornis, tuberculidens, Fabricii, ? Richardsonii, Algerina Newport, Trans. Linn. Soc., Lond., xix, p. 378–387.

Scolopendra Gervaisiana, Scopoliana, fulvipes, elegans, erythrocephala, bilineata, ? Togana, platypus Gervais, Walckenaer Ins. Apt., iv, p. 259–280.

Scolopendra carinipes, Californica Saussure et Humbert, Etud. s. Myriap., p. 125–127, tab. v, fig. 6 and 8.

Scolopendra pella, porphyratænia Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 13–15.

Scolopendra morsitans Wood, Trans. Amer. Philos. Soc., xiii, p. 161.

Scolopendra morsitans, ? Scopoliana, Gervaisiana, planipes, infesta C. L. Koch, Die Myriap., i, fig. 33, 34, 46; ii, figs. 179, 180.

Scolopendra picturata, intermedia, cognata, Alfzelii, Leachii, attenuata, pilosella, chorocephala, Wahlbergi, saltatoria Porath, Ofvers. Vet. Akad. Förh., 1871, No. 9, p. 1144–1151.

Scolopendra platypus, longicornis, cognata, impressa Porat, Sv. Vet. Akad. Handl. Bih., B. 4, No. 7, p. 11–13.

Scolopendra Mossambica, ? brachypoda Peters, Reis. Mozamb. Zool., v, p. 527–529, tab. xxxiii, figs. 1–2.

Ochracea vel brunnea, sæpe plus vel minus olivacea, margine postico laminarum dorsalum sæpissime, antennis pedibus posterioribus partim pleurisque sæpe virescentibus; robusta vel minus robusta, sublævis, laminis ventralibus plus vel minus manifesto bisulcatis; capite subovali. Antennæ longiusculæ, ad basin paulum incrassatæ, attenuatæ, 17–22 articulatæ, præter articulos senos vel septenos priores brevissime hirsutæ, articulis mediis longiusculis.

Dentes prosternales quini vel rare quaterni (bini vel terni interiores plus vel minus coaliti), minores, obtusiusculi; dens coxalis in latere nodulo parvo armatus.

Pedum articulus primus tarsalis, pedibus ultimis vel binis posterioribus exceptis, calcare armatus.

Pedes anales breviusculi, plus vel minus incrassati (varissime longiusculi, vix incrassati), articulis binis prioribus deplanatis marginatis, in margine sup. interiore femoris spinulis quaternis vel quinis longis, in series binas digestis, angulo apicali in spinam longiorem, tri- vel quadrifidam producto, in latere inferiore spinulis senis vel novenis majoribus, in series ternas concinne digestis, armati.

Laminæ dorsales posteriores marginatæ.

Pleuræ posticæ latæ, sublæves, dense porosæ, in angulum minorem, tri- vel quadrifidum productæ, margine postico fere in transversum leviter sinuato, spinula perparva armato.

Lamina ultima ventralis breviuscula, latiuscula, lateribus sinuatis, valde angustata, post brevius rotundata.

Long. 90–130 mm.

Perhaps this Scolopendra is the most inconstant species among all the Myriapods, but also very few animals are so common and so widely distributed as Sc. morsitans; yet through all its variations the short, flat, marginated pedes anales with three rows of larger spines on the under side of the femora seldom are missed. On the other hand, if we are not willing to believe in such variability, we are compelled to accept an infinity of species, such as most conspicuously v. Porat has made; but I do not hesitate to say that a larger number of specimens from different parts of the world will bring us to follow the views which Dr. Wood and Dr. Kohlrausch have so forcibly declared with regard to the genus Scolopendra.

Hab. This species is found in all tropical regions, whence it is often brought alive in ships to more northern localities. For this reason it will be of no value to enumerate all those from which specimens have been received by the Museum.

13. Scolopendra rugosa, n. sp.

Rufo-brunnea, pedibus antennisque flavis; minus robusta, manifesto rugosa; capite subcordiformi. Antennæ longiusculæ, ad basin valde incrassatæ, 18-articulatæ, præter articulos senos vel septenos priores brevissime hirsutæ, articulis breviusculis.

Dentes prosternales seni (bini interiores approximati), parvi; dens coxalis ad apicem carinatus, in latere nodulo instructus.

Pedum articulus primus dorsalis, pedibus binis posterioribus exceptis, calcare armatus.

Pedes anales breviusculi, incrassati, in margine sup. interiore rotundato femoris spinulis ternis magnis, in trigonum digestis, angulo apicali in spinam breviorem, acutam, bifidam producto, in latere inferiore spinis binis magnis seriatis, armati.

Laminæ dorsales præter septem priores marginatæ.

Pleuræ posticæ amplæ, sublæves, densissime porosæ, in angulum minorem, bifidum productæ, margine postico in obliquum leviter arcuato, inermi.

Lamina ultima ventralis longiuscula, latiuscula, valde angustata, post manifesto sinuata.

Long. 120 mm.

Hab. Hong-Kong, Capt. W. H. A. Putnam (one single specimen).

14. Scolopendra subspinipes.

Scolopendra subspinipes Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 96.

? *Scolopendra subspinipes* Leach, Trans. Linn. Soc. Lond., xi, p. 383.

Scolopendra subspinipes, Placeæ, ? Gervaisii, ? Ceylonensis, planiceps, sexspinosa, lutea, ornata, flava Newport, Trans. Linn. Soc. Lond., xix, p. 389–392.

Scolopendra subspinipes, Lucasii, rarispina, Sandwichiana, audax, ? Newportii Gervais, Walckenaer Ins. Apt., iv, p. 262–281.

Scolopendra byssina, dinodon, parvidens, atra, plumbeolata Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 10–14.

Scolopendra byssina Wood, Trans. Amer. Philos. Soc., xiii, p. 164.

Scolopendra pulchra, mactans, ferruginea, sulphurea, gigantea, ornata C. L. Koch, Die Myriap., i, figs. 21, 79, 80, 92; ii, figs. 133, 134.

Scolopendra elongata Porath, Ofvers. Vet. Akad. Förh., 1871, No. 9, p. 1143.

Ochracea vel brunnea, præter caput laminamque primam dorsalem plus vel minus olivacea, margine postico laminarum dorsalium sæpe virescente; robusta vel valde robusta, læviuscula, laminis ventralibus obscurius bisulcatis; capite suborbiculari. Antennæ longiusculæ, ad basin paulum incrassatæ, attenuatæ, 17–20-articulatæ, præter senos priores hirsutæ, articulis plurimis longis.

Dentes prosternales quini vel seni, rarissime quaterni vel septeni, minores, obtusiusculi ; dens coxalis magnus, ad apicem carinatus, in latere nodulo parvo instructus.

Pedum articulus primus tarsalis, pedibus ultimis vel binis posterioribus exceptis, calcare armatus.

Pedes anales longiusculi, sat graciles, in margine sup. interiore rotundato femoris paulum deplanati spinulis sæpissime binis majoribus, angulo apicali plus vel minus producto sæpissime bifido, in latere interiore spinula singula vel nulla, in latere inferiore spinulis binis, in seriem longitudinalem digestis, armati.

Laminæ dorsales præter quatuor vel quinque priores marginatæ.

Pleuræ posticæ minus amplæ, subrugosæ, densissime porosæ, in angulum minorem, bifidum productæ, margine postico leviter arcuato, inermi.

Lamina ultima ventralis longiuscula, angustiuscula, valde augustata, post brevius rotundata.

Long. 150–180 mm.

With regard to frequency, distribution and variability Sc. subspinipes comes near to Sc. morsitans, and therefore I can here refer to my preceding remarks.

Hab. This species also is so common in all tropical and subtropical localities, that I shall not enumerate the many places from which the Museum has specimens.

15. Scolopendra De Haanii.

Scolopendra De Haanii Brandt, Recueil, p. 59.

Kohlrausch, Arch. f. Naturg. Jahrg., 47, p.

Scolopendra Silhetensis, ? inermis, ? concolor, Childreni, Hardwickii Newport, Trans. Linn. Soc. Lond., xix, p. 393–395.

Scolopendra ? limicolor, ? cephalica, ? ? gracilis (*var.*) Wood, Proc. Acad. Nat. Sc. Philad., 1861, p. 12–13.

Scolopendra bispinipes Wood, Trans. Amer. Philos. Soc., xiii, p. 166.

Scolopendra bicolor Humbert, Essai Myriap. Ceylan, p. 12.

Scolopendra histrionica, horrida C. L. Koch, Die Myriap., i, figs. 44, 67.

Scolopendra fissispina C. L. Koch, Verh. Zool. bot. Ges. z. Wien, xv, p. 891.

Flavo-brunnea, supra sæpe, præsertim in margine postico laminarum dorsalium, olivacea vel virescens (interdum laminis dorsalibus alternantibus totis olivaceis) ; robusta vel valde robusta, sublævis, laminis ventralibus manifesto bisulcatis ; capite suborbiculari. Antennæ longiusculæ, ad basin valde incrassatæ, attenuatæ, 18-articulatæ, præter articulos senos priores densissime brevissime hirsutæ, articulis plerisque longis.

Dentes prosternales quini, rare quaterni, minores, obtusi ; dens coxalis magnus, obtusiusculus, nodo vel nodis obsoletis instructus.

Pedum articulus primus tarsalis, pedibus binis posterioribus exceptis, calcare armatus.

Pedes anales longiusculi vel longi, sat graciles, in margine sup. interiore femoris paulum vel sat deplanati spinulis binis tenuibus, interdum evanidis, angulo apicali in spinam longam angustatam, sæpissime bifidam producto, armati.

Laminæ dorsales præter sex vel undecim priores marginatæ.

Pleuræ posticæ amplæ, sublæves, densissime tenuius porosæ, in angulum majorem, bifidum productæ, margine postico in obliquum leviter arcuato, inermi.

Lamina ultima ventralis longiuscula, angustiuscula, valde angustata, post rotundate truncata.

Long. 160–170 mm.

Hab. This species also is spread over the whole tropical and subtropical world, and I have seen specimens from: Society Islands, Mr. A. Garrett; Pennaculum, S. India, D. C. Scudder (var.: Sc. histrionica C. L. Koch); Africa, without further narrative of the locality; San Francisco, Cal., T. G. Cary, Jr. (an original specimen of Dr. Wood's Sc. bispinipes).

16. Scolopendra Indica, n. sp.

Olivaceo-flava, ante et post obscurior, supra sæpe viridi-olivacea, capite cum antennis atque fascia media virescentibus, pedibus antennisque flavo-brunneis; minus robusta, sublævis, ante sparse leviter punctata, laminis ventralibus manifesto bisulcatis; capite fere rotundato, post arcuatim sulcato, a lamina prima dorsali partim obtecta vel laminam illam obtegens. Antennæ longiusculæ, ad basin valde incrassatæ, 17–19-articulatæ, præter articulos decem priores dense hirsutæ, articulis plurimis longiusculis.

Dentes prosternales quaterni (exteriores valde discreti), magni, truncati (exteriores acuti); dens coxalis major, acutus.

Pedum articulus primus tarsalis, pedibus binis posterioribus exceptis, calcare armatus.

Pedes anales breviusculi, sat incrassati, deplanati, in latere sup. interiore femoris spinulis ternis parvis, angulo apicali brevi, bi- vel trifido, in latere interiore spinulis ternis vel quinis, in series binas digestis, in latere inf. interiore spinulis binis vel quaternis, in latere inferiore spinulis septenis vel octonis, in series binas digestis, armati.

Laminæ dorsales modo tres vel quatuor posteriores marginatæ.

Pleuræ posticæ angustiusculæ, subrugosæ, dense tenuiter porosæ, in angulum breviorem vel longiorem, acutiusculum, trifidum, in latere spinula singula instructum productæ, margine postico in obliquum levissime sinuato, ad angulum exteriorem spinula parva armato.

Lamina ultima ventralis brevis, latiuscula, lateribus rotundatis, valde angustata, post latissime rotundata vel rotundate truncata.

Long. 60 mm.

In some respects, peculiarly with regard to the structure of the head, Sc. Indica is a connecting link between Scolopendra and the following genus Cormocephalus.

Hab. The Rev. Mr. M. Carleton has collected this Scolopendra at some places in East India; Koolloo, Himalaya; Ambala; a station 70 miles S. W. from Ambala.

9. Gen. **Cormocephalus.**

Cormocephalus Newport, Trans. Linn. Soc. Lond., xix, p. 419.

Lamina cephalica a lamina prima dorsali partim obtecta vel libera (scuta dorsalia metameri tertii manifesta).

Oculi ocellis 4.

Antennæ breviusculæ, ad basin plus vel minus incrassatæ, ante plus vel minus attenuatæ, 17–19-articulatæ, articulis plerisque breviusculis.

Labri fimbria longa, setis longis, densis, simplicibus.

Labii processus subconici, barba e setis brevibus, densis, uncinatis facta; palporum fimbria e setis brevibus, densis, manifesto uncinatis facta.

Palporum maxillarium unguis in latere interiore dentibus binis validis, acutiusculis armatus; fimbria digitalis longior, setis longioribus, densis, parum uncinatis, unguem medium paulum superans.

Mandibulæ ante 12–13 pectinibus juxta et pone lamellam dentatem coarctatis instructæ.

Metameri quarti sternum integrum, robustum; prosternum longe prominens, in dentes majores incisum; pedes prensorii articulo secundo et tertio parvis, interruptis.

Segmentum septimum absque spiraculis.

Spiracula sat profunda, magna, angusta, manifesto triangula, longitudinalia, per paria longitudine decrescentia.

Pleuræ posticæ infra porosæ, in angulum majorem vel minorem productæ.

Pedes anales breviusculi vel longiusculi, paulum incrassati, quinque-articulati, articulo primo (femore) subcarinato, spinigero, ungue sat parvo, parum arcuato unguiculis binis armato vel simplice.

I. Pedum analium unguis unguiculis binis armatus.

1. Cormocephalus afer, n. sp.

Flavo-olivaceus, ante obscurior, linea media dorsali pallida notatus; sat gracilis, ante robustior, sublævis, laminis ventralibus manifesto bisulcatis; capite subovato, truncato. Antennæ breves, ad basin crassæ, attenuatæ, 17-articulatæ, præter articulos octonos priores dense brevissime hirsutæ, articulis brevibus vel breviusculis.

Dentes prosternales quaterni (exteriores discreti), majores; dens coxalis magnus, acutus.

Pedum articulus primus tar[illegible]s, pedibus binis posterioribus exceptis, calcare armatus.

Pedes anales breves vel breviusculi, sat incrassati, in latere sup. interiore femoris spinulis ternis majoribus, angulo in spinam bifidam producto, in latere interiore spinula singula, in latere inf. interiore spinulis ternis, in latere inferiore spinulis senis, in series binas obliquas digestis, armati.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ latæ vel latiusculæ, læviusculæ, dense porosæ, in angulum majorem, acutiusculum, trifidum productæ, margine postico in obliquum levissime emarginato, ad angulum exteriorem spinulis binis parvis armato.

Lamina ultima ventralis breviuscula, latiuscula, lateribus rotundatis, valde angustata, post obscure sinuata.

Long. 45 mm.

Hab. Zanzibar, Cooke.

2. Cormocephalus aurantiipes.

Scolopendra aurantipes Newport, Ann. and Mag. of Nat. Hist., xiii, p. 99.

Cormocephalus aurantiipes Newport, Trans. Linn. Soc. Lond., xix, p. 420.
Kohlrausch, Arch. f. Naturg. Jahrg., 47, p. 87, tab. v, fig. 18.

Cormocephalus brevispinatus T. Koch, Verh. Zool. bot. Ges. z. Wien, xvii, p. 248.

? *Cormocephalus obscurus, pallipes* Newport, Trans. Linn. Soc. Lond., xix, p. 421–424.

Flavo-olivaceus, fusco trilineatus, pedibus flavis; robustus, sublævis, ante sparse leviter punctatus, laminis ventralibus bisulcatis; capite subobovato, sæpe libero (lamina basali magnam partem detecta). Antennæ breviusculæ, ad basin paulum incrassatæ, attenuatæ, 17-articulatæ, præter articulos quinos vel senos priores dense brevissime hirsutæ, articulis plurimis breviusculis.

Dentes prosternales quaterni (exteriores discreti), magni obtusi; dens coxalis magnus, trilaciniatus vel simplex.

Pedum articulus primus tarsalis omnium inermis.

Pedes anales breviusculi vel breves, incrassati, in latere sup. interiore femoris spinis binis majoribus, angulo in spinam sæpe bifidam producto, in latere interiore spinula singula vel nulla, in latere inf. interiore spinulis binis, in latere inferiore carinula curvata, spinulis binis vel quaternis instructa, armati.

Laminæ dorsales præter sex vel octo priores marginatæ.

Pleuræ posticæ latiusculæ, sublæves, dense porosæ, in spinam breviorem, acutiusculam, in apice bifidam, productæ, margine postico in obliquum sinuato, inermi.

Lamina ultima ventralis breviuscula, latiuscula vel lata, valde angustata, post rotundate truncata.

Long. 85 mm.

Hab. Melbourne, Australia, H. Edwards. Also from America (viz: Guatemala, Ferd. von Müller; Rio de Janeiro, Thayer Exp.), I have seen two specimens, which I cannot separate from this species.

II. Pedum analium unguis inermis.

3. Cormocephalus ambiguus.

Cormocephalus ambiguus Newport, Trans. Linn. Soc. Lond., xix, p. 423.
? *Scolopendra ambigua* Brandt, Recueil, p. 63.
Gervais, Walckenaer Ins. Apt., iv, p. 263.

Flavus vel rufo-brunneus, ante et post rufescens; sat robustus, sublævis, ante et post leviter punctatus, laminis ventralibus manifesto bisulcatis; capite subovali, sæpe libero (lamina basali magnam partem detecta).

Antennæ longiusculæ, ad basin crassiusculæ, attenuatæ, 17- vel 18-articulatæ, præter articulos quinos priores dense brevissime hirsutæ, articulis imis longiusculis.

entes prosternales quaterni (exteriores discreti), majores; dens coxalis gnus, bifidus.

edum articulus primus tarsalis omnium inermis.

'edes anales longiusculi, crassiusculi, in latere sup. interiore femoris nulis binis minoribus, angulo in spinam majorem producto, in latere eriore spinula singula, in latere inf. interiore spinulis binis vel quater-;, in latere inferiore carinula spinulis quinis vel senis instructa, armati.

Laminæ dorsalis præter octo priores marginatæ.

Pleuræ posticæ latæ, sublæves, dense porosæ, in angulum majorem, utiusculum, bifidum productæ, margine postico in obliquum fere truncato, uleo singulo, perparvo armato.

Lamina ultima ventralis breviuscula, lata, valde augustata, post sinuate runcata.

Long. 90 mm.

Hab. Port Elizabeth, Cap. bon. sp., Hanson.

10. Gen. **Opisthemega.**

Opisthemega Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 35.
? *Theatops* Newport, Trans. Linn. Soc. Lond., xix, p. 410.

Lamina cephalica laminam primam dorsalem partim obtegens.

Oculi nulli vel evanidi.

Antennæ breves, ad basin incrassatæ, ante subfiliformes, 17-articulatæ, articulis brevibus vel partim longiusculis.

Labri fimbria in medio interrupta, setis paucioribus, margine manitesto dentato.

Labii processus producti, attenuati, barba brevi e setis paucioribus, simplicibus facta ; palporum fimbria e setis longis, densis, uncinatis facta.

Palporum maxillarium unguis duplex (profunde fissus) ; fimbria digitalis longa, setis longis, densis, uncinatis, unguem manifesto superans.

Mandibulæ ante 12 pectinibus juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum integrum, robustum, medium longe productum ; prosternum brevius vel longius prominens, ante in dentes majores vel minores incisum ; pedes prensorii articulo primo maximo, secundo et tertio parvis, interruptis, quarto solito multo minore.

Lamina basalis partim detecta.

Segmentum septimum absque spiraculis.

Spiracula sat profunda, magna, producte ovalia, fere perpendicularia, ante et post magis obliqua.

Pleuræ posticæ infra porosæ, magnam partem obtectæ, subtruncatæ.

Pedes anales perbreves, percrassi, contigui (adapti) vel fere contigui. quinquearticulati, articulo primo (femore) inermi, ungue permagno, valido, parum arcuato, inermi.

1. Opisthemega spinicauda.

Opisthemega spinicauda Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 36.

Trans. Amer. Philos. Soc., xiii, p. 170.

? *Cryptops posticus* Say, Journ. Acad. Nat. Sc. Philad., ii, p. 112.

? *Theatops postica* Newport, Trans. Linn. Soc. Lond., xix, p. 410.

Ochraceum, ante et post rufescens, minus robustum, sparse punctatum, lamina dorsali prima ante angulatim sulcata, laminis ventralibus fovea media impressis ; capite subovali. Antennæ breviusculæ, tenuiusculæ, paulum attenuatæ, 17-articulatæ, ad basin sublæves, ante sparsius longius hirsutæ, articulis mediis longiusculis.

Dentes prosternales bini vel terni, evanescentes ; dens coxalis perparvus, obtusus.

Pedum tibia, articulusque primus tarsalis, pedibus binis posterioribus exceptis, calcare armata.

Pedes anales breves, crassati, fere contigui, adapti, margine sup. interiore atque inf. interiore acutis crenulatis, in latere sup. interiore femoris spinulis binis (posteriore majore), in margine inf. interiore spinulis binis vel ternis preparvus armati.

Laminæ dorsalis præter ultimam immarginatæ.

Pleuræ angustæ, subrugosæ, porosæ, truncatæ, inermes.

Lamina ultima ventralis longa, lateribus sinuatis, valde angustata, post levissime sinuata.

Long. 35 mm.

I have seen only one specimen, which was labeled "Opisthemega postica Wood," and is among the large number of Myriapods, which are designated as "types determined and described by Dr. H. Wood in his Myriapods of N. America"; but a little note was attached to this species: "the original catal. says spinicauda," and actually it is to be referred to Opisthemega spinicauda Wood and not to Op. postica Wood.

Hab. Acapulco, Mexico, Mr. A. Agassiz.

2. Opisthemega crassipes, n. sp.

Rufo-brunneum, subtus pallidius, pedibus antennisque flavis; minus vel sat crassum, sparse leviter punctatum, annulo ultimo pedibusque analibus densius, grossius punctatis lamina dorsali prima ante angulatim sulcata, laminis ventralibus sulco longitudinali atque transversali cruciatim exaratis; capite subovali. Antennæ longiusculæ tenuisculæ, paulum attenuatæ, 17- vel 18-articulatæ, præter latus superius articulorum quaternorum priorum, densius brevius hirsutæ, articulis plurimis longiusculis.

Dentes prosternales bini vel terni, majores; dens coxalis parvus acutiusculus.

Pedum tibia articulisque primus tarsalis, pedibus articis binisque posterioribus exceptis, calcare armati.

Pedes anales perbreves, percrassi, contigui, adapti, deplanati, margine sup. interiore et inf. interiore carinatis, femore inermi.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ angustæ, sublæves, porosæ, post late sinuatæ, inermes.

Lamina ultima ventralis longa, lata, lateribus parum sinuatis, valde angustata, post rotundate truncata.

Long. 36 mm.

Hab. Jacksonville, Fla., J. A. Allen; St. Johns river, Fla.; Pennington's Gap, Lee Co., Va.; Bee Spring, Ky., F. G. Sanborn.

3. Opisthemega insulare, n. sp.

Flavum vel ochraceum, ante et post rufescens; sat gracile, sublæve, lamina ultima dorsali pedibusque analibus sparse leviter punctatis, lamina dorsali prima ante in formam ypsili sulcata, laminis ventralibus sulco longitudinali profundo foveam mediam secante exaratis; capite subovali. Antennæ breviusculæ, paulum crassiusculæ, attenuatæ, 17 articulatæ, ad apicem sparsius, brevissime hirsutæ, articulis mediis longiusculis.

Dentes prosternalis bini vel terni, parvi; dens coxalis perparvus, obtusus.

Pedum tibia articulusque primus tarsalis, tibia pedum primorum pedibusque binis posterioribus exceptis, calcare armata.

Pedes anales breves, crassi, fere contigui, margine sup. interiore et inf. interiore carinatis manifesto serrulatis, in latere sup. interiore femoris post spinula majore armati.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ angustæ, subrugulosæ, porosæ, post late sinuatæ, inermes.

Lamina ultima ventralis longa, lateribus sinuatis, valde angustata, post rotundate truncata.

Long. 35 mm.

Hab. Sandwich Islands, A. Garrett.

11. Gen. **Cryptops.**

Cryptops Leach, Zoöl. Miscell., iii, p. 42.

Lamina cephalica laminam primam dorsalem sæpissime partim obtegens.

Oculi nulli vel evanidi.

Antennæ breviusculæ vel longiusculæ, subfiliformes, 17-articulatæ, articulis plurimis longis vel longiusculis.

Labri fimbria perbrevis, margine in lacinias setiformes, ramosas vel denticulatas inciso.

Labii processus parvi, subconici, barba brevissima, e setis paucis, simplicibus facta ; palporum fimbria brevis, e setis simplicibus vel parum uncinatis facta.

Palporum maxillarium unguis integer, inermis, gracilis, fimbria digitalis brevior, setis longis densis, valde uncinatis, unguem explens vel paulum superans.

Mandibulæ ante 7–10 pectinibus juxta et pone lamellam dentatam coarctatis instructæ.

Metameri quarti sternum integrum, subrobustum ; prosternum haud prominens (obtectum), inerme ; pedes prensorii articulo secundo et tertio parvis, secundo parum interrupto, tertio integro.

Lamina basalis sæpe omnino evanida.

Segmentum septimum absque spiraculis.

Spiracula profunda, parva, producte ovalia, parum obliqua vel fere prona, per paria sensim latitudine parum, longitudine vix decrescentia.

Pleuræ posticæ amplæ, liberæ, porosæ, subtruncatæ.

Pedes anales elongati, crassiusculi, quinquearticulati, aculeati, articulo tertio et quarto infra serratis, cum quinto animali mortuo spastice inflexis, ungue longo, tenuiusculo, paulum arcuato, inermi.

1. Cryptops validus, n. sp.

Ochraceus vel fulvus, pedibus pallidioribus ; robustus, ante sublævis vel obscure punctatus, post obscure scabrosus, laminis dorsalibus præter binas priores et posteriores quadrisulcatis, laminis ventralibus præter primam et ultimam in crucem profunde impressis, posterioribus manifestius scabrosis;

capite subquadrato, angulis rotundatis, lateribus arcte marginatis. Antennæ longiusculæ, ad basin paulum incrassatæ, 17-articulatæ, post aculeis brevioribus sparsissime vestitæ, præter articulos quaternos priores manifesto brevissme hirsutæ, articulis plerisque breviusculis.

Dentes prosternales desunt, margine antico aculeis viginti breviusculis instructo ; dens coxalis deest.

Pedes aculeis validis, breviusculis densius vestiti.

Pedes anales caduci.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ latæ, rugulosæ, parum hirsutæ, dense tenuiter porosæ, margine postico subrecto, aculeis paucis perbrevibus instructæ.

Lamina ultima ventralis longiuscula, angustiuscula, lateribus rotundatis, multum angustata, post breviter rotundata.

Long. 45 mm.

Hab. Zanzibar, Mr. Cooke.

2. Cryptops Patagonicus, n. sp,

Fulvo-brunneus, pedibus pallidioribus ; gracilis, sublævis, laminis dorsalibus præter anticam tresque posteriores sulcis binis arcuatis exaratis, laminis ventralibus præter tres posteriores in crucem manifesto impressis ; capite subcordiformi, post truncato, immarginata. Antennæ breviusculæ, ad basin vix incrassatæ, 17-articulatæ, post sparsissime longe aculeatæ, præter articulos ternos priores manifesto longius hirsutæ, articulis breviusculis.

Dentes prosternales desunt, margine antico glabro ; dens coxalis deest.

Pedes aculeis longis ante sparse, post sparsissime vestiti.

Pedes anales caduci.

Laminæ dorsales præter ultimam immarginatæ.

Pleuræ posticæ angustiusculæ, semiobtectæ, aculeis paucis vestitæ, poris paucis majoribus perforatæ, margine postico subrecto, aculeis paucis tenuibus instructæ.

Lamina ultima ventralis breviuscula, lata, lateribus rotundatis, multum angustata, post latissime rotundata.

Long. 18 mm.

Hab. Puerto Bueno, Patagonia (one single specimen).

3. Cryptops sulcatus, n. sp.

Fulvo-brunneus, pedibus antennisque pallidioribus ; pergracilis, sublævis, laminis dorsalibus præter anticam et ultimam sulcis senis (mediis obsoletioribus, exterioribus arcuatis) in corpore medio profundioribus exaratis, laminis ventralibus præter anticam duasque posteriores in crucem (sulco longitudinali lato, profundo, manifestiore) impressis, capite subovali, post truncato, immarginato. Antennæ breves, ad basin paulum incrassatæ, 17(16)-articulatæ, post densius longius aculeatæ, sparse hirsutæ, ante sparsissime, brevius aculeatæ, densius hirsutæ, articulis brevibus.

Dentes prosternales desunt, margine antico glabro ; dens coxalis evanidus.

Pedes aculeis longis ante sparse, post sparsissime vestiti.

Pedes anales caduci.

Laminæ dorsales præter ultimam immarginatæ,

Pleuræ posticæ latiusculæ, subliberæ, subglabræ, poris paucioribus subseriatis majoribus perforatæ, margine postico subrecto, aculeis paucis tenuibus instructæ.

Lamina ultima ventralis, breviuscula lata, lateribus subrectis, valde convergentibus, post latissime sinuata.

Long. 15 mm.

Hab. Bee Spring, Ky., F. G. Sanborn.

2. Fam. GEOPHILINI.

Segmenta pedifera numerosa (31–173 paria), inter se æqualia.

Pedes breves, tarsis integris.

Antennæ 14-articulatæ.

Oculi nulli.

(Pedes prensorii articulo secundo et tertio semper in latere exteriore evanidis vel interruptis.)

Lamina basalis semper manifesta.

Spiraculorum paria numerosa, segmentis numero paulo deteriora.

1. Gen. **Mecistocephalus.**

Mecistocephalus (Newport) Meinert, Myriap. Mus. Haun. i. Geophil., p. 92.

Corpus subdepressum, post plus vel minus angustatum.

Lamina cephalica trophos pro parte minore obtegens, elongata ; lamina frontalis discreta ; lamina basalis angustata, lateribus ante paulum convergentibus ; lamina præbasalis obtecta.

Antennæ sat longæ, vel longæ, filiformes.

Labrum liberum, tripartitum, parte media angustata, margine antico glabro.

Labii sternum bipartitum ; processus producti ; palpi simplices, producti, integri.

Palporum maxillarium unguis major vel minor.

Mandibulæ ante lamellis pluribus dentatis instructæ.

Metameri quarti sternum subquadratum, ante dentibus duobus parvis armatum ; prosternum haud prominens, obtectum ; pedes prensorii articulo ultimo (ungue) ad basin dente armato.

Scutella spiraculifera parva, præscutello pluries minora, postscutella magnitudinis fere scutelli, discreto ; scutella atque præscutella media et interna evanida.

Laminæ dorsales manifesto bisulcatæ.

Pori ventrales inconspicui.

Pori pleurales numerosi, in ventre et dorso siti.

Pedes anales sexarticulati, inermes; feminæ tenues vel tenuissimi, maris modice incrassati, articulo primo parvo.

Lamina ultima ventralis triangula, præscutis discretis. Palpi genitales maris sat breves, biarticulati.

1. Mecistocephalus punctifrons.

Mecistocephalus punctifrons Newport, Proc. Zool. Soc. 1842, p. 179, Trans. Linn. Soc. Lond., xix, p. 429, tab. 33, fig. 17.

Meinert, Myriap. Mus. Haun. i. Geophil., p. 97.

Mecistocephalus heteropus Humbert, Essai Myriap. Ceylan, p. 19, tab. ii, fig. 4, 4a–4d.

? *Mecistocephalus Guildingii* Newport, Trans. Linn. Soc. Lond., xix, p. 429, tab. 33, figs. 18–19.

Meinert, Myriap. Mus. Haun. i. Geophil., p. 96.

Minus robustus, post manifesto attenuatus; ochraceus vel fulvis, capite cum trophis laminaque prima dorsali dilute castaneis, antennis pedibusque flavis; sparsissime breviter pilosus, pedibus densius pilosis.

Pedes prensorii breviter vel brevissime, densius pilosi, flexi articulum primum antennarum explentes; sternum multo latius quam longius (5 : 4), coxa paulo longius, margine antico in medio alte sinuato, dentibus angularibus manifestis, acutis; coxa dentibus binis magnis armata; unguis dente majore, setoso armatus.

Lamina cephalica vix duplo longior quam latior (fere 9 : 5), sparsissime foveolata, foveis sex sulcos duos posticos, breves explentibus, marginem anticum laminæ basalis obtegens; lamina basalis multo latior quam longior (7 : 5).

Antennæ breviusculæ vel longiusculæ, articulis brevibus, primis subnodiformibus, paulum compressis.

Laminæ dorsales sublæves, præter ter vel quatuor priores atque tot posteriores manifesto bisulcatæ (5–20 obsolete foveolatæ), præscutis anterioribus obtectis vel brevissimis, mediis atque posterioribus longis.

Spiracula anteriora magna (antica maxima, subovalia, perpendicularia) subrotunda; media et posteriora minuta, rotunda.

Laminæ ventrales anteriores præter primam impressione ypsiliformi notatæ, posteriores in medio manifesto sulcatæ, scabrosæ.

Pedes paris primi perminuti; ceteri sat longi, anteriores manifesto breviores atque crassiores.

Pleuræ posticæ sat vel parum amplæ, densius pilosæ, poris minus numerosis, minutis infra instructæ, margine interiore late, breviter hirsuto; lamina ultima ventralis triangula, lateribus subrectis, breviter hirsuta.

Pedes anales pedibus paris anterioris valde longiores, paulo tenuiores, breviter hirsuti, articulis prioribus sparsius (♀) vel densius (♂) breviter hirsutis.

Pedes feminæ pp. 49, maris 49. Long. feminæ 52 mm., maris 50 mm. Lat. feminæ 1.7 mm., maris 1.8 mm.

Hab. The Rev. Mr. Carleton has presented eight specimens of this species, all from East India; Koolloo, near Himalaya; Ambala; a station 70 miles S. W. from Ambala.

2. MECISTOCEPHALUS HEROS, n. sp.

Robustus, post valde attenuatus; ochraceus, in dorso atque lateribus dense nigro-marmoratus, capite cum trophis laminaque prima dorsali castaneis, antennis pedibusque flavis; ante subglaber, post in ventre atque lateribus dense et breviter hirsutus, pedibus breviter pilosis.

Pedes prensorii subglabri, flexi articulum primum antennarum fere explentes; sternum vix sesqui latius quam longius (10 : 7), coxa multo longius (fere 5 : 4), margine antico alte sinuato, simplice; coxa dente obtuso armata, supra glabra; unguis dente evanido armatus.

Lamina cephalica vix duplo longior quam latior (9 : 5), sparsissime foveolata, foveis decim vel duodecim in duas series digestis, sulcum posticum, medium, brevem explentibus, marginem anticum laminæ basalis obtegens; lamina basalis bis vel ter latior quam longior (fere 5 : 2).

Antennæ perlongæ, articulis ternis prioribus subclaviformibus, ceteris teretibus, longius vel perlongis.

Laminæ dorsales sublæves, præter quatuor vel quinque priores atque tot posteriores manifesto bisulcatæ, præscutis anterioribus obtectis vel brevissimis, mediis atque posterioribus longis.

Spiracula anteriora magna (antica maxima), subovalia, perpendicularia; media et posteriora minuta, rotunda.

Laminæ ventrales anteriores et mediæ, præter duas anticas, impressione ypsiliformi notatæ; posteriores in medio sulcatæ, sulco post sensim evanescente.

Pedes paris primi brevissimi; ceteri sat longi, anteriores paulo breviores, manifesto crassiores.

Pleuræ posticæ sat amplæ, dense pilosæ, poris majoribus atque minoribus, numerosis, subseriatis infra et supra instructæ; latere interiore breviter hirsuto; lamina ultima ventralis trapezoidea, lateribus subrectis, post breviter hirsuta.

Pedes anales pedibus paris anteriores valde longiores, manifesto tenuiores, pilosi.

Pedes maris pp. 49. Long. maris 83 mm. Lat. maris 4.5 mm.

Hab. St. Mauritius Island, N. Pike.

3. MECISTOCEPHALUS BREVICEPS, n. sp.

Sat robustus, post modice attenuatus; ochraceus, capite cum trophis dilute castaneo, antennis fulvis, pedibus flavis; subglaber, pedibus setis sparse vestitis.

Pedes prensorii subglabri, flexi articulum primum antennarum non explentes; sternum sesqui latius quam longius, coxa vix sesqui longius (10 : 7), margine antico in medio alte sinuato, dentibus angularibus manifestis; coxa dente obtuso armata; unguis dente minuto armatus.

Lamina cephalica sesqui longior quam latior, foveolis paucis subseriatis impressa, marginem anticum laminæ basalis obtegens; lamina basalis (magnam partem obtecta) quater latior quam longior.

Antennæ breviusculæ, articulis mediis longioribus.

Laminæ dorsales sublæves, præter primam atque posteriores leviter bisulcatæ, præscutis anterioribus brevissimis, post sensim longioribus, posterioribus longis.

Spiracula anteriora magna (antica maxima), subovalia, perpendicularia; media et posteriora minuta, rotunda.

Laminæ ventrales anteriores præter primam in medio sulco profundo vel post magis obsoleto, marginem attingente, exaratæ, laminæ posteriores sublæves.

Pedes paris primi breves; ceteri sat longi, anteriores paulo breviores atque crassiores.

Pleuræ posticæ sat amplæ, hirsutæ, poris majoribus atque minoribus, numerosis, subseriatis, infra et supra instructæ; margine interiore late hirsuto, lamina ultima ventralis triangula, lateribus subrectis, post breviter hirsuta.

Pedes anales pedibus paris anterioris manifesto longiores, breviter-densius pilosi.

Pedes maris, pp. 45. Long. maris 65 mm. Lat. maris 2.5 mm.

Hab. Nantucket, Mass.

2. Gen. **Geophilus.**

Geophilus (Leach) Meinert, Myriap. Mus. Haun. i. Geophil., p. 58.

Corpus depressum vel subdepressum, ante vix, post modice angustatum.

Lamina cephalica trophos non obtegens; lamina frontalis sæpissime discreta, lamina basalis minus lata vel angusta, lateribus ante convergentibus; lamina præbasalis partim vel omnino obtecta.

Antennæ plus vel minus longæ, filiformes vel subfiliformes.

Labrum liberum, tripartitum, in dentes vel lacinias incisum.

Labii sternum integrum; processus sat parvi; palpi biarticulati, in latere exteriore processibus binis longis instructi.

Palporum maxillarium unguis major vel minor.

Mandibulæ ante lamina singula pectinata instructæ.

Metameri quarti sternum integrum, lineis duabus chitineis abbreviatis vel integris fultum, margine antico inermi vel dentibus duobus parvis instructo ; prosternum haud prominens, obtectum ; pedes prensorii articulo ultimo (ungue) dente basali sæpissime armato.

Scutella spiraculifera parva vel minima, præscutello pluries minora, postscutello majore discreto ; scutella atque præscutella media et interna evanida.

Laminæ dorsales manifesto bisulcatæ ; præscuta plurima magna vel longa.

Pori ventrales plus vel minus manifesti.

Pori pleurales multi vel pauciores aut nulli, in ventre solummedo vel etiam in dorso siti.

Pori anales duo aut nulli.

Pedes anales sexarticulati, ungue armati aut inermes ; feminæ graciles, maris graciles vel minus incrassati, articulo primo parvo.

Lamina ultima ventralis angusta aut lata, præscutis a lamina discretis, inter se coalitis aut non coalitis. Palpi genitales maris biarticulati.

A. Lamina frontalis discreta.

(Pori anales nulli).

1. Geophilus cephalicus.

Geophilus cephalicus Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 44.
Trans. Amer. Philos. Soc., xiii, p. 178.

Geophilus lævis Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 44.
Trans. Amer. Philos. Soc., xiii, p. 180.

Sat robustus ante vix, post paulum angustatus ; testaceus, capite cum trophis antennisque dilute brunneo, striga lata, duplice, interrupta, obscura in dorso medio notatus ; sublævis.

Pedes prensorii læves, flexi marginem frontalem spatio majore vel magno superantes ; sternum simplex oblingulatum, multo latius quam longius (fere 4 : 3), coxa duplo longius, margine antico in angulum, in medio sinuatum, producto, inermis ; coxa inermis ; unguis incurvus, dente minuto vel minimo, nodiformi armatus.

Lamina cephalica fere æque longa ac lata, lævis, subovalis, angulos priores laminæ basalis obtegens ; lamina basalis quater latior quam longior, ante alte emarginata, lamina præbasali parvam partem libera.

Antennæ breviusculæ vel longiusculæ, articulis prioribus præter primum longiusculis.

Laminæ dorsales foveis binis longitudinalibus impressæ, manifesto bisulcatæ, præscutis anterioribus brevibus, mediis et posterioribus longis.

Spiracula rotunda, anteriora (præsertim antica) magna ; media et posteriora minuta.

Laminæ ventrales in medio sulcatæ, in angulis fovea porosa vel rotunda (in angulis prioribus) vel transversali (in angulis posterioribus) obsolete exaratæ.

Pedes paris primi ceteris manifesto breviores atque tenuiores, anteriores quam posteriores paulo breviores atque crassiores.

Pleuræ posticæ parum inflatæ, glabræ, foveis binis obliquis, poriferis, semiobtectis instructæ; lamina ultima ventralis perlata, lateribus valde convergentibus, rotundatis.

Pedes anales pedibus paris anterioris paulo longiores, paulo (feminæ) vel valde (maris) crassiores, subglabri (feminæ) vel hirsuti (maris), ungue valido armati.

Pedes feminæ pp. 51–53; maris 49. Long. feminæ 47 mm.; maris 37 mm. Lat. feminæ 2 mm.

Hab. Fred. Co., Md., P. R. Uhler (the type of Dr. Wood); Michigan, E. P. Austin; Charl. Co., Md., Bryant. One specimen was labeled Zanzibar (an recte?).

2. Geophilus mordax, n. sp.

Minus robustus, post manifesto angustatus; fulvus, pedibus flavis; subglaber, pedibus pilis brevioribus sparsissime vestitis.

Pedes prensorii subglabri, flexi marginem frontalem vix attingentes; sternum lineis duabus chitineis, integris fultum, sesqui latius quam longius, coxa fere duplo longius (20 : 11), margine antico longe producto, in medio alte sinuatus, inermis; coxa inermis; unguis valde curvatus, dente minimo, obtuso armatus.

Lamina cephalica fere æque longa ac lata, subglabra, subovalis, angulos priores laminæ basalis obtegens; lamina basalis ter latior quam longior, lamina præbasali partem minimam libera.

Antennæ longiusculæ vel longæ, articulis prioribus præter primum longiusculis, articulo ultimo articulos duos antecedentes conjunctos longitudine procul æquante.

Laminæ dorsales sublæves, manifesto bisulcatæ.

Spiracula anteriora ovalia vel subovalia, perpendicularia, magna vel permagna, per paria sensim magnitudine decrescentia; media et posteriora rotunda, minuta.

Lamina ventrales anteriores sulco medio, profundo, abbreviato areaque postica transversali, porosa, mediæ et posteriores sulco minus profundo, integro exaratæ.

Pedes paris primi ceteris paulo breviores atque tenuiores, anteriores quam posteriores paulo breviores atque crassiores.

Pleuræ posticæ vix inflatæ, subglabræ, poris dēnis vel duodenis magnis, subseriatis instructæ; lamina ultima ventralis minus lata, lateribus subrectis, manifesto convergentibus.

Pedes anales caduci.

Pedes feminæ pp. 51. Long. 25 mm. Lat. 1.2 mm.

Hab. The specimen had no more distinct indication than U. S. A.

B. Lamina frontalis coalita.

a. Pori anales nulli.

3. Geophilus marginalis, n. sp.

Sat robustus, post manifesto angustatus; flavus, capite cum trophis laminaque prima dorsali dilute brunneo, striga lata, duplice, interrupta, obscura in dorso medio notatus, lateribus maculis obscuris, densis irroratis; pilis longioribus densius vestitus.

Pedes prensorii pilis brevibus densius vestiti, flexi articulum primum antennarum spatio majore superantes; sternum simplex, multo latius quam longius (fere 7 : 6), coxa vix sesqui longius, margine antico in medio profunde sinuato, dentibus duobus brevibus armato; coxa dente majore, obtuso armata; unguis parum curvatus, dente magno, acuto armatus.

Lamina cephalica vix sesqui longior quam latior (fere 10 : 7), sat grosse, densius punctata, sulcis duobus longioribus obsolete impressa, lateribus subrectis, post paulum convergentibus, marginem anticum laminæ præbasalis obtegens; lamina basalis ter vel quater latior quam longior (fere 25 : 7).

Antennæ longæ vel perlongæ, articulis prioribus præter primum longis vel perlongis, articulo ultimo duobus antecedentibus conjunctis paulo breviore.

Laminæ dorsales sat grosse punctatæ, foveis binis longis manifesto exaratæ, obscurius bisulcatæ, præscutis anterioribus brevissimis, mediis et posterioribus longiusculis.

Spiracula bina priora ovalia, perpendicularia, magna vel permagna, cetera rotunda, minuta vel perminuta.

Laminæ ventrales profunde sulcatæ, anteriores areis vel foveis quaternis porosis exaratæ.

Pedes paris primi ceteris multo breviores atque tenuiores, anteriores quam posteriores paulo breviores, multo crassiores.

Pleuræ posticæ parum inflatæ, sparse pilosæ, poris numerosis, parvis, seriatis in ventre et dorso instructæ; lamina ultima ventralis angusta, lateribus subrectis, manifesto vel valde angustatis.

Pedes anales (maris) pedibus paris anterioris paulo longiores, valde crassiores, ungue evanido.

Pedes maris pp. 61. Long. 46 mm. Lat. 1.6 mm.

Hab. Key West, Fla. (one single specimen).

4. Geophilus urbicus, n. sp.

Minus robustus, post multum attenuatus; fulvus; pilis brevibus sparsissime vestitus, pedibus pilis longioribus sparse vestitis.

Pedes prensorii subglabri, flexi marginem frontalem procul attingentes; sternum simplex, sesqui latius quam longius, coxa plus sesqui longiores (5 : 3), margine antico in medio late sinuato, dentibus duobus obtusis, evanidis armato ; coxa dente parvo, acuto armata ; unguis valde curvatus, dente minuto, obtuso armatus.

Lamina cephalica fere æque longa ac lata, subglabra, sulcis duobus transversalibus ante marginem posticum impressa, lateribus rotundatis, manifesto convergentibus, angulos priores laminæ basalis obtegens, margine postico late sinuato ; lamina basalis vix quater latior quam longior, lamina præbasali partim libera.

Antennæ breviusculæ, dense hirsutæ, articulis prioribus præter primum longiusculis, articulo ultimo articulos duos antecedentes conjunctos longitudine manifesto superante.

Laminæ dorsales foveis binis obsoletis exaratæ, obsolete bisulcatæ, præscutis anterioribus et posterioribus brevibus, mediis longis vel perlongis.

Spiracula rotunda, anteriora parva, per paria sensim magnitudine decrescentia, media et posteriora perminuta.

Laminæ ventrales anteriores sulco medio profundo notatæ, mediæ et posteriores sulcis ternis obsoletioribus, post sensim evanescentibus exaratæ.

Pedes paris primi ceteris subæquales, anteriores posterioribus subæquales.

Pleuræ posticæ paulum inflatæ, pilis longioribus sparse vestitæ, poris vicenis magnis vel permagnis (posticis) instructæ ; lamina ultima ventralis angusta, lateribus subrectis, parum convergentibus.

Pedes anales pedibus paris anterioris paulo breviores, multo crassiores, ungue magno armati.

Pedes feminæ pp. 41. Long. 22 mm. Lat. 1.1 mm.

Hab. Cambridge, Mass., E. Schwarz (one single specimen).

5. Geophilus Georgianus, n. sp.

Sat gracilis, post manifesto attenuatus ; ochraceus vel flavus, capite cum trophis dilute brunneo, pedibus testaceis ; subglaber, pedibus pilis longioribus, sparsis vestitis.

Pedes prensorii subglabri, flexi marginem frontalem spatio magno superantes ; sternum simplex, multo latius quam longius (7 : 6), coxa vix duplo longius (20 : 11), margine antico in medio late sinuato, inermi ; coxa dente evanido armata ; unguis curvatus, dente minuto armatus.

Lamina cephalica multo longior quam latior (9 : 7), pilis paucis, brevibus vestita, sulcis duobus longis ante marginem posticum obsolete impressa, subovalis, marginem anticum laminæ basalis obtegens ; laminæ basalis pars libera plus duplo latior quam longior (7 : 3).

Antennæ longæ, in latere exteriore dense pilosæ, articulis prioribus præter primum longis, articulo penultimo articulis duobus antecedentibus conjunctis manifesto breviore.

Laminæ dorsales foveolis binis longitudinalibus obsolete notatæ, manifesto bisulcatæ, præscutis longiusculis vel longis, posterioribus paulo longioribus.

Spiracula rotunda, anteriora magna, per paria sensim magnitudine decrescentia, media et posteriora minuta.

Laminæ ventrales anteriores in medio profunde sulcatæ, pone sulcum area transversali, angusta, porosa notatæ.

Pedes paris primi ceteris multo breviores atque tenuiores, anteriores posterioribus paulo breviores atque crassiores.

Pleuræ posticæ parum inflatæ, poris singulis, validis, obtectis.

Pedes anales pedibus paris anterioris valde longiores, manifesto crassiores, pilis brevibus, sparsis vestiti, ungue evanido armati.

Pedes feminæ pp. 61. Long. 34 mm. Lat. 0.9 mm.

Hab. Georgia (one single specimen).

b. Pori anales parvi.

6. Geophilus occidentalis, n. sp.

Sat gracilis, post manifesto angustatus; ochraceus, capite cum trophis dilute brunneo, antennis flavis; subglaber, pedibus longe, sparse pilosis.

Pedes prensorii subglabri, flexi articulum primum antennarum fere explentes; sternum simplex, æque longum ac latum, coxa sesqui longius, margine antico in medio alte sinuato, angulis integris; coxa dente obtuso armata; unguis dente nodiformi, minore armatus.

Lamina cephalica vix sesqui longior quam latior, post paulum angustata, foveolis minutis, sparsis, subseriatis sulcisque duobus brevibus, obsoletis notata; lamina basalis libera, fere ter latior quam longior.

Antennæ longæ, articulis plurimis longis.

Laminæ dorsales sublæves, manifesto bisulcatæ, præscutis anterioribus perbrevibus, mediis longis, posterioribus longiusculis.

Spiracula præter antica parva, rotunda; antica subovalia.

Laminæ ventrales anteriores profunde sulcatæ, mediæ atque posteriores obsolete impressæ.

Pedes paris primi ceteris manifesto breviores, anteriores quam posteriores paulo crassiores.

Pleuræ posticæ vix inflatæ, poris novenis vel denis liberis, majoribus vel minoribus atque singulo magno, distante instructæ; lamina ultima ventralis angustiuscula, longa, post manifesto angustata.

Pedes anales subglabri, crassiusculi, ungue evanido.

Pedes maris pp. 73. Long. 39 mm. Lat. 1 mm.

Hab. San Francisco, Cal., T. G. Cary, Jr. (one single specimen.)

c. Pori anales magni.

7. Geophilus Huronicus, n. sp.

Sat vel minus robustus, post manifesto angustatus; flavus, capite cum trophis dilute brunneo, pedibus testaceis vel flavis; subglaber, pedibus pilis longioribus sparse vestitis.

Pedes prensorii subglabri, flexi marginem frontalem spatio majore vel minore superantes ; sternum simplex, multo latius quam longius (fere 6 : 5), coxa plus sesqui longius (5 : 3), margine antico altius sinuato, inermi ; coxa dente evanido armata ; unguis dente minuto armatus.

Lamina cephalica paulo longior quam latior (fere 10 : 9), sparse minus grosse punctata, sulcis duobus sat longis obsolete exarata, subovalis, partem majorem laminæ basalis obtegens ; lamina basilis ter latior quam longior.

Antennæ longæ vel perlongæ, articulis præter primum et ultimos longis, articulo ultimo articulis duobus antecedentibus conjunctis manifesto breviore.

Laminæ dorsales fovea media, obsoleta exaratæ, manifesto bisulcatæ, præscutis anterioribus brevissimis vel brevibus, mediis et posterioribus longiusculis vel brevibus.

Spiracula rotunda, anteriora magna per paria sensim magnitudine decrescentia ; media et posteriora minuta.

Laminæ ventrales manifesto sulcatæ, anteriores et mediæ pone medium area magna, transversali, porosa vel integra (in anterioribus) vel bipartita (in mediis) notatæ.

Pedes paris primi ceteris multo breviores atque tenuiores, anteriores posterioribus vix breviores, paulo crassiores.

Pleuræ posticæ vix inflatæ, pilis brevibus sparse vestitæ, poris senis vel octonis majusculis, maximam partem obtectis instructæ ; lamina ultima ventralis lata, lateribus subrectis, paulum convergentibus.

Pedes anales pedibus paris anterioris valde longiores, paulo (feminæ) vel multo (maris) crassiores, ungue majore (feminæ) vel minore (maris) armati.

Pedes feminæ pp. 55–57 ; maris 53–55. Long. feminæ 33 mm.; maris 30 mm. Lat. feminæ 1 mm.; maris 1.2 mm.

Hab. I have seen four specimens of this species; the two were labeled Massachusetts, and the two others "N. Engl."

3. Gen. **Scolioplanes.**

Scolioplanes (B. & M.) Meinert, Myriap. Mus. Haun. i. Geophil., p. 48.

Corpus subdepressum, ante et post attenuatum.

Lamina cephalica trophos non omnino obtegens ; lamina frontalis discreta aut coalita ; lamina basalis transversalis ; lamina præbasalis in duas lamellas partita, obtecta aut detecta.

Antennæ plus vel minus longæ, filiformes, hirsutæ.

Labrum liberum, tripartitum, partis mediæ margine antico in dentes multos inciso.

Labii sternum integrum ; processus sat magni ; palpi integri vel bipartiti, simplices.

Palporum maxillarium unguis parvus.

Mandibulæ ante lamina singula pectinata instructæ.

Metameri quarti sternum integrum, simplex ; prosternum haud prominens, obtectum ; pedes prensorii articulo ultimo (ungue) dente basali valido armato.

Scutella spiraculifera sat magna, præscutello duplo vel triplo minora, postscutello minore discreto ; scutella et præscutella media et interna evanida.

Laminæ dorsales læves ; præscuta longiora vel breviora.

Pori ventrales parvi vel minimi, in aream transversalem, posticam dispositi.

Pori pleurales plures vel pauciores.

Pori anales duo, parvi.

Pedes anales sexarticulati ; feminæ gracilis, attenuati, maris percrassi vel crassi, hirsuti, articulo primo parvo.

Lamina ultima ventralis longa, lateribus postconvergentibus, præscutis discretis. Palpi genitales maris integri.

I. Lamina frontalis discreta.

1. Scolioplanes bothriopus.

? *Strigamia bothriopus* Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 46.

Trans. Amer. Philos. Soc., xiii, p. 182.

? *Strigamia flava* Sayer, Proc. Acad. Nat. Sc. Philad., viii, p. 109.

Wood, Trans. Amer. Philos. Soc., xiii, p. 183.

Minus robustus, ante et post multum attenuatus ; fulvus, capite cum trophis dilute brunneo ; pilis brevibus sparse vestitus, pedibus pilis breviusculis densius vestitis.

Pedes prensorii pilis breviusculis sparse vestiti, flexi marginem frontalem spatio magno non attingentes ; sternum stricte cordiforme vix duplo latius quam longius (fere 9 : 5), coxa bis vel ter longius (5 : 2), margine antico in medio alte sinuato, inermi ; coxa inermis ; unguis parum curvatus, dente valido, acuto armatus.

Lamina cephalica paulo latior quam longior (10 : 9), pilis longioribus sparse vestita, læviuscula, lateribus rotundatis, manifesto divergentibus, margine postico a lamina basali obtecta ; lamina basalis bis vel ter latior quam longior (fere 5 : 2).

Antennæ longiusculæ, articulis prioribus præter primum longiusculis, articulo ultimo articulos duos antecedentes conjunctos longitudine subæquante.

Laminæ dorsales læviusculæ, præscutis longiusculis vel longis.

Spiracula rotunda, magna vel majuscula, anteriora posterioribus paulo majora.

Laminæ ventrales fovea media, obsoleta areaque magna, duplice, porosa ante marginem posticum notatæ.

Pedes paris primi ceteris manifesto breviores, anteriores et posteriores subæquales.

Pleuræ posticæ parum inflatæ, pilis longioribus sparse vestitæ, poris tredenis vel sedenis (præter unum distantem in series rotundatas digestis) parvis et majusculis instructæ ; lamina ultima ventralis angusta, lateribus curvatis, convergentibus.

Pedes anales pedibus paris anterioris paulo breviores, vix (feminæ) vel valde (maris) crassiores, ungue parvo armati.

Pedes feminæ pp. 51 ; maris 47–51. Long. feminæ 24 mm. ; maris 35 mm. Lat. maris 1.3 mm.

The specimen of the Museum of Comp. Zoöl. was labeled "Strigamia fulva Say," determined by Dr. Wood.

Hab. Massachusetts.

2. Scolioplanes chionophilus.

? *Strigamia chionophila* Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 50.
Trans. Amer. Philos. Soc., xiii, p. 189.

Minus robustus, ante et post multum attenuatus ; fulvus, capite cum trophis dilute brunneo ; pilis brevibus sparse vestitus, pedibus pilis longioribus sparse vestitis.

Pedes prensorii subglabri, flexi marginem frontalem non attingentes ; sternum subcordiforme, paulo latius quam longius (10 : 9), coxa bis vel ter longius (5 : 2), margine antico in medio late sinuato, inermi ; coxa inermis ; unguis valde curvatus, dente valido, acutiusculo armatus.

Lamina cephalica multo latior quam longior (5 : 4), subglabra, læviuscula, lateribus paulum rotundatis, manifesto divergentibus, margine postico subrecto, laminam basalem plus vel minus obtegente ; lamina basalis plus ter latior quam longior (fere 10 : 3).

Antennæ breviusculæ, articulis præter primum el ultimum breviusculis, articulo ultimo articulos duos antecedentes conjunctos longitudine subæquante.

Laminæ dorsales læviusculæ, præscutis anterioribus brevibus vel brevissimis, mediis et posterioribus longis vel perlongis.

Spiracula rotunda, anteriora parva, media et posteriora minuta.

Laminæ ventrales foveis ternis in seriem mediam transversalem digestis plus vel minus manifesto exaratæ.

Pedes parium trium priorum per paria sensim longitudine manifesto crescentes, ceterorum anteriores posterioribus subæquales.

Pleuræ posticæ coxiformes, subglabræ, poris novenis vel tredenis in obliquum subseriatis, magnis et permagnis instructæ ; lamina ultima ventralis triangula.

Pedes anales pedibus paris anterioris subæquales, ungue minore (feminæ) vel paulo crassiores, ungue longo (maris).

Pedes feminæ pp. 39 ; maris 41. Long. feminæ 22 mm. ; maris 25 mm. Lat. maris 1.3 mm.

Hab. Cambridge, Mass., Mr. E. Schwarz.

3. Scolioplanes robustus, n. sp.

Sat robustus, ante et post vix angustatus ; fulvus, capite cum trophis laminaque basali et prima dorsali dilute brunneo ; subglaber, pedibus pilis brevibus sparsissime vestitis.

Pedes prensorii subglabri, flexi marginem frontalem spatio magno non attingentes ; sternum subcordiforme, plus sesqui latius quam longius (5 : 3), coxa plus duplo longius (9 : 4), margine antico in medio alte sinuato, inermi ; coxa inermis ; unguis parum curvatus, dente valido, acuto armatus.

Lamina cephalica paulo latior quam longior (10 : 9), subglabra, læviuscula, lateribus rotundatis, manifesto divergentibus, margine postico a lamina basali vix obtecto ; lamina basalis quam lamina cephalica duplo brevior, bis vel ter latior quam longior (5 : 2).

Antennæ longæ, articulis prioribus præter primum longis, articulo ultimo articulis duobus antecedentibus conjunctis manifesto breviore.

Laminæ dorsales læviusculæ, præscutis breviusculis.

Spiracula rotunda, sat magna.

Laminæ ventrales fovea media oblonga, post sensim obsoletiore, areisque duabus duplicibus, porosis ante marginem posticum exaratæ.

Pedes paris primi ceteris manifesto breviores, anteriores quam posteriores paulo breviores et crassiores.

Pleuræ posticæ modice inflatæ, glabræ, poris vicenis magnis et permagnis, subseriatis instructæ ; lamina ultima ventralis angusta, triangula, parva.

Pedes anales pedibus paris anterioris paulo breviores atque tenuiores, ungue majusculo armati.

Pedes feminæ pp. 53. Long. 40 mm. Lat. 2.1 mm.

Hab. This species had no more distinct locality than N. A.?

4. Scolioplanes exul, n. sp.

Robustus, ante valde post parum angustatus, fulvus ; pedibus flavis ; pilis brevissimis sparse vestitus, pedibus pilis brevioribus sparse vestitis.

Pedes prensorii pilis brevissimis et brevibus densius vestiti ; flexi marginem frontalem fere attingentes ; sternum subcordiforme, plus sesqui latius quam longius (5 : 3), margine antico in medio alte sinuato, inermi ; coxa inermis ; unguis curvatus, dente valido, acutiusculo armatus.

Lamina cephalica æque longa ac lata, pilis brevibus sparse vestita, læviuscula, subovalis, margine postico subrecto, laminam præbasalem fere totam obtegente ; lamina basalis quam lamina cephalica vix ter brevior, plus ter latior quam longior.

Antennæ longæ, subfiliformes, articulis prioribus præter primum longis, articulo ultimo articulis duobus antecedentibus conjunctis manifesto breviore.

Laminæ dorsales læviusculæ, præscutis breviusculis.

Spiracula rotunda magna vel permagna, anteriora per paria sensim magnitudine decrescentia.

Laminæ ventrales anteriores in medio profunde sulcatæ, foveis binis obsoletioribus, lateralibus areisque binis magnis, porosis ante marginem posticum exaratæ, mediæ et posteriores in medio obsoletius (ante) vel manifestius (post) sulcatæ, ante marginem posticum area permagna, transversali, porosa notatæ.

Pedes paris primi ceteris manifesto breviores et tenuiores, anteriores et posteriores subæquales.

Pleuræ posticæ coxiformes, sat inflatæ, pilis brevioribus densius vestitæ, poris denis magnis, partim obtectis instructæ; lamina ultima ventralis brevis, transversalis, lateribus subrectis, valde convergentibus.

Pedes anales pedibus paris anterioris manifesto longiores, valde incrassati, compressiusculi, articulo ultimo quam penultimo multoties minore, conico, ungue evanido armato.

Pedes maris pp. 65. Long. 45 mm. Lat. 2.2 mm.

Hab. This new species was labeled "No Loc."

II. Lamina frontalis coalita.

5. Scolioplanes parviceps.

? *Strigamia parviceps* Wood, Trans. Amer. Philos. Soc., xiii, p. 187.

Minus robustus, ante multum post manifesto angustatus; flavus, concolor, vel ante et post fulvus; glaber.

Pedes prensorii glabri, flexi marginem frontalem procul attingentes; sternum vix duplo latius quam longius (fere 9 : 5), coxa duplo longius, margine antico in medio rectangulatim inciso, inermi; coxa inermis; unguis parum curvatus, dente valido, acuto armatus.

Lamina cephalica fere æque longa ac lata, glabra, lævis, lateribus rotundatis, manifesto divergentibus, margine postico rotundato, laminam præbasalem maximam partem obtegente; lamina basalis quam lamina cephalica duplo brevior, bis vel ter latior quam longior (fere 5 : 2), lamina præbasali in lateribus paulum libera.

Antennæ longiusculæ, articulis prioribus præter primum longis, articulo ultimo articulis duobus antecedentibus conjunctis multo breviore.

Laminæ dorsales læviusculæ, præscutis anterioribus breviusculis vel brevibus, mediis et posterioribus longiusculis.

Spiracula rotunda, anteriora permagna vel magna, per paria sensim magnitudine decrescentia; media et posteriora mediocria.

Laminæ ventralis præter primam et ultimam foveis septenis porosis, quarum singula rotunda in medium senæque in binas series laterales digestæ, exaratæ.

Pedes paris primi ceteris manifesto breviores et tenuiores; priores per paria sensim longitudine crescentes.

Pleuræ posticæ manifesto inflatæ, glabræ, poris fere tricenis parvis et magnis, subseriatis instructæ; lamina ultima ventralis angusta, lateribus subrectis, multum convergentibus.

Pedes anales pedibus paris anterioris manifesto longiores, paulo tenuiores, ungue parvo armati.

Pedes feminæ pp. 75. Long. 47 mm. Lat. 1.7 mm.

A specimen, which was said to be a type of Dr. Wood, was labeled "Strigamia bidens Wood."

Hab. The locality was not more distinct than "N. A. Loc.?"

6. SCOLIOPLANES ? LONGICORNIS, n. sp.

Sat gracilis, ante valde post manifesto angustatus; fulvus, antennis pedibusque flavis; subglaber, pedibus pilis longioribus sparse vestitis.

Pedes prensorii subglabri, flexi marginem frontalem fere attingentes; sternum subcordiforme, sesqui latius quam longius, coxa fere duplo longius, margine antico in medio alte sinuato; coxa inermis; unguis longus, tenuis, curvatus, dente sat magno armatus.

Lamina cephalica multo longior quam latior (11 : 8), glabra, lævis, lateribus rotundatis, manifesto convergentibus, margine postico marginem anticum laminæ præbasalis obtegente; lamina basalis quam lamina cephalica bis vel ter brevior (2 : 5), plus duplo latior quam longior (9 : 4), lamina præbasali magnam partem libera.

Antennæ ad basin fere contiguæ, longæ vel perlongæ, filiformes, articulis prioribus præter primum perlongis, articulo ultimo articulos duos antecedentes conjunctos longitudine subæquante.

Laminæ dorsales læviusculæ, præscutis anterioribus breviusculis, mediis et posterioribus longiusculis.

Spiracula rotunda, magna vel mediocria, anteriora paulo majora, per paria sensim magnitudine decrescentia.

Laminæ ventrales sulcatæ, foveis binis exaratæ, sulcis foveisque post sensim obsoletioribus.

Pedes paris primi ceteris vix breviores et tenuiores, anteriores posterioribus paulo crassiores, vix breviores.

Pleuræ posticæ parum inflatæ, subglabræ, poris vicenis magnis, biseriatis instructæ; lamina ultima ventralis minus lata, lateribus subrectis, manifesto convergentibus.

Pedes anales pedibus paris anterioris multo longiores, vix crassiores, ungue magno armati.

Pedes feminæ pp. 107. Long. 65 mm. Lat. 1.2 mm.

Perhaps, or rather probably, this species ought to constitute a new genus, but solely I have had for investigation one single specimen, and therefore I have not been able to put the animal and particularly the parts of the mouth to the necessary microscopical examination.

Hab. Also the species was labeled " No locality."

4. Gen. **Himantarium.**

Himantarium (Koch) Meinert, Myriap. Mus. Haun. i. Geophil., p. 21.

Corpus depressum vel subdepressum, lineare vel ante et post levissime angustatum.

Lamina cephalica trophos obtegens; lamina cephalica discreta aut coalita; lamina basalis latissima, transversalis, lateribus post convergentibus vel subparallelis, lamina præbasalis evanida.

Antennæ curtæ, crassæ, attenuatæ.

Labrum liberum, integrum, dentatum.

Labii sternum integrum; processus parvi; palpi integri vel biarticulati, extrorsum dente magno armati.

Palporum maxillarium unguis minor.

Mandibulæ ante laminis pectinatis pluribus atque lamella dentata instructæ.

Metameri quarti sternum integrum, lineis chitineis duabus fultum; prosternum haud prominens, obtectum; pedes prensorii ungue inermi.

Scutella spiraculifera parva, præscutello duplo vel pluries minora, posscutello parvo discreto; scutella atque præscutella media et interna manifesta.

Laminæ dorsales obsolete bisulcatæ, subglabræ vel scabrosæ; præscuta breviuscula vel longiuscula.

Pori ventrales in omnibus fere vel in pluribus laminis in aream definitam coarctati.

Pori pleurales sæpissime permulti, interdum pauciores, obtecti vel nulli; pleuræ inflatæ, interdum coxiformes.

Pori anales nulli.

Pedes anales inermes, sexarticulati; feminæ graciles, subfiliformes, subnudi, maris paulo crassiores, breviter hirsuti.

Lamina ultima ventralis plus vel minus triangula, præscutis evanidis vel discretis. Palpi genitales maris manifesto biarticulati.

Lamina ultima dorsalis lævis, simplex.

Lamina frontalis coalita.

1. Himantarium insigne, n. sp.

Robustum, ante et post manifesto angustatum; olivaceum vel luridum; glabrum.

Pedes prensorii glabri, flexi marginem frontalem procul attingentes;

sternum plus duplo latius quam longius (7 : 3), coxa sesqui longius, margine antico in medio late sinuato, inermi; coxa inermis; unguis valde curvatus, inermis.

Lamina cephalica subsemicircularis, vix sesqui latior quam longior (10 : 7), glabra, læviuscula, margine postico latissime rotundato, marginem anticum medium laminæ basalis obtegente; lamina basalis quam lamina cephalica plus quater brevior, quater vel quinquies latior quam longior (fere 9 : 2).

Antennæ breves, ad basin contiguæ, incrassatæ, manifesto attenuatæ, articulis præter ultimum transversalibus, articulo ultimo articulis duobus antecedentibus conjunctis multo longiore (4 : 3).

Laminæ dorsales læviusculæ, foveis binis lateralibus, obsoletis exaratæ, præscutis longiusculis.

Spiracula subovalia, paulum obliqua, mediocria, anteriora posterioribus paulo majora.

Laminæ ventrales præter primam et ultimam pone medium area transversali, porosa instructæ.

Pedes paris primi ceteris paulo breviores atque tenuiores, anteriores et posteriores subæquales.

Pleuræ posticæ coxiformes, non inflatæ, integræ; lamina ultima ventralis parva, transversalis, lateribus subrectis, paulum convergentibus, margine postico angulatim sinuato.

Pedes anales pedibus paris anterioris paulo breviores, manifesto tenuiores, inermes.

Pedes feminæ pp. 77. Long. 105 mm. Lat. 4 mm.

Hab. Koolloo, Rev. Mr. Carleton.

2. Himantarium Indicum, n. sp.

Sat robustum, ante multum, post paulum angustatum; fulvum vel flavum, glabrum, pedibus pilis brevibus sparsissime vestitis.

Pedes prensorii glabri, flexi marginem frontalem spatio magno non attingentes; sternum duplo latius quam longius, coxa duplo longius, margine antico in medio late sinuato, inermi; coxa inermis; unguis valde curvatus, inermis.

Lamina cephalica æque longa ac lata, glabra, læviuscula, lateribus rotundatis, manifesto divergentibus, margine postico vix rotundato marginem anticum laminæ basalis obtegente; lamina basalis quam lamina cephalica plus quater brevior, quater vel quinquies latior quam longior.

Antennæ breves vel perbreves, ad basin distantes, crassæ attenuatæ, articulis præter ultimum transversalibus, articulo ultimo articulis duobus antecedentibus conjunctis manifesto longiore.

Laminæ dorsales læviusculæ vel obsolete rugulosæ, præscutis anterioribus brevibus vel breviusculis, mediis et posterioribus longis vel longiusculis.

Spiracula rotunda anteriora magna, per paria sensim magnitudine paulum decrescentia, media et posteriora parva.

Laminæ ventrales præter primam et ultimam impressione lineari, transversali, porosa notatæ.

Pedes paris primi ceteris paulo breviores atque tenuiores, anteriores posterioribus paulo crassiores.

Pleuræ posticæ coxiformes, pilis brevissimis sparse vestitæ, integræ; lamina ultima ventralis sat parva, lateribus rectis, parum convergentibus.

Pedes anales pedibus paris anterioris multo longiores, aut vix (feminæ) aut valde (maris) crassiores, articulo ultimo quam penultimo paulo longiore, inermes.

Pedes feminæ pp. 67; maris 67. Long. feminæ 45 mm.; maris 53 mm. Lat. maris 2.2 mm.

Hab. Koolloo, Rev. Mr. Carleton.

3. Himantarium tæniopse.

Strigamia tæniopsis Wood, Journ. Acad. Nat. Soc. Philad., new ser., v, p. 48.
Trans. Amer. Philos. Soc. xiii, p. 185.

Minus gracile, ante et post paulum angustatum; fulvum vel flavum; glabrum.

Pedes prensorii glabri, flexi marginem frontalem fere attingentes; sternum fere duplo latius quam longius, coxa fere sesqui longius, margine antico in medio late sinuato, inermi; coxa inermis; unguis curvatus, inermis.

Lamina cephalica multo latior quam longior (fere 4 : 3), glabra, læviuscula, margine postico subrecto, marginem anticum laminæ basalis obtegente; lamina basalis quam lamina cephalica plus ter brevior (fere 3 : 10), quater latior quam longior.

Antennæ longiusculæ, ad basin distantes, paulum incrassatæ, manifesto attenuatæ, articulis prioribus præter primum longiusculis, articulo ultimo articulis duobus antecedentibus conjunctis manifesto breviore.

Laminæ dorsales læviusculæ, præscutis anterioribus breviusculis, mediis et posterioribus longiusculis.

Spiracula subovalia, perpendicularia, anteriora magna, per paria sensim magnitudine paulum decrescentia, media et posteriora minuta.

Laminæ ventrales anteriores area majore, subovali, transversali, porosa, mediæ et posteriores area minore vel parva, rotundata, porosa pone medium exaratæ.

Pedes paris primi ceteris paulo vel vix breviores, anteriores posterioribus manifesto crassiores, paulo breviores.

Pleuræ posticæ parum inflatæ, glabræ, integræ; lamina ultima ventralis mediocris, lateribus rotundatis, multum convergentibus.

Pedes anales pedibus paris anterioris vix longiores, manifesto tenuiores, inermes.

Pedes feminæ pp. 143. Long. 130 mm. Lat. 2.4 mm.

Hab. San Diego, Cal.

4. Himantarium laticeps.

Strigama laticeps Wood, Journ. Acad. Nat. Sc. Philad., new ser., v, p. 49.
Trans. Amer. Philos. Soc. xiii, p. 186.

Gracile, ante et post leviter angustatum, ochraceum, glabrum.

Pedes prensorii glabri, flexi marginem frontalem fere attingentes; sternum oblingulatum, plus duplo latius quam longius (9 : 4), coxa vix duplo longius (fere 9 : 5), margine antico in medio sat alte sinuato, inermi; coxa inermis; unguis parum curvatus, inermis.

Lamina cephalica multo latior quam longior (4 : 3), glabra, lævis, subpentagona, partem anteriorem mediam laminæ basalis obtegens; lamina basalis, quoad liberam, quam lamina cephalica quater brevior, quinquies latior quam longior.

Laminæ dorsales obsolete bisulcatæ, area media paulum depressa, præscutis breviusculis vel longiusculis.

Spiracula rotunda, anteriora magna; media et posteriora parva.

Laminæ ventrales præter primam et ultimam area angusta, transversali, porosa in medio vel post sensim marginem posticum proprius exaratæ.

Pedes paris primi ceteris manifesto breviores, anteriores posterioribus manifesto crassiores.

Pleuræ posticæ parum inflatæ, glabræ, foveis ternis magnis, semiobtectis, porosis instructæ; lamina ultima ventralis sat lata, post angulatim sinuata, profunde sulcata, lateribus rectis, valde convergentibus.

Pedes anales pedibus paris anterioris paulo breviores, valde crassiores, inermes.

Pedes maris pp. 81. Long. 76 mm. Lat. 1.4 mm.

Hab. Texas, Chas. Stolley (the type of Mr. Wood).

5. Gen. **Orphnæus.**

Orphnæus Meinert, Myriap. Mus. Haun. i. Geophil., p. 17.

Corpus subdepressum, ante et post minus angustatum.

Lamina cephalica trophos plus vel minus obtegens; lamina frontalis coalita; lamina basalis latior, lateribus post paulum divergentibus; lamina præbasalis evanida.

Antennæ subteretes, curtæ, paulum attenuatæ.

Labrum liberum, integrum, dense dentatum.

Labii sternum integrum; processus breves; palpi integri, extrorsum processis binis membranaceis instructæ.

Palporum maxillarium unguis sat magnus.

Mandibulæ ante laminis pectinatis quaternis vel quinis instructæ.

Metameri quarti sternum integrum, transversale, simplex; prosternum haud prominens, obtectum; pedes prensorii ungue inermi.

Scutella spiraculifera magna, fere magnitudinis præscutelli, postscutello majore discreto; scutella atque præscutella interna evanida.

Laminæ dorsales leviter vel levissime scabrosæ, bifoveolatæ ; præscuta majora.

Pori ventrales in plagas quaternas digesti.

Pori pleurales nulli.

Pori anales nulli.

Pedes anales inermes, pseudo-septemarticulati, pleuris coxas simulantibus, hirsuti ; feminæ sat graciles, attenuati, maris aliquanto crassiores.

Lamina ultima ventralis lata, obtusa, præscutis discretis. Palpi genitales maris manifesto biarticulati.

1. Orphnæus lividus.

Orphnæus lividus Meinert, Myriap. Mus. Haun. i. Geophil., p. 19.

Minus robustus, ante et post paulum angustatus ; ochraceus vel lividus, vitta media, duplice, latiore, fusca in dorso plus vel minus manifesto notatus.

Pedes prensorii glabri, flexi marginem frontalem spatio magno non attingentes ; sternum plus duplo latius quam longius (fere 11 : 5), coxa plus duplo longius (7 : 3), margine antico in medio late sinuato, inermi ; coxa inermis ; unguis curvatus, inermis.

Lamina cephalica multo latior quam longior (fere 5 : 4), glabra, læviuscula, lateribus rotundatis, manifesto divergentibus, margine postico subrecto, marginem anticum laminæ basalis obtegente ; lamina basalis quam lamina cephalica plus duplo brevior (fere 3 : 7), vix ter latior quam longior (fere 11 : 4).

Antennæ breves vel perbreves, ad basin distantes, crassæ, attenuatæ, articulis præter ultimum transversalibus, articulo ultimo articulis duobus antecedentibus conjunctis paulo breviore.

Laminæ dorsales leviter scabrosæ foveis ternis, media multo majore et obsoletiore, plus vel minus manifesto exaratæ, præscutis brevibus.

Spiracula ovalia, obliqua, anteriora magna, per paria sensim magnitudine paulum decrescentia ; media et posteriora parva vel minuta.

Laminæ ventrales præter primam et sæpe ultimam fovea media vel foveis ternis in seriem transversalem digestis notatæ, poris in plagas quaternas magnas dispositis.

Pedes paris primi ceteris vix breviores atque tenuiores, anteriores et posteriores subæquales.

Pleuræ posticæ vix inflatæ, glabræ, integræ ; lamina ultima ventralis parva, transversalis, lateribus rectis, valde convergentibus.

Pedes anales pedibus paris anterioris paulo breviores, vix (feminæ) aut aliquanto (maris) crassiores, inermes.

Pedes feminæ pp. 71–79 ; maris 71. Long. feminæ 85 mm.; maris 50 mm. Lat. feminæ 2.75 mm.

Hab. Sandwich islands, Society islands, J. M. Barnard ; Ascension islands, South sea ; Zanzibar, Mr. Cooke.

2. Orphnæus Brasiliensis.

Orphnæus Brasiliensis Meinert, Myriap. Mus. Haun. i. Geophil., p 20.

Minus vel sat robustus, ante multum post paulum angustatus, ochraceus vel pallide lividus, capite cum trophis laminaque basali dorsalique ultima fulvo vel brunneo, antennis fulvis, maculis fuscis, in series plures digestis, notatus ; subglaber.

Pedes prensorii glabri, flexi marginem frontalem magno spatio non attingentes ; sternum ter latius quam longius, coxa sesqui longius, margine antico in medio leviter sinuato, inermi ; coxa inermis ; unguis curvatus, inermis.

Lamina cephalica manifesto latior quam longior, glabra, læviuscula, lateribus rotundatis, paulum divergentibus, margine postico subrecto, marginem anticum laminæ basalis obtegente ; lamina basalis quam lamina cephalica plus duplo brevior (9 : 20), ter latior quam longior.

Antennæ breves, ad basin distantes, crassæ, attenuatæ, articulis præter ultimum transversalibus, articulo ultimo articulis duobus antecedentibus conjunctis paulo longiore.

Laminæ dorsales bi- vel trisulcatæ, sulco medio latiore, obsoletiore, foveis binis lateralibus notatæ.

Spiracula ovalia, anteriora obliqua, magna, per paria sensim magnitudine decrescentia; media et posteriora prona, parva.

Laminæ ventrales fovea vel area media, post sensim paulo majore atque obsoletiore impressæ, lateribus porosis.

Pedes paris primi ceteris manifesto breviores, anteriores posterioribus manifesto crassiores, vix breviores, medii paulo longiores.

Pleuræ posticæ vix inflatæ, glabræ, integræ ; lamina ultima ventralis sat parva, lateribus subrectis, valde convergentibus.

Pedes anales pedibus paris anterioris paulo breviores, vix (feminæ) aut aliquanto (maris) crassiores, inermes.

Pedes feminæ pp. 75–85 ; maris 67. Long. feminæ 86 mm. ; maris 47 mm. Lat. feminæ 2.1 mm.

Hab. Rio de Janeiro, Thayer Exped. ; Panama ; Poloon, Occidental Dept., Nicaragua, Mr. McNiel.

6. Gen. **Notiphilides.**

Notiphilides Latzel, Myriap. oesterr. ung. Mon., p. 20.

Corpus depressum, ante et post angustatum.

Lamina cephalica trophos non obtegens ; lamina frontalis coalita ; lamina basalis lata, lateribus post paulum divergentibus ; lamina præbasalis evanida.

Antennæ subdepressæ, curtæ, parum attenuatæ.

Labrum coalitum integrum, margine antico interne dense, externe sparsim dentato.

Labii sternum integrum ; processus breves, perlati, subconici ; palpi lati, integri, extrorsum processibus binis longis instructi.

Palporum maxillarium unguis in marginibus interioribus in dentes plures incisus.

Mandibulæ ante laminis pectinatis quaternis instructæ.

Metameri quarti sternum integrum, transversale, simplex ; prosternum haud prominens, obtectum ; pedes prensorii coxa inermi.

Scutella spiraculifera magna, præscutello paulo minora, postscutello majore discreto ; scutella et præscutella interna manifesta.

Laminæ dorsales bisulcatæ ; præscuta brevia.

Pori ventrales minimi, in marginem anticum et posticum digesti, inconspicui.

Pori pleuralis nulli.

Pori anales nulli.

Pedes anales inermes, pseudo-sexarticulati, pleuris coxas simulantibus, feminæ subgraciles, parum attenuati, subnudi, maris parum incrassati atque attenuati, subnudi.

Lamina ultima ventralis transversalis, præscutis nulles discretis. Palpi genitales maris manifesto biarticulati.

1. Notiphilides Maximiliani.

Notiphilus Maximiliani Humbert et Saussure, Rev. et Mag. Zool., 2 sér., xxii, p. 205.
Saussure et Humbert, Etud. s. Myriap., p. 141, tab. vi, figs. 22, 22d, 22v.

Robustus, ante et post manifesto angustatus; brunneo-olivaceus, glaber.

Pedes prensorii glabri, flexi marginem frontalem procul attingentes ; sternum ter latius quam longius, coxa duplo longius, margine antico in medio late sinuato, inermi ; coxa inermis ; unguis inermis.

Lamina cephalica multo latior quam longior, lævis, subovalis, margine postico a lamina basali obtecto ; lamina basalis quater latior quam longior.

Antennæ breviusculæ vel breves, attenuatæ, articulis præter ultimum transversalibus, articulo ultimo articulos duos antecedentes conjunctos longitudine subæquante.

Laminæ dorsales manifesto scrobiculatæ, præscutis brevissimis.

Spiracula subovalia, obliqua, anteriora majora, per paria sensim magnitudine decrescentia ; media et posteriora minora.

Laminæ ventrales præter sulcos binos lateralibus maximam partem porosæ, impressione media, angusta, simplice notatæ.

Pedes paris primi ceteris multo breviores, paulo tenuiores, anteriores posterioribus subæquales.

Pleuræ posticæ coxiformes, integræ ; lamina ultima ventralis parva, transversalis, lateribus subrectis, multum convergentibus.

Pedes anales pedibus paris anterioris manifesto breviores, multo crassiores, inermes.

Pedes feminæ pp. 97 ; maris 85. Long. feminæ 90 mm. ; maris 55. Lat feminæ 3.7 mm.

Hab. Guatemala, v. Patten.

On the Structure of the Brain and Auditory Apparatus of a Theromorphous Reptile of the Permian Epoch. By E. D. Cope.

(*Read before the American Philosophical Society, October 16, 1885.*)

The following observations are made on a part of a skull of one of the Diadectidæ (Pelycosauria with transverse molar teeth*), which is accompanied by several vertebræ and other fragments of the skeleton, of a single individual of undetermined species. A few characters are derived from skulls of two allied species, *Diadectes phaseolinus* and *Empedias molaris* Cope, which, like the first named specimen, were derived from the Permian formation of Texas. A cast of the brain chamber was obtained, thanks to the skill of my assistant, Mr. Geismar, first in the elastic material patented by Bendernagel & Co., of Philadelphia, for the manufacture of printers inking rolls; and afterwards in plaster of Paris, in a mould made from the elastic cast.

The brain-case in the Diadectidæ differs from that of the Clepsydropidæ much as that of the Varamidæ differ from those of other Lacertilia. That is, it is continued between the orbits, so as to enclose the olfactory lobes of the brain within osseous walls. These walls are thin; especially at the interorbital region, and in the specimen the anterior extremity is so far imperfect as to leave the form of the anterior fundus in doubt.

The brain in reptiles, as is well known, does not fill tightly the cranial chamber as is the case with the Mammalia, there being a wadding of connective tissue, with interspaces filled with lymph and fat, between it and the cranial walls. In the present species the postfrontal part of the cranium is so contracted that there could have been but little space of this kind, and the superior walls are clearly impressed by the surfaces of the middle brain and the cerebellum. The form of the inferior surface of the brain posterior to the fifth pair of nerves cannot be determined from the specimen examined, owing to the absence of the basioccipital and basisphenoid bones.

The conformation of the cranial walls requires preliminary notice. In the first place the vestibule of the ear can only have been separated from the brain by a membranous septum, as is the case in the *Protonopsis horrida*† (Menopoma). In clearing out the matrix no trace of osseous lamina could be detected on either side, and the edges of the huge foramen thus produced are entire, and present no broken edges. Anterior to the vestibule, the proötic bone has a small extension, terminating in a vertical border. In front of this is the huge vertical foramen through which issues the trigeminus nerve, which is even larger than that found in the Testudinata and Crocodilidæ. The anterior border of this foramen is formed by

*For a definition of this family and the included genera, see Proceedings of the American Philosophical Society, 1880, p. 45.

†See Journal Academy Philadelphia, 1866, p. 105, where the characters of the skull in the Urodela are pointed out.

the probable alisphenoid, whose posterior edge is nearly parallel with the anterior border of the proötic, sloping forwards as it descends. The basicranial axis is thin at their union on the middle line below, and, thickening forwards, is excavated by rather small conical fossa. Anterior to the fossa is a smaller impressed fossa, and on either side of it, each lateral wall is excavated into a shallow fossa which descends towards it. The frontoparietal fontanelle is of extraordinary size.

1. *The Brain.*

When the superior border of the medulla oblongata at the foramen magnum is placed horizontally, the axis of the brain ascends at an angle of 45° towards the frontoparietal fontanelle. The superior surface, anterior to the foramen magnum, is subquadrate in outline, the angles being truncated, and directed anteriorly, posteriorly and laterally. A posterior constriction connects it with the medulla ; and an anterior one defines the middle brain and hemispheres. Each lateral truncated angle represents the foramen of the trigeminus nerve. The space thus bounded is divided into two nearly equal areas by a transverse groove, which extends from the posterior edge of one of these foramina to the other. The posterior of these I suppose to represent the cerebellum, and the anterior the optic thalami. The cerebellar surface indicates that, as in many lizards, the cerebellum is simple, and very slightly convex.

Anterior to the foramen trigemini, the brain contracts so as to have a transverse diameter scarcely more than one-third its vertical diameter. The cast at a point twice as far in advance of the cerebellar line as the fore and aft width of the cerebellum, rises to fill the frontoparietal foramen, forming a mass which represents the huge pineal sac or epiphysis. The proportions of this body are even greater than they are in any of the existing Lacertilia, and it has a greater transverse diameter than the middle brain inferior to it. Its posterior border is at right angles to the line continued forwards from the superior border of the medulla oblongata at the foramen magnum. At its posterior base a flat horizontal process, as wide as the brain at this point, extends posteriorly in a corresponding fossa of the superior cranial wall. Its posterior margin occupies a transverse groove of the superior wall between the superior and inferior plates. Each lateroposterior angle is produced, and may represent the foramen of exit of a narrow canal which appears to perforate the lateral wall and issue beneath the roof of the temporal fossa. A larger projection of each side of the base of the epiphyseal mass occupies a large foramen of the lateral wall, which has the superior wall for its superior border. This may only represent a vacuity of the wall, but the fossa at the posterior base of the epiphysis has greater significance. What this is I am at present unable to ascertain.

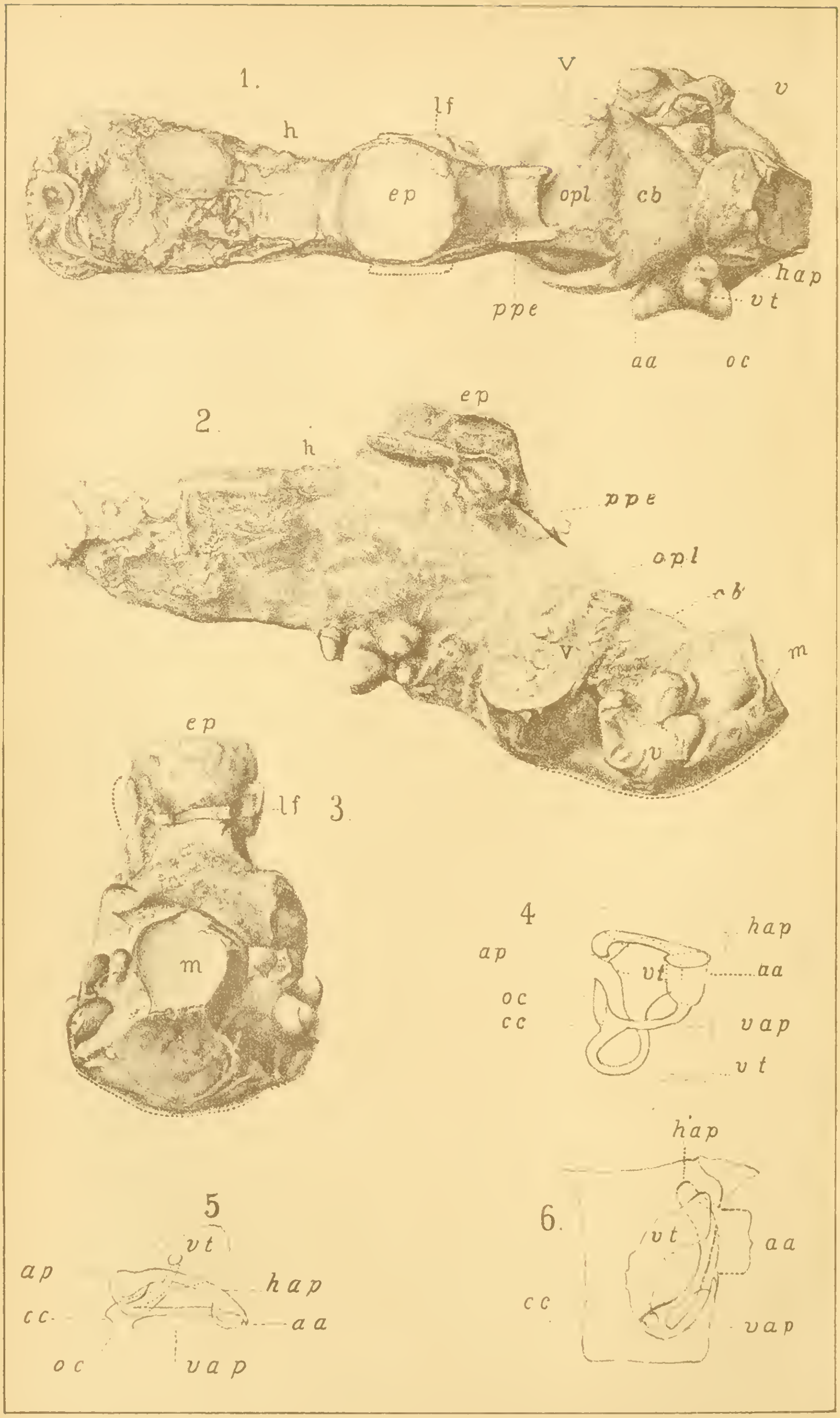
Below the epiphysis the transverse diameter of the brain is about one-fourth the vertical, not including a short inferior prominence. The latter is small and conical, and is situated below the center of the epiphysis when the cerebellar surface is placed horizontally, or in front of it, when the medulla at the foramen is placed horizontally. Its significance is unknown to me, as it is anterior to the position of the hypophysis. A thickening of the cast on either side of its base converges to the median line posterior to it. I can find no optic foramina, and believe, therefore, that the optic nerves issued from the same large sinus as the trigeminus. The cast diminishes in vertical diameter anterior to the inferior conical process, and increases in transverse diameter of its superior surface. The inferior border continues to be keel-like, so that a vertical section is triangular with the base superior. It is impossible to distinguish the outlines of the cerebral hemispheres or the olfactory lobes, both of which are probably included in this part of the cast, although the latter probably extended much anterior to the extremity of the brain case as preserved. The form may or may not give an idea of the forms of the hemispheres. In any case they were narrower than in any known reptile.

The prominent features of this brain are then the following : The widest part is at the origin of the trigeminus nerve. Both the cerebellum and optic thalamus are flat and simple. The hemispheres are narrower than the segments posterior to them, and of greater vertical diameter. The epiphysis is enormous, and sends a process posteriorly between the tables of the pariëtal bone. The olfactory lobes were apparently large, and had a greater transverse diameter than the hemispheres. The reduced diameter of the hemispheres is a character of fishes and Batrachia rather than of reptiles, but the thalami are also smaller than is the case in Batrachia. The small, flat cerebellum is rather batrachian than reptilian.

2. The Auditory Apparatus.

As already remarked, the internal wall of the vestibule is not bony, so that the cast of the brain cavity includes that of the vestibule also. On the external wall of the latter are the orifices of the semi-circular canals. These are, one double fossa at the superior anterior part of the wall ; a second double one at the posterior superior part of the wall, and a single orifice at the inferior posterior part of the wall. The external part of the vestibule is produced upwards and outwards to the fenestra ovalis. The "double fossæ" above mentioned are the osseous representatives of the membranous ampullæ at the junction of two pairs of semicircular canals.

On sawing open the periotic bones, which here form a continuous mass, the following is seen to be the direction of the semicircular canals. The superior canal is horizontal. The second canal from the posterior ampulla, descends forwards, and after a course a little longer than that of the horizontal canal, turns posteriorly. The inferior canal from the anterior ampulla also descends, and after a shorter course than the canal last mentioned, also turns backwards and joins it, the two forming a single canal, which enters the vestibule by the single posterior foramen already described. The lumen of the longer perpendicular canal is much larger than



Brain and Internal ear of Diadectidae.

that of the others. As its ampullar orifice is also the largest of all, I suppose this increased diameter to be partly normal; but it may be partly abnormal, as its walls are irregular and rough.

The fenestra ovalis is not preserved in this specimen, but can be seen in the crania of the species *Diadectes phaseolinus* and *Empedias molaris* above mentioned.* The vestibule or a diverticulum from it is produced upwards and backwards, and terminates in a round os. This is clearly not a tympanic chamber, nor is it a rudimental cochlea. It does not appear to be homologous with the recessus labyrinthi, since that cavity is not perforated by the fenestra ovalis. It appears to be a prolongation outwards of the vestibule and sacculus, which may be observed in a less degree in the genus Edaphosaurus (Cope), also from the Texas Permian formation. Here the adjacent bones are produced slightly outwards, and the fenestra ovalis is closed by a large stapes similar in external form to the one I have described in the *Clepsydrops leptocephalus*.† Its more intimate structure I have not yet examined. ‡

The result of this examination into the structure of the auditory organs in the Diadectidæ may be stated as follows: The semicircular canals have the structure common to all Gnathostomatous Chordata. The internal wall of the vestibule remains unossified as in many fishes and a few batrachians. There is no rudiment of the cochlea, but the vestibule is produced outwards and upwards to the fenestra ovalis, in a way unknown in any other family of vertebrates.

I may add that in the specimen examined, the semicircular canals were filled with a white calcareous powder, probably derived from the comminution of otolites.

EXPLANATION OF PLATE.

Figs. 1, 2 and 3 cast of cranial cavity, natural size. As the basicranial axis is lost, the inferior outline posteriorly is provisional only.

Fig. 1, from above.

Fig. 2, from the left side.

Fig. 3, from behind.

The letters signify as follows: *m.*, medulla; *cb.*, cerebellum; *opl.*, optic lobe; *ep.*, epiphysis; *ppe.*, posterior process of epiphysis; *lf.*, lateral foramen; *h.*, region of cerebral hemispheres; *v.*, cast of vestibule; *hap.*,

*See skull of *E. molaris*, Proceedings Amer. Philosoph. Society, 1881, Plate v, figs. *a* and *b*, where the fenestra is represented.

†See Proceedings Amer. Philosoph. Society, 1884, p. 41.

‡Professor Owen has figured (Todd's Encyclopedia, art. Monotremata) a structure in Echidna, which looks remarkably like that here described. This is a tubular elongation of the meatus auditorius externus with more or less cartilaginous walls. This structure might be regarded as homologous with that displayed by the Empedias, could we imagine that with their diminution in size in the Monotreme, the ossicula auditus had retreated within this tube preceding the membranum tympani, from a position at its distal, to one at its proximal extremity. But such a supposition has as yet no foundation, and the very similar parts in the two types may have no homology.

do. of orifice of horizontal anteroposterior semicircular canal; *vt.*, do. of vertical transverse canal; *oc.*, do of os commune of vertical anteroposterior and vertical transverse canals; *aa.*, do. of anterior ampulla; *V.*, cast of foramen of fifth pair of nerves.

Figs. 4, 5 and 6 diagrams of the semicircular canals, natural size.

Fig. 4, interior view.

Fig. 5, anterior view.

Fig. 6, inferior view.

The letters signify as follows: *aa.*, anterior ampulla; *ap.*, posterior ampulla; *hap.*, horizontal anteroposterior canal; *vap.*, vertical anteroposterior canal; *vt.*, vertical transverse canal, enlarged in its upper portion, probably accidentally; *cc.*, canalis communis of the vertical anteroposterior and vertical transverse canals; *oc.*, os commune of do.

Notes on the Mangue; an extinct Dialect formerly spoken in Nicaragua. By Daniel G. Brinton, M.D.

(Read before the American Philosophical Society, November 20, 1885.)

Sources. Nothing whatever has been published about the Mangue language, except a list of ninety-five words, by Mr. E. G. Squier in his work, "Nicaragua, its People, Scenery and Monuments." Whence he obtained this short vocabulary he does not state; but it is evidently the work of some one only slightly acquainted with the character of the language. I do not make any use of it in the present notes, except in a few instances for comparison.

My authorities are, first, Don Juan Eligio de la Rocha's *Apuntamientos de la Lengua Mangue, MS.* The author was born in Granada, C. A., June 15, 1815. By profession a lawyer, his taste led him to the study of languages, and he acquired a fluent knowledge of French, English and Italian. He was appointed instructor in French and Spanish grammar in 1848 in the University of Leon, C. A., and ten years later, 1858, published his *Elementos de Gramàtica Castellana* (Leon, 1858, small 4to, pp. 199). His death occurred in 1873.

While living in Masaya in 1842, he became interested in the surviving remnants of the Mangues, and undertook to collect materials for a study of their language. Unfortunately, he never completed these investigations, and many of the sheets on which he had recorded his notes were scattered. A few of them, however, were in the hands of his brother, Doctor Don Jesus de la Rocha, of Granada, who gave Dr. C. H. Berendt an opportunity to copy them in 1874.

In that same year, 1874, Dr. Berendt collected the last obtainable fragments of the Mangue. In his (printed) lecture before the American Geographical Society in 1876, he thus describes his efforts in this direction, and at the same time points out the localities where the Mangue speaking populations where located when they first came to the knowledge of the invading whites.

"The Spaniards on entering the present State of Nicaragua from Nicoya bay, and then marching through the country, came into contact first with the southern section of the Chorotegas or Mangues, as they were also called; then with a Nahuatl tribe, whose capital and king are mentioned as bearing the name of Nicarao; and after these again with Chorotegas or Mangues, who, however, did not occupy the whole tract of land up to the Bay of Fonseca, but were again separated from the Chorotegas on the shores of that bay by another foreign tribe called Maribios. Thus we obtain the three sections into which the Chorotegas of Nicaragua were divided at the time of the Conquest. Now, their language seemed to me an object worthy of having some special attention bestowed upon it—not so much for its own sake, but in order that a better understanding might be arrived at of the ethnological features of Nicaragua, which, on account of an insufficient acquaintance with its actual condition as well as with the early writers, and of the rather precarious speculations and conjectures of modern authors based upon such scanty knowledge, have become greatly confused. Having studied the Chapanecan language on a former expedition, and wishing to compare it with the Chorotegan, I visited Nicaragua in the year 1874. I found that the Indian population near the Nicoya and the Fonseca bays had entirely disappeared, and in both districts only met with some local names belonging to the Chorotegan language. In the third district also, where descendants of the old stock are still living in twelve villages around the lakes of Masaya and Apoyo, I was informed that no other vestiges of the old idiom were left, the inhabitants speaking exclusively the Spanish language. I had, however, the good luck to ferret out some old people who still remembered words and phrases they had heard in their childhood; and I was enabled to collect material sufficient to convince myself and others of the identity of this Mangue or Chorotegan idiom with the Chapaneco language of Mexico. I was not a moment too early in obtaining this information, for the greater number of my informants died while I was staying in the country. I still hope that with the knowledge of the Chorotegan thus gained in Nicaragua and Chiapas, it may be possible to trace their history and descent backwards to one of the nations that were living in Anahuac in the earliest times of which our records speak."

The materials were never published by Dr. Berendt, nor, indeed, did the many other projects which occupied him allow him the leisure to collate and arrange them. I have taken them from his original notes, often in pencil and not always perfectly legible. But I believe those here offered can be depended upon as accurate, and have special value as the sole remaining vestiges of an idiom now wholly extinct.

Synonyms. It will be seen that Berendt speaks of this people as the "Chorotegas or Mangues." I have given the origin of these names in the Introduction to "The Güegüence, a Comedy-Ballet in the Nahuatl-Spanish Dialect of Nicaragua," published as Number III, of "Brinton's Library of Aboriginal American Literature" (Philadelphia, 1883). They adjoined on the north-east and south-west the Nahuatl-speaking tribe, who occupied the narrow strip of land between Lake Nicaragua and the Pacific ocean.

"They were of one blood and one language, and called themselves *Mánkeme*, rulers, masters, which the Spaniards corrupted into *Mangues*. The invading Aztecs appear to have split this ancient tribe into two fractions, the one driven toward the south, about the Gulf of Nicoya, the other northward, on and near Lake Managua, and beyond it on Fonseca bay. Probably in memory of this victory, the Aztec Nicaraguans applied to them the opprobious name, *Chololteca*, 'those driven out,' from the Nahuatl verb *choloa*, in its compulsive form *chololtia*, and the suffix, *tecatl*, people; which was corrupted by the Spaniards into *Chorotegas*." (*The Güegüence*, Introduction, p. viii.)

In Squier's work above referred to they are called "Chorotegans or Dirians." The latter is from the Mangue *diri*, a hill or mountain, and was applied to that portion of them who dwelt in the hilly country south of Masaya.

The Spanish form of their native name is that which I should recommend for adoption in ethnological works.

Early Notices. The old historians and travelers, on whom we depend for our knowledge of Nicaragua, tell us practically nothing about this language, and little about the people who spoke it. The chieftain, called Nicoya, living on the bay of that name, was first visited by Captain Gil Gonzalez Dávila in 1523. The natives were estimated at about six thousand, who received the Spaniards in a friendly manner, and gave them considerable gold.*

Oviedo in his *Historia de las Indias* gives a few words of the language as follows:

mamea, hell.
nam bi, dog.
nam bue, tiger,

the last two of which correspond to those in later vocabularies.†

The Auditor Garcia de Palacio (1576) mentions the Mangue as spoken in Choluteca, Nicaragua and Costa Rica, in the last mentioned as introduced from elsewhere.‡ About a century later a colony of Mangues, several hundred in number, were found by Juan Vazquez de Coronado, almost at the extreme eastern end of Costa Rica, in the Province of Pacaca.§ Those on the Pacific Coast, about the Gulf of Nicoya, were accustomed to cross to the ocean on the north for trading purposes, and to obtain salt.‖ They appear to have been a people of moderate cultivation, and rather extended commercial connections.

Affiliations. The Mangue is the mother tongue from which the Chapanec (or Chiapanec) of Chiapas branched off. The separation from the ancestral tribe, and the migration from Nicaragua to Chiapas, were distinctly remembered by the Chapanec off-shoot when first encountered by the whites. Remesal, in his well-known history, gives a brief but clear account of it.

The date of this occurrence cannot be specifically stated, but its occasion can be readily surmised. The Mangues at one time occupied the whole coast from the entrance of the Gulf of Nicoya to Fonseca bay. At a period which we may locate some time in the fourteenth century, a large colony of Aztecs descended the coast and seized the strip between Lake Nicaragua and the Pacific, thus splitting the Mangues in two, and driving a large portion of them out of their homes. Some of these wanderers remained with their relatives, but one body of them marched north and west until they reached a lofty peak on the

* Letter of Gil Gonzalez Dávila to the Emperor Charles V, in *Costa-Rica, Nicaragua y Panama en el Siglo* xvi, por D. Manuel E. de Peralta, p. 9 (Madrid, 1883).

† *Historia General y Natural de Indias*, Part iii, Lib. iii.

‡ Palacio, *Carta al Rey*, Ed. Squier, p. 20.

§ See the Report of Coronado in the collection of Peralta above quoted, p. 777.

‖ Ibid, p. 704.

Rio Grande in Central Chiapas, where they constructed a formidable fortress, and became the terror of their Nahuatl-speaking neighbors.*

No connection has been demonstrated between the Mangue (or Chapanec), and any other North American language, although owing to the liberal exertions of M. Alphonse Pinart, we have now in print and easily procurable, a grammar and a number of texts of the Chapanec dialect.†

A comparison, the partial results of which I have previously published, proves that the differences between the Chapanec and Mangue are slight and unimportant, and for purposes of collation with other stocks the two may be looked upon as identical.

In the Introduction to "The Güegüence," I pointed out some singular coincidences between the Mangue and the Aymara of Peru. Further examination of the two tongues has not added to the list given, and has weakened the belief I entertained of some possible connection in the past between them.

I take this occasion to point out an error which has crept into several philological works, that of confounding the Mangue with the Nagrandan of Nicaragua. Thus, Francisco Pimentel, in his work on the languages of Mexico, falls into the capital mistake of declaring the Chapanec of Chiapas to be allied to the Nagrandan of Nicaragua; and to prove his assertion, gives a list of alleged Nagrandan words, all of which belong to the Mangue tongue!‡

The same confusion marks an attempt of Mr. Hyde Clark, of

* "Vinieron antiguamente de la Provincia de Nicaragua unas gentes que cansados de andar y de las descomodades que la peregrinacion træ consigo, se quedaron en tierra de Chiapa, y poblaron en un peñol aspero orillas de un Rio Grande que pasa por medio della y fortificaronse allí, porque nunca se quisieron sujètar á los Reyes de Mejico, antes tenian continuamente guerra con sus capitanes." etc. Remesal, *Historia de Chiapa y Guatemala*, Lib. iv, cap. xiii.

† *Arte de la Lengua Chiapeneca.* Por Fray Juan de Albornoz.

Doctrina Cristiana en Lengua Chiapaneca. Por Fray Luis Barrientos.

These two publications comprise Vol. i of the *Bibliothèque de Linguistique et d'Ethnographie Americaines, publiée par* Alph. L. Pinart (Paris, 1875).

Dr. Berendt states that the natives pronounce the name of the province *Chapa*, not *Chiapa*, and that the word is the Mangue *Chapa*, which means their sacred bird, the Ara or Guacamayo, from which they named their fortress in the State of Chiapas. Father Juan Nuñez, who was missionary among them about 1620, and who preached and wrote in their tongue, also called it "la lengua Chapaneca." See Brasseur (de Bourbourg), *Bibliothèque Mexico-Guatemalienne*, pp. 109, 110.

‡ *Çuadro Descriptivo de las Lenguas Indigenas de Mexico*, Tomo iii, p. 559 (Mexico. 1875).

London, to bring into relation "the Masaya language of Nicaragua with the Sioux language." The words he quotes as from Masaya are all from the Nagrandan of Subtiaba, near Leon. There is really no relationship between the Nagrandan and Mangue, and although Dr. Latham has attempted to indicate some few analogies,* they must be deemed quite accidental.

A comparison of about 125 words of the Mangue with the Mixteca, which I find among the Berendt MSS., reveals only about half a dozen similarities, all apparently accidental.

Phonetics. The Mangue words in this paper are principally in letters with the Spanish powers, some of the semi-vowels being in smaller type. The *h* is pronounced as an aspirate, and is equivalent to the *j*, which has its aspirated Spanish value.

All syllables are open; that is, they all end in a vowel sound. Thus *nimbu*, water, is to be divided *ni-mbu*. In this respect it resembles the Cherokee, the Japanese, etc.

Dr. Berendt stated that the Chapanec dialect was the most difficult of any American language he had ever studied, on account of the obscurity and uncertainty of its sounds. It is greatly syncopated, and terminal syllables are often pronounced in so low a tone that they escape the unpracticed ear. The vowels are not distinct, and many of the consonants are "alternating" as it is called, that is, one may be substituted for another without altering the meaning of the word. Thus, evil spirit (*demonio*) may be either *tixämbι'* or *sisa*^{i}*mb*^{u}*i*, these two being the same word pronounced indifferently, either way, by the same individual. This is by no means without parallel in American languages.

The curious frequency in the Mangue of the "resonants" *n* and *m* will strike every observer. This is also the case in the Chapanec. Albornoz regards it as a phonetic phenomenon only, and remarks, "Whenever a word begins with *b*, *g*, *y* or *d*, an *n* must be written before it, which is pronounced with the word itself." Dr. Berendt calls it an "article" which appears as *n*, *na*, *ni*, or *m*, especially before the letter *b*. As such, I may suggest its similarity to the Nahuatl *in*, and the Othomi *na*, both of which are demonstratives worn down almost to articles.

There is a similar resonant nasal in various South American

* Latham, *Essays, chiefly Philological and Ethnographical*, p. 373 (London, 1860).

tongues, especially the Tupi-Guarani dialects of Brazil. It appears most frequently before the consonants *b* and *d*. Its peculiarity is that it is not an expiratory sound, but a soft *inspirate*, and as such is claimed by Dr. Nogueira to be a phonetic phenomenon confined exclusively to American tongues.* I have been unable to decide from the descriptions within my reach of the Chapanec phonetics, whether the initial resonant is an inspirate, and I would call the attention of travelers to this interesting point.

In addition to this simple resonant prefix there are a number of particles beginning either with *n* or *m*, which are added to indicate the absolute or independent form of the noun, that is, to characterize it when not attached to a personal possessive pronoun. Of these Albornoz gives fourteen for the singular, and seven for the plural. This will explain the striking prevalence of words beginning with these letters in the vocabulary.

Accent is of the utmost importance in both these dialects, and the identity to the eye of various words as *nyujmi*, ear and smoke, arises from absence of proper accent marks in my authorities. The words for bird, snake and flower are the same; but Albornoz gives this very example to illustrate the importance of accent, *nolŏ*, a snake, *nolô*, a flower. Unfortunately, none of my authorities employ any accentual mark but the acute, and this appears to be syllabic. A vowel written above the line of the word, in Berendt's MSS., signifies a semi-vowel.

Structure. The general structure of the Mangue was clearly polysynthetic and incorporative in a marked degree. In its grammar it was no doubt identical in all essential points with the Chapanec, about which, as above mentioned, we have considerable information in published sources. Nominal and verbal forms are defined by the categories of animate and inanimate genera, a distinction which is to a certain extent purely grammatical, as for instance, a book is considered animate, and a table inanimate (Albornoz, *Gram.*, cap. xiii). The first person plural has an inclusive and exclusive form. Adjectives usually, but not always, follow the nouns. Plurals are frequently formed by simply lengthening the terminal vowel sound.

*See the excellent work of Dr. B. C. A. Nogueira, *Apontamentos sobre o Abañeênga tambem chamado Guarani ou Tupi*, pp. 56, 57 (Rio Janiero, 1876).

The Vocabulary. The words in the vocabulary have been obtained from the Rocha and Berendt MSS. Where these two authorities differ the variants are indicated by the affixed initials, R. and B. All words quoted for the sake of comparison from Squier, are marked by an affixed S. The observations, explanations and other remarks attached to the words and phrases are my own. The comparative expressions taken from the Chapanec (marked, *Chap.*) are from the printed works above mentioned, or from MS. vocabularies of various authorship in my possession.

All of Rocha's words are from the dialect of Masaya; but Dr. Berendt obtained some at the villages of Masatepec, Niquindomo, and Namotiva′, and this explains the occasional variants given. The differences, however, between the speech of these localities was evidently slight.

Vocabulary: English–Mangue.

Achiote, nariyu. (The *Bixa orellana*, a fruit tree; *achiote* is Nahuatl).

Aguacate, nirimo′, narimu. (Fruit of the *Persea gratissima*).

Ancestor, kopo′. The same as *old*, q. v.

Ancestress, kapoi. Apparently a feminine form of *kopo*, old.

Anona, naria′. Fruit of the *Anona squamosa*.

Ant, an, náju, na^{a}.

Ara, lapa; *Chap.* txapa. The *Ara macao*, of ornithologists.

Arm, ndiro. Compare *hand*, and *finger*. Properly "the upper extremity." S. deno. *Chap.* gulu^{u}a.

Armpit, ngisa. Compare, *beard*. Perhaps "hair of the armpit."

Armadillo (*Dasypus*) nyuku′. Compare *lizard*.

Ashes, nitsu, nisú.

Atole, nambo. (A dish prepared from maize.)

Bad, gangame, ganyame. Properly *not-good*.

Bark, nanso^{u}a′.

Basket, naj^{u}ari.

Bat, nyuta′.

Bean, nyumú.

Beast, nyumbú. Compare *tiger*.

Bear, to (to bear children) pindih.

Beard, gísa.

Bed, nakutá.

Bee, nopopo.

Beetle, nag^{u}a.

Belly, ngusi.

Bird, nori, nyuri′. Compare *snake* and *flower*. *Chap.* nuri.

Bitter, yasi.

Black, nansome.

Blood, nijnyú; S. nenuh.

Blue, nandipame.

Body or Flesh, nimbrome, nampoome.

Bone, n̄yu^{i}.

Bowels, ngita.

Boy, nasome; R. norome; little boy, noromiñamu.

Branch (of a tree) ndiro nya; = "its arm, tree."

Brandy, nimbuyasi; = "water, bitter."

Brave, pusit^{i}u.

Brook, nanda.

Brother, man̄ku, mambo.

Brother, younger, mambo nyamo nasome.

Buttocks, bojo^{i}; nbasi, basti′.

Cacao, nyúsi.

Camote, yujmi (an edible root).

Cane, sugar, niriómbome.

Cantaro (a water jar), natiyojpo.

Casava, see *yuca:*

Cat, misa, mixa.

Cat, wild, misa se nirome; = "cat of the forest."

Chachalaca, tásara. A kind of partridge called, in Nahuatl, *chachalacatl*.

Chalchihuitl (a green stone, Nah.), nyu se rayo; the last word, *rayo*, is Spanish, and the expression means "stone of the lightning," the belief being that these stones are thunderbolts.

Cheek, girote. Compare *face*.

Chief, ruler, mánkeme. *Chap.* m̀anaχämä, from *χimá*, the head. See *The Güegüence*, Introd., p. viii, note.

Chief, female, najyumbu.

Child, nasungi.

Chile (a sort of red pepper), nin̄gi.

Chocolate, nimbu nyusi; = "water-cacao."

Chocollo (a bird), naturi.
Church, nakúmbui.
Clay, nambroj.
Clay, potter's, nambrój se nati; = "clay of jars."
Cock, a, norij^{u}é.
Cockroach, nambisa.
Cocoyol, neme; a species of palm.
Cold, poro', yoro, oro.
Collar, or necklace, bakoya'jo.
Comal (a dish or plate), nambujyo^i.
Come, to, na.
Conch-shell, txote.
Cook, a female, naka^i nakupasi. Comp. *kitchen.*
Corn-field, namasinyu', ndam bur'rio.
Cotton, naroti'.
Cotton, thread of, tapakúsime naròti.

Dance, to, tasosmo.
Daughter, banya nasinyamo. Comp. *son* and *girl.*
Daughter-in-law, mbájtioro.
Dead, ko^{i}jme. Comp. *to die.*
Deaf, gungupajo; = not hearing.
Deer, nyúmba ngami.
Devil, natamasimo.
Die, to, naga^{a}nyu; *imper.* koijme.
Dish from a gourd, nambira. Comp. *water.*
Distant, ha^{i}tsu.
Door, nya síyu.
Drink, to, *imper.* koi ri (?).
Drum, nyunsú. Comp. *jicara.*
Dog, nyumbi'.
Dog, female, nyumbi nyaka^i.

Ear, nyújmi.
Earth, land, nikupu', nambrome.
Eat, to, nasu, *imper.* ko^{i}ta'.
Egg, nyuga-yori. Comp. *bird.*
Egg-shell, nanso^{u}a. Compare *bark.*
Enclosure, mendí.
Enclosure of stone, mendi nyu^a.
Excrement, nig^{u}a.

Eye, nate.

Face, ngroti. Compare *cheek*.

Father, k^{u}é; kújk^{u}e; S. gooha. R. coehyo.

Feather, napa yorí.

Female, of animals, nyaka.

Finger, ndiro. Compare *arm* and *hand*. *Chap.* banya dilá.

Finger nail, monsu′, munsú.

Fire, nyayu, naku; S. nahu.

Fish, nyujú.

Flatus, píj^{i}.

Flea, louse, etc., nyu^{i}.

Flesh, for eating, nampumi.

Flint, nyupa nyugo. Compare *stone*.

Flower, nyuri, niri. Compare *bird*, and *snake*

Fly, a, nimbrome.

Food, nyumuta. Comp. *bean*.

Foot, ngirá.

Forehead, gula.

Forest, nijome, nmandi.

Fork, a, nya nangu. Compare *house*. Probably the forked stick, which supports the ridge-pole.

Friend, ngurí; manku. Comp. *brother*.

Frog, natakopó. Comp. *toad*.

Fruit, narime.

Gall, bayatimé.

Gaspar, nyuju yansu. A fish sometimes called the "lizard fish."

Girl, nasunyamo. R. najiñamu.

God, kupankeme Dio; nikus′p^{u}a. (Our Lord.) *Chap.* kop-andχame; *comp. chief*. S. gopahemedeo.

Good, pami, pame, yame.

Great, yok^{u}e, yok^{u}eme.

Green, apame, yapame.

Guacal (small dish), narí.

Guayabo (a fruit), nikonyo′.

Hair, nimbi′.

Half-breed, nyukús^{u}a.

Hamack, nyu. Comp, *mecate*.

Hand, ndiro. Comp. *arm* and *finger*. *Chap.* di^{l}la.

Hat, nimpe.
Hatchet, nimunguyá.
Hawk, nake′.
He, pron. neje.
Head, ngu′ kimo.
Heart, nambume.
Heaven, sky, nakup^{u}i ; nakujpu.
Heavy, arime.
Hedge, or fence. See enclosure.
Henequen (a fibrous plant), notome.
High, opome.
Hoe, bajarítojo.
Hog, nyuju.
Hog, wild, nyuju mandi. Comp. *forest.*
Honey, nambo′ pu, nombó.
Horn, nimbomo.
Horse, nyumpie′. Comp. *tapir.*
Hot, tsujmu, yátsumu.
House, nan̄gu, nge.
Husband, boh^{u}e. Comp. *man* and *male.*
Iguana, nyumbu. Comp. *animal*, *beast.*
Indian, an, namba′jimo.
Jar, of pottery, nimbúgu.
Jicaro (tall jar), nyúnsu.
Kill, to, tambajme.
Kitchen, nakupasi.
Lake, ninda.
Leaf, nyuma′.
Leg, ngiko.
Light, *adj.* ngári me ; = not-heavy.
Lightning, k̀ŏyo′mo (?).
Lion, couguar, nyumbú nyan̄gami. Comp. *deer.*
Little, kame ; R. ñamu.
Lizard, nyukú.
Low, nyamo. Comp. *small.*
Macana (an iron implement for cutting brush), nampúj.
Mecapal (a net for carrying loads), napalumu.
Machete (a heavy knife), nímb^{i}u.
Maize, namá.

Maize, ear of, nyupó.
Maize, cob of, neje′.
Maize, green, nyopome.
Maize, cooked (nistamal), nyu′ritu.
Maize, masa of, nambima.
Male, of animals, j^{u}e, f^{u}e.
Mamma, su ngitsu, ngisu.
Man (homo), ndijpu. *Chap.* dipaju.
Man (vir), nyugo, nojue, enkaj; S. nuho. *Chap.* nu^{u}a.
Mantle, of cotton, nambu sán̄gui; R. nimbu ranguma.
Married man, koipujma nasominyamo.
Married woman, nojí.
Mat, nuri.
Metapail (hand-stone for pounding grain), ndiro nyupa (hand-stone).
Metate (mealing stone, mortar), nyupá; = *stone.*
Mill woman, a, nasinyamo tapa′ kup^{u}i.
Mole, nyu′kupu. Comp. *armadillo.*
Money, najmo.′ Comp. *silver.*
Monkey, nambi.
Moon, yu. *Chap.* yujú.
Mother, ngumo; nyame; ngimo; S. goomo. R. guirmoh.
Mountain, hill, tiri, diri.
Mouth, nyunsu; R. ñunzu.
Much, pókopi.
Musquito, néju.

Nacatamal (maize cooked with flesh), nyuga mpume. Comp. *tamal.*
Navel, ngutinyamo.
Near, kopunapu.
Neck, nko^{1}.
Negro, a, nanso′me. Comp. *black.*
Nephew, batsún kényamo.
Nest, ngä. Comp. *house.*
Net (for carrying), niskupu, namu.
Net (for fishing), najkupu; niskupu se yuju.
Night, koyujmi (it is now night).
No, áku.
Nose, nyungú; R. nuñgu.

Old, man, kopo′. Comp. *ancestor.*
Old woman, naka^{i}, naska^{i}me.
Opossum, niyú.
Orphan, butájmu.
Pain, gaime.
Parrot, nimbusojo.
Pearl color (nacar), narimbame.
Pebble, nipa. Comp. *stone.*
Penis, bu^{a}yore.
Petticoats, nimbusame; nambusan̄gume. Comp. *mantle.*
Pigeon, nyurinyamo.
Pineapple, nindi.
Pinole (maize roasted and pulverized), nambari.
Pisote (a badger?), nyundi.
Plantain, green, nirinte, nikotona.
Plantain, ripe, ndurime.
Plate (of dried gourd), nambira.
Pleiades, the, napopo.
Poor, nambájimo, nambainjume.
Pretty, tapustxuya.
Priest, ku^{u}jk^{u}é.
Privates (female), sungip^{u}ai motxo′tete,
Rabbit, nyuku. Comp. *lizard.*
Rain, nimbu. Comp. *water.*
Rat, nan̄gi.
Red, arimbome.
Reed, néjeri.
Rind (peel), nanso^{u}a′. Comp. *bark.*
River, neju.
Road, niro.
Roof, nimú, nakamu′.
Room, apartment, nakangu. Comp. *home.*
Rope, string (mecate), nyu^{i}.
Sacate (a species of grass), nimú, nakamo.
Saliva, nimbójmo.
Salt, niri.
Sandal, or moccasin, nyansu, ninsu.
Sapote, red (a fruit), noxa′, nyuxa′.
Scorpion, nyumbukukí.

Sea, nimbu yumbu,

She, pron. neja. See He.

Shirt, for men, mboyú.

Shirt, of women, nayu.

Shore, ninda. Comp. *lake.*

Shoulder, inku^{i}.

Silver, najmo. Comp. *money.*

Sing, to, undamo.

Sister, boronyamo, mambo. Comp. *brother.*

Skin, hide (of animals), nínsu, nansú, nyún su.

Sleep, to, nagu.

Small, txote, nyamo. Comp. *low.*

Smoke, nyujmi; S. nemare.

Snake, nyurí. *Chap.* nulú. Comp. *bird* and *flower.*

Son, banya.

Son-in-law, ngismó.

Sorcerer, nyu^{u}ja.

Sour, yagu.

Speak, to, nata, *imper.* papa′me.

Squirrel, naré.

Star, nyutí; R. nuti; S. nuete. *Chap.* nahuiti.

Stone, rock, nyupá (pl. nipa).

Stool, nambu ku ta′.

Sugar, nombó. Comp. *sweet.*

Sun, nyumb^{u}i, nomo; S. numbu. *Chap.* mapíju. Comp. *moon*

Sweet, nombo′.

Tamal (a dumpling of sweetened maize), nyuga.

Tapir, the, nyumpié mandi. Comp. *forest.*

Tear, a, nimbu nate. Comp. *water* and *eye.*

Tenamaste or cooking stone, hajmi nyugu (three stones), nakupasí (see, to cook), nikusugo′.

Thief, tiposi′tinyo.

Thorn, ni, nindi.

Thunder. Koi tapu′meme; lit, "it thunders."

Thrush, nyúj^{u}a. A species of *Caprimulgus.*

Tick, nambisá, nansumá.

Tiger, jaguar, nyumbú. Comp, *animal.*

Tiste (a drink of cacao, etc.), nimbyusi. Comp. *water.*

Toad, natakopó.

Tobacco, nyumurime; nimburime; S. nemurema. To smoke tobacco, fasomo nimbu rimi

Tomate, naripo.

To-morrow, majimi. Comp. *yesterday.*

Tongue, grij^{u}í.

Tooth, niji.

Tortilla, no^{i}.

Totoposte (a kind of corn-bread), nyua yan̄jí.

Town, namá puma, namépume.

Tree, nya. Comp. *wood.*

Trough, nimbóya. Comp. *water.*

Turtle, of water, nyuka,

Ugly, ganyame. Comp. *bad.*

Unio (the shell so-called), nyukanyamu.

Vapor (mist, steam, etc.), ndipí

Vase (tinaja), nojpú.

Washwoman, nasinyamo tapapa′poro.

Wasp, najú (?).

Water, nimbú.

Wax, nyu.

Well (noun), kita.

Where? nde.

White, nandirime.

Wife, mboome, njujmi. Comp. *husband.*

Wind, nitiu′; níjt^{i}u. S. neshtu.

Woman, noji, nasi.

Wood, nya, nindomi (?).

Yellow, nandiume.

Yes, un; taspo (?).

Yesterday, yajimi.

Yuca (the *Yatropha manihot*), noya, nuya. *Chap.* niya.

Numerals.

1. tike.
2. ha, ja, jami, jojo.
3. hajmi, jajame.
4. hahome.
5. hagujmi.

10, jendo.

20. jajué.

800. ja^{i}mbí.

The Verb "to be," R.

I am,	cejo.
Thou art,	simuh.
He is,	neje sumu.
We are,	eis mi muh.

Pronouns.

I,	saho, S.
My,	amba, mba.
He,	neje, R.
She,	neja, R.

Phrases.

Koi múrio, It is already dawn.
Koi yujmi, It is already night.
Koi prijpi, It is already growing dark.
Koi újumbo, He has already urinated.
Koi gaimi ndiro, He gave me his hand.
Koi pajo nama siñú, I am going to die (ya me voy à la muerte).
Koi-li nimbuyati, I drank some brandy.
Koi-tā cutaca ñumbi′, I ate like a dog.
Koi-li gipomo ga muningui, I ate broth with chile.
Tagüaime ga muñunso yok"e, Give me a large jar.
Tari nimbuin, on güari? Will you drink some tiste, or will you not?
Oyat us ma? How do you like it (*i. e.*, hot or cold)?
Pókopi ndijpo, } Many people,
Taku pámu ndijpú, }
Koi jini kújk"e, His father died.
Muri kagro', Here is the old woman.
Ai nambunú ju, I have a pain in the belly.
Ni koi sime, You have already bought.
Pe ya puti nakutá, Go and lie down in the room.
Tiki numapuna, It is the town.
Nam bu mejo, His stomach is weak.
Koi tsujmú nimbu, The water is already warm.
Koi puró nimbu, The water is already cold.
Koi piro, He has already come.

Pami nyumuta, The food is good.
Cajo rismoh, I am seated.
Neje zumu rimah, They are lying down.
Guay cane noy, Give me a piece of tortilla.
Koi guaja, I have already given you some.
Garoh, Not yet.
Ejeh / Uji! } Take some!
Susupusca? / Kuj mi mo? } How are you?
Ko′ mi muya′ i ku? And you, how are you?
Camo cujmi umyaique, Nasi pujimo camo? There is nothing new; and you, how are you?
Gusapo, Take a seat.
Nam bro′ gatsuro yaji? Why did you not come yesterday?
Koi k^u^eme, I was up there.
Kupa kastai, Señor, Good-by, Señor.
Nohue opome, A tall man.
Nya opome, A high tree.
Nya nyamo, A short tree.
Nyumbi yok^u^e, A large dog.
Nyumbi pusit^i^u, A brave dog.
Kŏyómo nikúj^u^i nímbu, With thunder comes rain.
Ko^i^ pirami nimb^u^í, Already comes the rain.
Tapuko kuno tipo kunyo, Let us go to see the sick man.
Mundamó, The pigeon sings.
Nde yat supu is ya? Where are you going?
Tsupu nekajui, I am going to the garden.
Munsu supu kujkui, They are (go) lame.
Ropia, Come here.
Ropia no somíngamo, Come here and sweep.
Koi apiñame naturi, The Chocollo (bird) has already cried.
Koi píndih Juaná, Joanna is with child.
Pieyas mah, She already was.
La puta (*Span.*) ansu punah, The whore that bore thee.
Cumbú puy muh, I do not remember.
Neje rumu coy cuhme, He is already a great man.
Nis puzu punah? What did she bring forth?
Naci ñamu, A little girl.

Taru miro, They are all mine.
Neja guirmiño, That is my half.
Niora múta pu ninda? Are you going to the shore?
Taspo, Yes.
Ya pu camu, In a little while.
Mu koi eu pumé, Thou hast already seen it.
Koi eu pumé, I have already seen it.
Uño! See!
Mis upa'? Where are you going?
Umimo uyako, Pasi pújimo, We are out of breath.
Pangare' manijitaré, Be quiet, I will pay you to-morrow.
Gugapi, koy ujmi, Let us sleep, it is night.
Bu^{u}si na^{a}, munikako, Get away from here, you son of a devil!
Nim bu' tajo pa'yamo? What were you doing by the water?
Tapame, Be good.
Motan atima nyumpia, You come on horseback.

Observations on the Vocabulary.

Prefixes.—The most frequent prefixes in the vocabulary are *nyu* and *nya*. They probably indicate the position of the noun as independent of expressed possessive relations. In the Chapanec they are also found, but not so commonly. They do not appear to be classificatory particles, as they are prefixed to the names of the most diverse objects.

Generic Names.—These are quite common, as is frequently the case in American languages, in spite of what has often been said to the contrary. The word *nyu-mbu* means any large quadruped; *nyu'*, any insect; *narimu*, any kind of wild fruit, etc. It must be remembered that the genera into which individuals are grouped have a widely different connotation from those to which we are accustomed.

Cat.—The word for cat, *misa*, seems identical with the Cakchiquel *mez*. In Chapanec it is *kitu*, reminding one of *kitten*. As the domestic cat was unknown in America before the discovery, these words can probably be traced to some European source.

Color Names.—The color names appear difficult to analyze, and vary from those in Chapanec. Thus, as given by the various authorities, they are :

	Mangue.	Chapanec.
Black,	nanzome, R.	dujamä.
White,	nandirime, R.	dilimä.
Yellow,	nandiume, R.	nandikumä.
Blue or Green,	nandipame, R. apame, B.	ndipamä.
Red,	arimbome, B.	nduimä.

In these adjectives the termination *me* or *mä* does not belong to the root. Father Abornoz tells us that this suffix characterizes adjectives in the singular number, when they qualify a certain class of nouns "in *tighe.*" (See his *Gram.* p. 15.) The nasal or resonant beginning most of them is also a mere prefix.

Proper Names.—But few native families of the Mangue districts of Nicaraugua have retained names drawn from their ancient tongues. In a list before me of several hundred persons in Masaya and Managua, the only surnames from the Mangue are *Norori*, *Ñamendi*, *Namullure*, *Putoi*, *Niononque*, *Macanche*, and perhaps *Huembes* and *Piura*. Generally, the natives adopted Spanish surnames.

On the other hand, a large number of local names, derived from the Mangue language, on the map of Nicaragua still define the region once occupied by this nation. Such are *Nindiria* (from *ninda*, shore, *diri*, hill), *Nakutiri* (from *naku*, fire, *diri*, hill), *Monimbe* (*nimbu*, water, rain), *Nandasimo* (*nanda*, brook), Mombonasi (*nasi*, woman), *Masaya*, *Managua*, *Namotiva*, *Norome*, *Nicoya*, *Oretina*, etc., etc.

Photography by a Lightning Flash.

By Prof. Edwin J. Houston.

(*Read before the American Philosophical Society, November 20, 1885.*)

Mr. Albert S. Barker, of Philadelphia, has recently sent me two photographic views of his stable and surrounding objects, the exposure for which were made during an exceedingly dark night, with no other illumination than a single lightning flash for each.

The photographic negatives were taken during the severe storm that occurred in Philadelphia and vicinity on the 29th of October, 1885. The exposure was made at 7 P. M. The thick clouds produced pronounced darkness. At the same time the rain was heavy, and the wind high. Considering the circumstances, the negatives secured were very good.

The circumstances of the exposure were as follows, viz: the camera was placed in an open window, and pointed towards the stable, its focus for this point having been previously obtained. The slide was then drawn and the plate left exposed to the night until a lightning flash came. This occurred in less than one minute, when the slide was instantly closed, the plate holder reversed, and another exposure obtained by means of the illumination of the next flash.

The plates were developed during the evening. The results obtained were, in Mr. Barker's judgment, about equal to what would have been secured by an exposure of about $\frac{1}{300}$ of a second in bright sunlight at noon.

The plates used were exceedingly sensitive gelatine films. A comparatively large diaphragm was employed in these exposures.

The circumstances under which these exposures were taken were such as thoroughly prevented any illumination of the objects save by the flash itself. The room in which the camera was placed was of course quite dark.

Apart from the interest attached to Mr. Barker's photographs as evidence of the recent advances made in what is generally called instantaneous photography, they appear to present considerable value in the light they throw on the question of the duration of the ordinary lightning flash.

The views generally held as regards the duration of the lightning flash is, that it is practically, if not actually, instantaneous. From experiments made by Wheatstone and others, the duration of a flash, as determined by means of a rapidly revolving disc, it is generally believed to be from the $\frac{1}{1000}$, to the $\frac{1}{10000}$ of a second. Whatever may have been the duration of the flashes thus measured, it would appear probable that flashes of great severity, where the discharge traverses many miles of air, would, under many circumstances, continue for quite an appreciable time.

Mr. Barker's photographs appear to show that this was the case during the night in which they were taken. While the fixed objects, such for example as the stable, came out quite sharply, the trees show unmistakable evidences of violent motion. It is true that these trees were not in sharp focus, being nearer the camera than the stable. Though somewhat blurred, they nevertheless exhibit unmistakable signs of having perceptibly changed their position during the time of exposure. In other words, the plate was illumined for a sufficient length of time to permit the motion to be clearly shown. The lightning flash, therefore, was not instantaneous in the sense generally attributed to it, but continued to illumine the plate for quite an appreciable time.

It would be interesting for the photographic experiments of Mr. Barker to be repeated under other circumstances to determine this question more certainly. For example, if the camera were focussed sharply on a distant tree, and a negative taken during a violent thunder storm by a lightning flash while the tree is in motion, if the foliage comes out in detail with no perceptible motion shown, the continuance of the illumination would then be proved to be too short a time for its appearance. If, on the contrary, the leaves appear blurred as if moved, then the generally received notions concerning the instantaneous character of the lightning flash must be changed.

Or, if the camera should be focussed on a rapidly moving wheel, and a photographic picture be taken during its illumination by a lightning flash, then the peculiarities of the negative could be utilized, not only to determine the question of the greater or less duration of the flash, but even to measure the actual duration itself.

It will be observed that the method here suggested substitutes the sensitive plate of the photographic camera for the retina of the eye. From the results of Mr. Barker's photographs, it might be inferred that the former is far more sensitive than the latter. If this be the case, then the photographs thus obtained would furnish more precise means for measuring the duration of the illumination, and hence of the flash itself, than the method followed by Wheatstone and others.

The lightning flash contains so large a percentage of the blue rays of light, that we may fairly suppose that its actinic effects on a photographic plate would be more decided than with equally bright sunlight. This greater sensitiveness of the light of a lightning flash may perhaps account in some degree for the possibility of taking photographic pictures by its means, but it also equally explains the probability of the blurred foliage in Mr. Barker's views being actually due to their movement during the short time they were exposed to the camera, and thus disproves the approximate instaneousness of the flash itself.

Central High School,
Phila., Nov. 20, 1885.

Résumé of the Work of the International Geological Congress, held at Berlin, Sept. 28 to Oct. 3, 1885. By Dr. Persifor Frazer.

(*Read before the American Philosophical Society, November 20, 1885.*)

An abstract of the Proceedings of the late Geological Congress at Berlin has been published by the writer in *Science;* a fuller report is about to appear in the *American Journal of Science and Arts.* The report, containing all the documents relating to the work of the Congress, and only less complete than the official report, will be presented to the American committee whenever it meets. In the meantime, it will interest Geologists to know at once, in a general way, what has been done, and also to learn of certain works which the Congress recommended and patronized, but did not undertake.

The map of Europe, colored geologically, will be issued in 49 sheets ; or 7 high and 7 broad. Each sheet will be 48 centimetres high and 53 cm. broad. The whole map will form a rectangle of 3.36 by 3.71 metres. Prof. Kiepert, of Berlin, is charged with the duty of making a topographical base from the very latest data. D. Reimer and Co. are the publishers. 900 copies are guaranteed by the Congress at 100 francs per copy, of which each of the great States of Europe, to wit : Great Britain, France, Germany, Austro-Hungary, Scandinavia, Italy, Spain and Russia is entitled to 100 copies. The remaining 100 copies are to be divided between the six small States, Belgium, Holland, Denmark, Switzerland, Portugal and Roumania. The other purchasers are to pay 125 francs a copy to the publishers. The scale of the map is to be 1 : 1500 000. A committee is charged with the duty of receiving the colored maps sent in by each country, and of harmonizing them so that they will make a connected whole. This committee consists of Messrs. Beyrich, Hauchecorne, Daubrée, Giordano, Möller, Mojsisovics, Topley and Renevier. But the Committee of Direction, which will really superintend this work, is composed of the first two named, who are on the ground and can better look after the publishing. It was proposed by the committee having in charge the adoption of a uniform system of coloration, that a greenish-gray tint be adopted for the Silurian (Cambrian included). This was warmly opposed and finally the section was altered so as to give the committee the discretion to adopt some *provisional* means of distinguishing the series at the base of the Paleozoic column, with the understanding that it should not in any way prejudice the final scientific decision of these questions. The divisions to be made of the Cambrian and Silurian combined will therefore be threefold, and the three divisions will be different shades of greenish-gray. After the color questions were thus disposed of, M. Dewalque began the more radical questions of the actual divisions themselves. The measures below the Paleozoic column are to be called Archæan, and each geologist is to be left free to distinguish their separate divisions by petrographic characters, without as yet attempting to correlate them in different countries. M. de Lapparent did a notable service to science here by proposing that the term "Protogine" which was based upon no important or necessary characteristic, be once for all abolished. This motion was unanimously carried. The Silurian-Cambrian question again coming up, it was decided to leave the debate on the proper coördination of the series till the meeting in England, three years hence. In the meantime, the committee on the map was permitted to make the divisions as well as it could, but to give no names.

It was decided to divide the Devonian into the Rhenan, the Eifelian, and the Famennian. (2). That the Calceola beds should form part of the Eifelian, and that the upper limit of the Devonian should be drawn at the base of the Carboniferous Limestones, *i. e.*, the system that includes the Psammites of Coudroz and the upper "Old Red." The question of associating the Permian with the Carboniferous provoked the most heated debate. Stur, Blanford, Lapparent, and Newberry spoke in favor of such association ; Hughes, Topley, Nikitin and some others, against it. It was finally decided to leave the question as it was. The Triassic was divided into three parts, but without assigning to them any names.

The eruptive rocks were divided according to the scheme of Prof. Lossen, into seven divisions, one of which is "Serpentine." This part of the Congress's work appears not to have received the attention it deserved, as all the petrographers who were consulted by the writer as to the advisability of such a heading of a division, agreed that it was unfortunate. Among these were Profs. Zirkel, Stelzner, and among the other geologists, Profs. Hughes, Hall, and a great many others.

The Congress formerly approved and voted committees to assist two works of the nature of compendiums. The first of these is a Geographical-Geological Dictionary, by D. Juan Vilanova, Piera Professor in the University of Madrid. The committee appointed at the Bologna Congress to assist in this work consisted of MM. Hughes, Mayer-Eymar, Steinmann, Meli, Szabó, and Inostranzeff. M. Vilanova explained that this was merely an attempt of his to make a French-Spanish dictionary of terms, but he hoped that it would be taken up and improved upon by others, and that especially the parallel terms in other languages would be gradually grafted upon it. I should be glad of the assistance of the members of this Society in extending a knowledge of its scope.

The other work which the Congress appointed a committee to foster was Neumayr's Nomenclator Palæontologicus. The names of the members of this committee are MM. Gaudry, Zittel, Neumayr, and Etheridge.

On the Species of Iguaninæ. By E. D. Cope.

(*Read before the American Philosophical Society, October 16th, 1885.*)

By Iguaninæ I mean Iguanidæ* without abdominal ribs† or free dermal margins of the digits‡ which have the nostrils on the line of the canthus rostralis and not below it, and which possess the compressed form and other characteristics indicating an arboreal rather than a terrestrial habit of life. With one exception§ these animals are confined to the forest regions of Tropical America, the greater number of species being found in the West Indies and Mexico. A few species, as the *Conolophus subcris-*

* Exclusive of the Anolidæ, which I have shown to differ in the structure of the lower jaw. Proceedings Academy, Phila., 1864.

† Those with abdominal ribs are the Polychrinæ.

‡ The Basiliscinæ are characterized by the digital margins.

§ The *Brachylophus fasciatus* of the Fejee Islands.

tatus, are entirely terrestrial in their habits. The genera are distinguished as follows :

I. Premaxillary and symphyseal teeth conical.

a Posterior digits with separate combs.

Tail with much of its length free from spines ; a gular fold, *Cyclura* Harl.

aa No separate combs on posterior digits.

Tail with the basal half spinous ; a throat fold......... *Ctenosaura* Wieg.

Tail short, spinous to the end ; a throat fold.............. *Cachryx* Cope.

Tail not spinous ; a throat fold........................ *Brachylophus* Cuv.

Tail not spinous ; a dewlap which has a crest of spines on its anterior edge . ... *Iguana* Laur.

II. Premaxillary and symphyseal teeth trilobate ; no combs on the posterior digits.

A throat fold ; tail not spinous ....,........ *Conolophus* Fitz.

No throat fold ; tail not spinous..................... *Amblyrhynchus* Bell.

CYCLURA Harlan.

Journal Academy Natl. Sciences, i, p. 242, 1825. Dum. Bibr., Erp. Gen., iv, 214, 1837. *Metopocerus* Wagl., Natürl. Syst. d. Amphibien, p. 147, 1830. Dum. Bibr., Erp. Gen., iv, p. 210, 1837. *? Aloponotus* Dum. Bibr., Erpet. Générale, iv, p. 189, 1837.

The species of this genus known to me are the following :

I. Scales of muzzle all small ; combs on third toe only.

Several rows of infralabial scuta ; five scales on canthus rostralis ; crest interrupted at rump only......................... *C. carinata* Harl.

II. Large scuta on muzzle ; combs on third toe only ; one row of large infralabials.

Infralabials and other scuta in contact with each other and with labials ; two scales on canthus rostralis ; crest low, much interrupted at nape and rump ; color uniform........................ *C. bæolopha* Cope.

Infralabial and other scuta separated from each other and from labials by small scales ; four scales on canthus rostralis ; green, with bands.... *C. nubila* Gray.

III. Large scuta on muzzle ; one on middle line protuberant ; combs on second and third toes ; several rows of large infralabials.

Scales very irregular, often minutely granular on scapular regions ; a trace of whorls on tail ; crest interrupted at nape and rump ; black.. *C. cornuta* Daud.

The reputed species *Cyclura macleayi* Gray, from Cuba, and *C. lophoma* Gosse, from Jamaica, are unknown to me by autopsy.

Cyclura carinata Harlan, Jour. Academy Philadelphia, iv, p. 250, 1825, pl. 15. Cope, Proceeds. American Philosoph. Society, 1870, 558 ; American Naturalist, 1885, 1006.

Turk's island, Bahamas ; *Harlan, Ebell.*

CYCLURA BÆOLOPHA Cope. Proceeds. Academy Philadelphia, 1861, p. 123; American Naturalist, 1885, 1006.
Andros island, Bahamas; *Wood.*

CYCLURA NUBILA "Shaw." Gray in Griffith's Animal Kingdom, ix, 39 fig. Cope, American Naturalist, 1885, p. 1006. *Lacerta nubila* Shaw, (teste Gray) Zoology. *Iguana cyclura* Cuv. *Cyclura harlani* Cocteau, Hist. S. l'Isle Cuba par de la Sagra Rep., p. 96. *C. carinata* Wiegm., Herpet. Mexicana, not of Harlan.
Cuba.

CYCLURA CORNUTA Dand. *Iguana cornuta* Daudin, Rept., p. 382. Latreille Hist. Nat. Rept., ii, 267, iv, 294. *Metopocerus cornutus* Wagler, Nat. Syst. d. Amphibien, 1830, p. 147. Wiegmann, Herp. Mex., 1834, i, p. 16. Dum. Bibr., Erp. Gen., iv, 211, 1837. Günther, Trans. Zool. Soc., London, 1882, p. 218, Pls. xliii, xliv. Boulenger Cat., Brit. Mus., ii, 1885, p. 188. *Cyclura nigerrima* Cope, American Naturalist, 1885, p. 1006. *C. onchiopsis* Cope, loc. cit.

This species has been until recently but little known, although its name frequently appears in literature. The characters ascribed to it by Duméril and Bibron do not agree with those of any individuals which have come under my notice. These authors distinguish the genus Metopoceros from Cyclura by the presence of two rows of femoral pores, a character which does not exist in either of the four specimens in the National Museum. The genus Aloponotus of the same authors possesses, according to them, the same peculiarity. M. Boulenger, in the last (1885) edition of the British Museum Catalogue, describes this character as though it only occurs "sometimes" in this species, evidently regarding it as inconstant. My confidence in its constancy leads me to describe as new two forms, which perhaps belong to the *C. cornuta*, under the names *C. nigerrima* and *C. onchiopsis*. These differ from each other very much as the genera Metopocerus and Aloponotus are said by Duméril and Bibron to differ from each other, *i. e.*, in the character of the scutellation. In the *C. nigerrima* the scales are distinct everywhere; in the *C. onchiopsis* they are minutely granular on the sides of the back and on the nape and withers. In a third specimen (in alcohol, No. 9977), the characters are intermediate. Thus, in the type of *C. onchiopsis*, the masseteric protuberances have larger scales set in a general surface of granulations; in the third specimen, the same surface is nowhere granular, but is scutellate. The anterior dorsal region is less granular in this specimen. I therefore think it necessary to unite my supposed species, as has been done by M. Boulenger.

If the presence of the second row of femoral pores is not constant in the *C. cornuta*, then the genus Metopocerus cannot be distinguished from Cyclura. M. Boulenger relies on the rather greater number of denticles in the lateral teeth in the *C. cornuta*, but my specimens show a tendency to the tridentate form of the *C. nubila.* The character is, I think, even if constant, insufficient for generic distinction.

I describe the two specimens which represent the extreme of variation of this species, commencing with the type of *C. nigerrima.*

In this specimen the scales of the superior regions are smaller than those of the inferior regions, and are in regular transverse rows, each scale surrounded with granules. There are three rows in two millimeters. The scales of the inferior surfaces are about a millimeter in diameter; like those of the back they have faint traces of keels. The scales of the limbs and tail are keeled. At intervals of about six scales, there are, on the median portions of the sides of the tail, two rows of scales a little larger than the others, which are homologous with those which form the spiny whorls in other species. The crest is rather low on the nape, and is well developed on the dorsal region and anterior part of the tail. On the latter it becomes lower, forming serrate teeth, which are distinguishable to the end of that organ. The crest is interrupted at both withers and rump. Besides the combs on the second and third digits, there is a rudiment of a comb at the base of the first digit. Femoral pores 14–16.

The type specimen of this species was partially skeletonized before it was suspected to be other than a *Metopocerus cornutus.* The plates and scales of the head cannot therefore be described excepting so far as to state that there is a median large scale at the middle of the base of the snout, on an elevation of the nasal bones just behind the transverse line connecting the posterior borders of the bony nares. Between this plate and the canthus rostralis the horizontal surface of the muzzle is covered with rather large antero-posteriorly oval scales, which have a median keel. In the center of these is a larger plate, several times as large as any ot them. The scales on the post-frontal region are similar and those of the zygomatic arch posteriorly are larger.

Measurements.	M.
Length of skull to end of quadrate bone	.108
Width of skull at front of tympanum	.070
Least interorbital width of skull	.018
Length of alveolar edge of maxillary bone	.050
" " body to vent	.340
" " tail	.500
" " humerus	.060
" " fore arm	.057
" " femur	.075
" " tibia	.063
" " foot	.110

The color is everywhere uniform black.

From Navassa island. National Museum, No. 9974.

In a second specimen, the type of *Cyclura onchiopsis,* the scales of the inferior surfaces are similar in every respect to those of the one described above, while those of the sides, tail, and superior surfaces are quite different. Those of the tail are flat and keeled, and smaller than those of that species, and of equal size. In the scutellation of the back the granular scales are far more numerous, covering almost the whole of the scapular regions and sides of the neck and body. Where the larger scales appear they are round and not arranged in rows, and are separated by granular interspaces as wide as or wider than themselves. On the temporal and lateral gular regions the larger scales are scattered at wide intervals in the granular surface. On the muzzle there are two pairs of scuta behind the nasal plates, which are separated by a granular interval. Behind these, and separated by another interval, is a knob-like median scutum. Between this and the canthus rostralis, but separated from it by a wide granular space, are several scales like the smaller ones in the same position in the *C. nigerrima*. There are three rows of small prominent scales over the eye, forming a rough surface. A series of larger scuta on the zygomatic arch, as far as below the front of the orbit. Two prominent scuta not in contact on the anterior border of the tympanum. Two large and two small rows of infralabial plates. Labials $\frac{8}{9}$. Symphyseal plate large, angulate behind. A longitudinal median gular fold, which terminates in a pendulous transverse gular fold. The scales on these folds are like those of the belly, and not granular like those of the lateral gular region. Femoral pores 18. Tail compressed. Dorsal crest low, interrupted at the withers and groin.

Color, dark brown; belly, breast, fore limbs and sides of head black.

Measurements.	M.
Length of head to end of os quadratum	.102
Width of head at front of tympanum	.055
Length of body to vent	.290
" " tail (tip wanting)	.370
" " fore leg	.140
" " humerus (measured behind)	.050
" " forearm	.057
" " hind leg	.200
" " femur (measured above)	.058
" " tibia	.065
" " hind foot	.095

There are three specimens of this species in the National Museum which agree in all essential respects. They are from the Island of Navassa. In all of them the temporal and pterygoid muscles are enormously developed, forming swollen enlargements unlike anything seen in any other Iguanid.

According to Duméril and Bibron there are in the *Metopocerus cornutus* three pairs of scuta on the muzzle. According to the description of these authors this animal also differs from the *M. cornutus* in having eight superior labials ; in the nasals being subround instead of triangular ; in having a large instead a small symphyseal plate. The specimen typical of *C. orchiopsis* has a very low and even imperfect dorsal crest, with a wide interruption between the shoulders, while in the other two it is better developed, and in the type of *C. nigerrima* best of all.

CTENOSAURA Wiegmann.

Isis von Oken, 1828, p. 371. *Enyaliosaurus* Gray. Catal. Lizards, Brit. Mus., 1845, p. 192.

The species of this genus are restricted to the Mexican and Central American regions as Cyclura is to the West Indian. The species known to me are six in number, as follows :

I. Caudal whorls complete ; dorsal crest extending only on the anterior dorsal region.

Tail round, whorls separated by one row of scales ; brown with a few black cross-bands on anterior dorsal region............ *C. hemilopha*

II. Caudal whorls complete ; dorsal crest extending to rump.

a Caudal whorls separated by one row of scales.

Three scales on canthus rostralis ; dorsal crest interrupted at rump ; black or dark brown.................................. *C. multispinis.*

aa Caudal whorls separated by two or three rows of scales.

Head short, obtuse ; three scales on canthus rostralis ; dorsal crest interrupted at rump ; black with yellow cross-bands ; sides of neck yellow...... .... *C. brevirostris.*

Head wedge shaped ; three or four scales on canthus rostralis ; all, except the posterior one, deeper than long ; dorsal crest interrupted at rump ; black, with yellow and green cross-bands and speckles....... *C. teres.*

Four canthal scales, the posterior longer than deep ; head elongate, wedge-shaped ; dorsal and caudal crests continuous at rump ; tail compressed ; green with narrow black cross-bands to belly.. *C. completa.*

III. Caudal whorls interrupted ; each represented by a median dorsal spine and two on each side at the base.

Tail depressed, shorter ; dorsal crest widely interrupted at rump ; pale brown with black cross-bands on anterior dorsal region. .... *C. ~~E.~~ quinquecarinata.*

Ctenosaura hemilopha Cope, Proceedings Philadelphia Academy, 1863, p. 105. *Ctenosaura acanthura* Bocourt, Miss. Scient. Mexique Rept. p. 138. *Cyclura acanthura* pars, Dum. Bibr., Erp. Gen. iv., p. 224.

This species is regarded by DeBlainville and Bocourt as the *Lacerta acanthura* of Shaw.* This cannot be correct, as Shaw distinctly states that the dorsal crest of his species extends to the rump. It is probably one of the species of the next section of the genus (II), but which one I am unable to ascertain.

Lower California only ; *Botta ; Xantus.*

* Zoology iii.

CTENOSAURA MULTISPINIS sp. nov.

Head elongate, flat above, muzzle narrowed ; nostril in the second third of the length to the orbit. Three scales on canthus rostralis, each deeper than long. Seven flat scales across muzzle between anterior angles of orbits. Two rows between supraorbital series. Scales above temporal muscles rather large, weakly keeled. Five series of infralabial plates, not separated by smaller ones. Dorsal crest rather elevated in adult, terminating at the rump. Median caudal crest composed of conical scales, commencing above the posterior margin of the femora. Tail cylindrical at base, covered by whorls of prominent scales with conical points which project strongly, and which are separated by one row of smaller flat scales on the upper half of the tail. On the inferior side of the tail the whorl rows are separated by two intervening rows, which are just like them, having a keel and a mucronate apex. Beyond the middle of the length (end lost) the tail is strongly compressed, but whether this is due to shriveling on drying, I am not sure. Median series of spinous scales uninterrupted. The abdominal scales are larger than the dorsal, which are longer than the lateral scales ; all are subquadrate, and none are keeled.

Seven femoral pores.

Color above and below, black.

Measurements.	M.
Length from end of muzzle to vent	.255
" to line of axilla	.125
" " line of auricular meatus	.062
Width of head at auricular meatus	.042
" " " above " "	.035
Length of anterior limb	.093
" " " foot	.037
" " posterior limb	.150
" " " foot	.076

I have before me two stuffed specimens of this species, a large one and probably adult, and a smaller and younger one. The former, which I described above, is No. 201 of Sumichrast's collection, and was procured by him at Dondomingvillo, in the State of Oaxaca, and sent to the Smithsonian Institution. The other specimen was obtained near Batopilas, Chihuahua, by Mr. Edward Wilkinson, and was recorded by me as *Cyclura acanthura* in the catalogue of his collection, Proceedings American Philosophical Society, 1879, p. 261. It agrees with the type specimen in having the distal two-thirds of the tail strongly compressed. The dorsal crest is much less elevated, probably owing to its younger age. The colors are paler, the prevailing tint being light brown with indistinct darker brown cross-bands.

I find a specimen of this species enumerated as var. B. of *Ctenosaura acanthura* by Boulenger in the vol. ii of the Catalogue of the Lizards in the British Museum, p. 197, which has just reached me.

CTENOSAURA BREVIROSTRIS, sp. nov.

Head short, with obtuse muzzle with decurved profile. Eyes large; nostril near end of muzzle, in the anterior third of distance between end of muzzle and orbit. The scales of the top of the muzzle and of the frontal region, are subquadrate or subhexagonal, and those of the temporal regions are but little longer than wide. All are more or less convex, the temporals most so. There are six rows of scales between the nasal plates, some of which are wider than long. Three canthal scales, of which the anterior is horizontally divided in one specimen. Four rows of wide loreal scales above four rows of narrow scales above the supralabials. Labials 13. Infralabials graduating in size to gulars, but there are five rows of subcarinate scales distinctly larger. Two rows between the subquadrate supraorbitals. Scales of lateral temporal region convex. Scales of belly larger than those of back and sides, which are equal, except those of the axillar, scapular and lateral cervical regions which are nearly granular. Dorsal crest very low, continuous, excepting for a short distance at the base of the tail. Tail nearly cylindric. The scales of the median superior crest are not more prominent than those of the sides of the tail, but they are not interrupted as are the latter. For the terminal three-fifths of the length, the scales of the tail (except below) are equally spinous. For the basal third they are separated above by two rows of non-spinous scales, and on the lower parts of the sides by three rows.

In both the specimens the femoral pores are exceedingly small and indistinct and are five in number on each thigh. The throat is distinctly cross-folded, but very indistinctly longitudinally folded on the middle line. The sides of the neck have two longitudinal folds.

The general color of the head and body is a blackish-brown, paler below. This is crossed on the back between the sacral and postscapular regions by five yellow marks, which are bands posteriorly, but become spots anteriorly. The sides of the neck are of the same color, contrasting strongly with the black of the throat and nape. This yellow space is partially divided by a black line, which extends posteriorly from the angle of the lower jaw. The limbs are blackish, and on the fore arm are numerous yellow scales, and the tibia is faintly cross-banded. The digits and the tail are annulated with blackish brown and yellow rings of about equal width.

Measurements.	M.
Total length to end of tail (end of latter imperfect)	.645
Length from muzzle to vent	.242
" " " " line of axilla	.097
" " " " " " meatus of ear	.045
Width at front of auditory meatus	.040
Length (axial) from orbit to end of muzzle	.022
" of fore leg	.096
" " fore foot	.047

Measurements.	M.
Length of posterior leg	.162
" " posterior foot	.085
" " tibia	.045

Two specimens of this species are in the National Museum, which were sent from Colima, in Western Mexico, by John Xantus.

CTENOSAURA TERES Harlan, Bocourt, Miss. Sci. Mexique, Reptiles, p. 142 *Cyclura teres* Harlan, Journ. Acad. Philada., iv, 1825, p. 246, tab. 16 Wiegmann, Herpert. Mex., 1834, p. 42. "*Ctenosaura armata* Gray Synopsis Griff. Anim. Kingdom, ix, 1831," Bocourt. *Cyclura pectinata* Weigmann, Herpetol. Mexicana, 1834, p. 42, tab. 2. Dum. Bibron, Erp. Gen., iv, 1837, p. 221. *Cyclura acanthura* Sumichrast, Univ. et Revue Suisse; Archiv. des Sciences Phys. et Nat., 1864, p. 49. *Ctenosaura pectinata* Wiegm., Gray Catal. Lizards, Brit. Mus., 1845, p. 49. Bocourt, Miss. Scientifique Mexique, Reptiles, p. 140.

Tehuantepec, *Sumichrast;* Colima, *Xantus;* Tampico, *Dallas;* Vega de Alatorre, Vera Cruz, *Comision Geografica.*

Subspecies BRACHYLOPHA Cope.

Four stuffed specimens from Mazatlan differ from others of equal size and age from other localities in the extreme shortness of the processes which compose the dorsal crest. They are in fact merely elongated compressed scales, longer than high, except on the interscapular region, where they are as high as long. The same character is seen in young specimens of the ordinary variety. There are three scales on the canthus rostralis, of which the posterior is longer than deep, the second deeper than long, and the third, adjacent to the nares, is deeper than long, and divided into a superior and an inferior plate. The color is apparently green in life, punctulated with blackish brown. The punctulations arrange themselves into a row of median dorsal spots, and in three of the specimens into two transverse bands near the middle of the sides of the abdomen. Tail with broad blackish rings. The measurements of the largest specimen are: Total length, 630 mm; to vent, 263 mm; to posterior border of membranum tympani, 59 mm; width of head at front of mem. tympani 40 mm; length of posterior leg and foot, 124 mm; of posterior foot 52 mm.

Mazatlan *Bischoff;* Nos. Natl. Museum, 7180–81–82–83.

CTENOSAURA COMPLETA Bocourt, Miss. Scientif. Mexique, Reptiles, p. 145. *Ctenosaura pectinata* Cope, Proceedings Academy Philada., 1866, p. 124; Proceedings Amer. Philos. Soc., 1855, p. 388.

Aspinwall, Panama, *Gill;* Guatemala, San Salvador, *Miss. Scientif.;* Yucatan, *Schott;* Cozumel Id., *Ridgway.*

CTENOSAURA QUINQUECARINATA Gray. Cope, Proceedings Amer. Philosophical Society, 1869, 161. *Cyclura quinquecarinata* Gray, Zoölogical Miscellany, p. 59. *Enyaliosaurus quinquecarinatus* Gray, Catal. Lizards, Brit. Mus., 1845, p. 192.

Tehuantepec, *Sumichrast.*

CACHRYX Cope.

Proceedings Academy Philada., 1866, p. 124.

This genus is of the type of Ctenosaura, differing only in the characters of its tail. It lacks the terminal portion which is in that and other genera free from spinous scales. It is not in my opinion allied to Urocentrum or Hoplocercus as suggested by Bocourt, genera which belong to the terrestrial division of the family, or Humivagæ.

Cachryx defensor Cope. Proceeds. Acad. Phila., 1866, p. 124. Proceeds. Amer. Philos. Soc., 1869, p. 169, pl. 10. Bocourt, Miss. Sci. Mexique, Reptiles, p. 148, pl. xvii. bis. figs. 12, 12a.

Yucatan, *Schott.*

BRACHYLOPHUS Cuvier.

Regne Animal, edit. ii, p. 41. Duméril Bibron, Erp. Gen., iv, p. 225. Gray, Catal. Brit. Mus., 1845, 187. Fitzinger Systema Reptilium, 1843, p. 55. *Chloroscartes* Günther, Proc. Zoöl. Soc. London, 1862.

Brachylophus fasciatus Brong. Cuv. Regne Animal, ii edit., p. 41. Dum. Bibron, Erp. Gen., iv, 1837, p. 226. Gray, Catal. Liz. B. M., 187. *Chloroscartes fasciatus* Günther, Proceeds. Zool. Soc. London, 1862, pl. xxv.

Feejee Is.

IGUANA Laurenti.

Specimen Synopsis Reptilium, 1768, p. 47. Duméril Bibron., Erp. Gen., iv, 1837, p. 199. Gray, Catal. Brit. Mus., 1845, p. 186. *Hypsilophus* Wagler, Nat. Syst. Amphib., 1830, p. 147. *Amblyrhynchus* "Bell" Wagl., l. c., p. 148 (nec Bellii.).

Iguana tuberculata Laurenti.

Subspecies tuberculata Laurenti, l. c., p. 49. Dum. Bibr., Erp. Gen., iv, p. 203; Gray. Catal. Liz. Brit. Mus., 1845, p. 186.

South America, east of the Andes; Lesser Antilles.

Subspecies rhinolopha Wiegm. *Iguana rhinolopha* Wiegmann, Herpetol. Mexicana, 1834, i, p. 44. Dum. Bibr., Erpet. Gen., iv, p. 207. *Iguana tuberculata* var. Wiegmann, Isis, 1828, p. 364; Cope, Proceeds. Amer. Philosoph. Society, 1869, p. 161.

Costa Rica, *Gabb;* Tehuantepec, *Sumichrast;* Colima, *Xantus;* Cozumel, Yucatan, *Ridgway.*

Tierra Caliente of Mexico.

Iguana delicatissima Laurenti. Specimen Syn. Reptilium, p. 48, 1768. Gray, Catal. Brit. Mus., 1845, p. 187. *I. nudicollis* Cuv., Regne Animal, ii, p. 40. Dum. Bibr., Erp. Gen., 1837, iv, p. 208.

Guadalupe, Nevis, *Ober.*

CONOLOPHUS Fitzinger.

Systema Reptilium, 1843, p. 55. Boulenger, Catal. Lizards, Brit. Mus., 1885, ii, p. 186. *Amblyrhynchus* pars Dum. Bibr., iv, p. 197. *Trachycephalus* Gray, Catal. Liz. Brit. Mus., 1845, p. 188.

M. Boulenger (Catalogue Lizards Brit. Museum, 1885) first pointed out the characters which distinguish this genus from Brachylophus.

CONOLOPHUS SUBCRISTATUS Gray. *Amblyrhynchus subcristatus* Gray, Zool. Misc., p. 6, 1831. Zoology Beechy's Voyage Rept., p. 93, 1839. *Amblyrhynchus demarlii* Dum. Bibr., Erp. Gen., iv, p. 197, 1837; Bell Zool. Beagle, iii, p. 22, 1843, pl. ii. *Conolophus demarlii* Fitz., Syst. Rept. *Conolophus subcristatus* Steindachner, Festschr. K. K. Zool. Bot. Gess. Wien; Die Schl. u. Eid. d. Galapagos Ins. 22, 1876, tab. iv, v, figs. 6–9; vi, figs. 4–6; vii, 5–8. *Trachyphalus subcristatus* Gray, Cat. Liz. Brit. Mus., 1845, p. 188.

Galapagos Ids.

AMBLYRHYNCHUS Bell.

Zoological Journal, London, 1825, p. 195. Dum. Bibr., Erp. Gen., iv, 204 pars. *Oreocephalus* Gray, Catal. Liz., Brit. Mus., 1845, p. 189.

Steindachner states that the *Amblyrhynchus cristatus* possesses no gular cross-fold. I know of no other ground for separating it generically from the *Conolophus subcristatus*.

AMBLYRHYNCHUS CRISTATUS Bell, loc cit. Tab. xii. Do. Voyage of the Beagle, iii, p. 23. Steindnachner Festschrift der K. K. Zoolog. Botan. Gess., Wien, 1876; Die Schlangen u. Eidechsen der Galapagos Ins., p. 16, tab. iii, v, vi, figs. 1–4. *Hypsilophus cristatus* Fitzinger. *Amblyrhynchus ater* Gray. Synops. Rept. Griff. Anim. Kingdom, ix, p. 37. Dum. Bibr., Erp. Gen., iv, p. 196. *Oreocephalus cristatus* Gray. Catal. Brit. Mus., 189.

Galapagos Ids.

Thirteenth Contribution to the Herpetology of Tropical America. By E. D. Cope.

(Read before the American Philosophical Society, Nov. 20, 1885.)

I. NICARAGUA, Bransford.

Dr. J. F. Bransford, U. S. N., has sent from time to time collections from Central America to our scientific institutions, which have thrown much light on the zoölogy of the regions he has visited. In 1874, I had the privilege of publishing a report on a collection obtained by him in Nicaragua*; and later (1875) I published an account† of a collection sent

* Proceedings Academy Philada., 1874, p. 64.

† Journal Academy Philada., 1875, p. 155.

by him from Panama. On these occasions I defined six species not previously known to science. On the present occasion I am able to determine the contents of a new collection obtained by Dr. Bransford in Nicaragua. This embraces thirty species, of which ten are new to science. The collection adds very much to our knowledge of the range of various species, both as to their southward and northward extension. The specimens are the property of the National Museum at Washington, which institution placed them in my hands for identification and description.

BATRACHIA.

Anura.

1. Bufo haematiticus Cope, Nos. 14178, 14181. Abundant.

2. Bufo marinus L., Nos. 14198, 14213. One specimen.

3. Bufo valliceps Wiegm., Nos. 14194–5–88. Three specimens.

4 Dendrobates tinctorius Ichn., No. 14183. Abundant.

5. Dendrobates typographus Keferst. No. 14189. Abundant.

6. Engystoma pictiventre, sp. nov.

One small metatarsal tubercle. Muzzle anterior to eye equal to twice long diameter of latter, and projecting well beyond the mouth. Nostrils lateral-terminal. No fold across occiput. Skin everywhere smooth. First finger shorter than second, which reaches end of muzzle when the limb is extended. When the hind limb is extended forwards, the distal end of the astragalus reaches the extremity of the muzzle. First toe very short; second a good deal longer than fifth; fourth elongate.

Color above olivaceous brown. A black band with a very narrow pale superior border extends from the end of the muzzle to the lower part of the groin, the superior border descending posteriorly. No inguinal spot. Below black, with white spots. Those on the abdomen are very large; those on the femora and tibia are smaller, and those on the thorax and gular region are still smaller.

Total length of head and body, 22.5 mm.; of posterior leg, commencing at groin, 29 mm.; length of posterior foot, 14 mm., of which the astragalar portion measures 4.5 mm.

No. 14196; National Museum.

7. Hypsiboas miliarius, sp. nov.

A species above medium size, in which the pollex is free from the index for most of its length, and terminates in a flattened cone, instead of a curved, acute spine.

Vomerine teeth in two transverse series behind the posterior borders of the choanæ, and within the lines of their internal borders. Ostea pharyngea half the size of the choanæ. Tongue subround, feebly emarginate posteriorly. Eyes large and prominent. Head flat and depressed, wider than long, muzzle broadly rounded and with perpendicular profile; and as long as the orbit's diameter. Canthus rostralis almost wanting, very concave. Nostrils terminal and lateral. Tympanum three-fifths diameter of orbit, larger than digital discs. Both anterior and posterior feet palmate to the bases of the last phalanges of the longest digits, except between the second and third anterior digits, which is only palmate to the bases of the penultimate digits. When the hind leg is extended the heel reaches the end of the muzzle. The posterior digits are short, but two phalanges projecting beyond the knee when the leg is closed. The palmation is wide, and extends a short distance between the external metatarsals. A well-marked cuneïform tubercle, with slightly free apex.

The under surfaces have the usual areolation. The superior surfaces are thickly covered with small tubercles, which are largest and most prominent on the top of the head, where some of them are subspinous. There is a serrate narrow free dermal margin on the external edge of the fore leg, from the elbow to the end of the fifth digit, and a similar one on the external edge of the posterior foot. There is none on the side of the body.

Length of head and body M. .062 ; length of head on middle line to line connecting posterior extremities of maxillary bones, .017 ; width of head at same point, .025 ; length of anterior limb from axilla, .035 ; do. of fore-arm, .011 ; length of carpus and digit, .019. Length of thigh from groin, .025 ; of tibia, .032 ; of tarsus, .019 ; of foot to end of fourth digit, .025.

The color of all the upper surfaces is a dark plum or mulberry, with an obscure coarse reticulation of a darker shade. The color of the inferior surfaces everywhere is yellowish, spotted with the color of the dorsal region. At each heel, and just below the vent, there is a yellow spot. The webs of both fore and hinder feet are plum-color, except the borders, which are yellowish. The digits are yellowish on the under sides. There is a spot of pale color on the upper lip below the space between the orbit and the tympanum, and some less distinct spots on the lip anterior to it. The dermal processes of the fore-arm and tarsus are light yellowish.

Collection No. 14193.

This fine species approaches nearer in coloration, dermal character, and form of palmation to the *Hyla marmorata* than to any other species of that genus. The remarkable development of the pollex, however, places it in the genus Hypsiboas, although it differs materially in the details of this part from the known species of the genus.

8. Hypsiboas albomarginatus Spix. Nos. 14190–91–92. One of the three specimens has a yellow dorsolateral band on each side.

9. Hyla quinquevittata, sp. nov.

Rather small. External fingers with a slight rudiment of a web at their bases. Toes with web only reaching the middle of the penultimate phalanges of the third and fifth digits. Vomerine teeth in two rather large rounded fasciculi close together on the anterior half of the space between the choanæ. Tongue a little longer than wide, feebly notched. Tympanic membrane round, two-fifths the long diameter of the eye-fissure. The muzzle is rather acuminate and projects beyond the mouth. The canthus rostralis is distinct and concave. The skin is perfectly smooth on all the superior surfaces. The wrist of the extended fore limb extends to the end of the muzzle ; while the heel extends a little beyond the same point.

Length of head and body M. .029 ; of fore-leg, .017 ; of hind leg, .043 ; of hind foot, .019 ; of tarsus, .009 ; of tibia, .015.

Color above light gray, with five parallel dark-gray longitudinal bands. The median band is somewhat indistinct posterior to the interscapular region and in front of the sacrum. Anteriorly it expands so as to form a large subtriangular spot between the eyes, the apex being posterior. The femur has one cross-band ; the cubitus two, and the tibia three. Inferior and concealed surfaces unspotted.

Coll. No. 14187.

This species is, in many technical respects, similar to the *Hyla eximia* Baird. The hinder legs are much longer ; the muzzle is more acuminate, and the color bands are much wider. The frog is probably of a different color in life.

10. Agalychnis helenæ Cope. Proceeds. Amer. Philosoph. Society, 1884, p. 182.

A larger specimen than the type, in which yellow border of the lateral purple stripe, and the bars which cross it, are wider. There are also traces of pale cross-bands on the back. No. 14186.

11. Lithodytes diastema Cope. One specimen ; No. 14209.

12. Lithodytes bransfordii, sp. nov.

Represented by a number of individuals of small size, but which are adult. The characters are well marked. The legs are short, the posterior when extended only bringing the heel to the orbit. The vomerine teeth are in two transverse or slightly arched series, near together well behind the line of the posterior nares, and not extending exterior to the middle of the latter. The tympanic disc is large, in four of the specimens equaling the diameter of the eye-fissure, in three others not exceeding two-thirds of that size. The muzzle does not project, and is slightly truncate, and is about equal in length to the diameter of the orbit. The nostril is nearly terminal-lateral. Canthus rostralis distinct, obtuse, nearly straight. The toes are entirely free, and the dilatations are moderate. Two metatarsal tubercles, the inner larger. The skin of the back is thrown into delicate longitudinal parallel folds, which are easily lost.

Length of head and body, M. .0255 ; length of anterior limb, .013 ; of posterior limb from groin, .036 ; of foot, .017 ; of tarsus, .0075 ; of tibia, .012.

In the color there is much pink on the upper and concealed surfaces. There are two dark spots on the lip, one below each canthus of the eye. There is a large more or less obsolete spot behind and above the axilla, with an oblique posterior border. There is a dark spot on the pariëtal region and generally one between the anterior parts of the orbits. There is generally a light open chevron pointing forwards across the middle of the back, with a dark one in front of it. In the largest specimen a pink band extends from the orbit posteriorly to the ilium. Posterior face of femur brown with light specks or finely brown mottled. Other lower surfaces whitish, except that in a few specimens the gular region is obscurely brown mottled.

This species belongs to the short legged group represented by the *L. diastema*, and need not therefore be compared with the *L. podiciferus, muricinus* and *rhodopis*, where the heel reaches much beyond the muzzle. From *L. diastema* it differs in the much longer posterior foot, and in the close approximation of its teeth, which form a row and not a fascicle. The tympanum is at all times much larger and more distinct, although it is variable in diameter.

This species is dedicated to Doctor John F. Bransford, U. S. N., whose researches have thrown much light on the fauna of Nicaragua.

Museum ; No. 14200.

13. LITHODYTES RANOIDES, sp. nov.

This form is a little nearer to some already known than the last described. The heel of the extended hind leg reaches exactly the end of the muzzle, being thus still shorter than in the group above mentioned, which is represented by the *L. rhodopis* and its allies. The vomerine teeth, unlike any of the forms mentioned, are in small fasciculi, which are not widely separated, and which are entirely behind the line of the posterior border of the nares, and within that of the internal border. A distinctive character is the presence of a small web between the toes, which is nearly as well developed as in the *Hylodes* (*Lihyla*) *guentherii* Keferst. The diameter of the tympanic disc is about half that of the ball of the eye. The tongue is a parallelogrammic oval, and is entire posteriorly. The head is relatively rather long, and the muzzle is acuminate. The muzzle projects somewhat beyond the mouth, and beyond the nares, which are above the edge of the symphysis mandibuli. Its length a little exceeds that of the eyeball, which itself is more than half larger than the interorbital width. The canthus rostralis is distinct and nearly straight. The digital dilatations are truncate. The external metatarsal tubercle is obsolete, and the internal one is small. The skin is nearly smooth, but a pair of feeble folds form an obscure pattern on the scapular regions.

Length of head and body, M. .0265 ; do. to line connecting posterior borders of tympana, .10 ; width at anterior borders of do., .0105 ; length of fore limb from axilla, .0155 ; of hind limb from groin, .041 ; of hind foot, .019 ; of tarsus, .0075 ; of tibia, .014.

Color dark ashen above, darker on the head. A pale cross-band across frontoparietal region. Four large dark spots on upper lip, commencing at end of muzzle. Limbs dark cross-banded ; three on tibia and two on femur. Sides and lower surfaces white, the former and the gular and pectoral regions thickly speckled with dark ash ; a few larger splotches of the same in front of and at the groin. The cross-bands of the tibia extend on the skin that covers the flexors of the foot so as to be seen from below.

Four specimens ; No. 14179.

14. HYLODES POLYPTYCHUS, sp. nov.

Vomerine teeth in two transverse series behind the posterior borders and within the lines of the internal borders of the choanæ. Tympanic disc a vertical oval, the long diameter two-thirds that of the orbit. Limbs short, the heel only reaching the muzzle. The toes are rather long, have rather small oval dilatations and are perfectly free at the base. The head is short, and the muzzle has an oval outline, and projects a little beyond the mouth. Its length anterior to the orbit equals the diameter of the same, and the nostril is nearly terminal. Two distinct metatarsal tubercles, the internal with a rather prominent apex. The tubercles below the bases of the phalanges are rather prominent. The skin of the abdomen is areolate. That of the upper surfaces is plicate and tuberculate. The plicæ are interrupted, and may be regarded as forming eight longitudinal series, the external of which are dorso-lateral. Below these the sides are tubercular ; as are also the spaces between the dorsal plicæ, the superior surfaces of the limbs, and the top of the head, especially the superior face of the eyelids. An external fold on the distal half of the tarsus.

Length of head and body, .027 ; of head to posterior line of tympanum, .009 ; width at anterior line of do., .011. Length of fore limb, .015 ; of hind limb, .037 ; of hind foot, .018 ; of tarsus, .0073 ; of tibia, .012.

Color above dark ashen, with indistinct shades. Four dark spots on upper lip ; a dark shade above and posterior to axilla ; four narrow black cross-bands on thigh, two across tibia and four across external side of foot. Inferior surfaces dirty white. Posterior face of thigh and gular region thickly clouded with brown.

Two specimens ; No. 14199.

15. RANULA CHRYSOPRASINA Cope. Several specimens ; No. 14180.

REPTILIA.

LACERTILIA.

16. AMIVA FESTIVA Licht. et Von M. All of the specimens (four) have but three supraocular scuta. Nos. 14204–5.
17. CORYTHOPHANES CRISTATUS. No. 14202. One specimen.
18. ANOLIS COPEI Boc. No. 14210. One specimen.
19. ANOLIS RODERIGUEZII Boc. Cope, Proceedings Amer. Philos. Soc., 1885, p. 391. Three specimens ; No. 13721.
20. ANOLIS CRASSULUS Cope. One specimen ; No. 14208.
21. ANOLIS CAPITO Peters. Three specimens ; No. 14203–12.
22. ANOLIS OXYLOPHUS Cope. Four specimens ; No. 14211.
23. ANOLIS QUAGGULUS Cope. Numerous specimens ; No. 14208. The

coloration of none of these individuals agrees with the type in having the vertical black lines, on the sides which I have described. The dorsal chevrons are frequently present, but they are sometimes replaced by large pale brown rhombs or a uniform metallic pale brown. The keels of the ventral scales are sometimes obsolete. The scales round the occipital are generally keeled, as well as those of the rest of the head.

24. SPHÆRODACTYLUS HOMOLEPIS, sp. nov.

Scales of upper surfaces small, flat, not granular nor keeled, a little smaller than those of the abdomen. Rostral plate large. Labials $\frac{5}{4}$, first inferior labial corresponding to three superior labials. Muzzle a little longer than distance from eye to auricular meatus, and one and two-thirds times the length of the eye's diameter. Scales of lower surface of normal tail similar to those of upper surface.

Brownish cream color with dark brown bands, longitudinal on the head, and transverse on neck, body and tail. There are seven lines on the head, one median, and three on each side. The inferior is short and is anterior to the auricular meatus; the second extends from the end of the muzzle through the eye to the neck, and the third runs backwards from the superciliary region to an equal length. The cross-bands are not so wide as the spaces between them. One is at the nape, one crosses the shoulders, one the middle of the body and one the groin. There are four complete annuli on the tail.

This species is of very small size. Total length M. .024; of head and body, .016; of head to auricular meatus, .004. No. 14207.

This Sphærodactylus is nearest the *S. sputator* of Cuba. In that species the scales are smaller, there are subcaudal scutella, and the head-bands are less numerous and distinct.

25. RHADINÆA DECORATA* Günther. No. 14217.

*A species of this genus in my collection from the State of Hidalgo, Meixco, is apparently undescribed. I call it *Rhadinæa quinquelineata*. It is nearest the *R. tæniata* Peters, but has a much shorter tail, and differs in coloration. The scales are in seventeen longitudinal rows, and as in other species of Rhadinæa, are poreless. There is but one preocular plate, which does not approach the frontal. The loreal is longer than high; postoculars 2; temporals 1-2. Superior labials, eight, all higher than long, excepting the last, which is as high as long; the third, fourth and fifth entering the orbit. Pariëtal plates elongate, exceeding the frontal. Anterior border of frontal angulate, its length about equal to the lateral border. Inferior labials ten, the pregeneials considerably shorter than the postgeneials. Gastrosteges 179; anal 1-1; urosteges 77. Total length M. .438; of tail, .115; to canthus oris .011.

Color light brown above; below to ends of gastrosteges, and upper lip, yellow. A black band runs along the middle of the fourth row of scales, and a dusky one on the adjacent halves of the seventh and eighth rows. A narrow black line along the median row. The lateral band extends through the eye to the end of the muzzle, crossing the tops of the 8th, 7th, 6th and 5th labials, becoming darker anteriorly. The band of ground-color above it extends to the eye, narrowing in front. The three dorsal bands unite into a wide brown one on the nape, which spreads out and covers the top of the head. The last two maxillary teeth are much stronger than the others.

Discovered by my friend Dr. Santiago Bernad; two specimens; a third from the State of Pueblo.

26. Ophibolus polyzonus micropholis Cope. No. 14214.

27. Herpetodryas melas, sp. nov.

Scales in ten longitudinal series, all smooth, those of the median rows larger than those of the lateral, and rather smaller than the pariëtal scuta. Pariëtals rather short and wide, openly emarginate behind. Nine superior labials, all longer than high, the fourth, fifth and sixth entering the orbit. Nasals well developed; loreal square; oculars 1–2; temporals 1–1–1. Muzzle rather short, and eye large; diameter of the latter equal length from orbit to nostril. Frontal not much concave at sides. Inferior labials ten, fifth longest, narrow, and the last one in contact with the geneials. Postgeneials longer than pregeneials. Gastrosteges 158; anal 1–1; urosteges 139. Total length M. 1.210; length of tail, .470; length to rictus oris, .029.

Shining black, except on the superior labial scuta and anterior half of body, which are cream-colored. The ends of the light gastrosteges remain black. Here and there a black scale has a white edge, and several present this character distinctly just posterior to the angle of the mandible on the neck. No. 14219.

This interesting species is nearest to the *Herpetodryas grandisquamis* Peters (Cope, Journal Academy Philada., 1875, p. 135), but differs in having the scales smaller, without keels, and in ten longitudinal rows. Peters placed the latter in Spilotes, but I have not adopted this arrangement, since like the *H. melas*, it has a divided anal plate, and scales without fossæ in an even instead of an odd number. These characters indicate clearly that its place is in Herpetodryas.

28. Dendrophidium dendrophis* Shl. *Herpetodryas poitei* D. & B.

Two specimens (Nos. 14215–20) adult and half-grown. The latter has the coloration ascribed to this species, while the cross lines and lateral spots are obsolete in the former. There are no markings on the head and neck of the adult. The top of the head is red in the adult. Oculars

* A species allied to the *D. dendrophis* was sent to the Smithsonian Institution from Guatemala by H. Hague, which has not yet, so far as I am aware, received a place in the system. It may be called *Dendrophidium chloroticum*. The scales are in seventeen rows, of which four rows on each side are smooth on the anterior part of the body, and only two smooth on the posterior. The pariëtal plates are a little longer than the frontal, which has straight sides. The eye is large, its anteroposterior diameter equaling the width of the superciliary and frontal scuta combined, and equaling the length of the muzzle to the middle of the prenasal plate. Oculars 1-2. Temporals 2-2, all narrow. Superior labials nine, the last three longer than high. Loreal large, higher than long; nasals rather small. Gastrosteges 169; anal 1-1; urosteges, 117. Color above, including ends of gastrosteges, green; below yellow. On stretching the skin it is seen to be black between the scales of the sides of every second or third row, in oblique lines running upwards and forwards. Total length M. 1.018; of tail, .311; to rictus oris .027.

This species is abundantly different from the *D. melanotropis* Cope, but is near to the *D. dendrophis* Schl. The muzzle is shorter than in our specimens of the latter, and in those figured by Jan, and the number of keeled rows of scales is less, nine to fifteen. The color is entirely different.

1–2. Three temporals border the labials above, except on one side of the younger specimen where there are but two, as in the individuals figured by Jan in Iconographic Generale des Ophidiens Livr. 31, Pl. iii. The specimens of the species hitherto described are from Cayenne.

29. HAPSIDOPHRYS SATURATUS Cope. *Leptophis saturatus* Cope, Journal Academy Philada., 1875, p. 133; Pl. 28, fig. 10.

The frontal plate, in the single specimen sent, has its lateral borders straight and not contracted as in the type specimen figured. No. 14216. *Hapsidophrys* Fisch. differs from Leptophis in having a loreal plate, and from Philothamnus Smith, in having keeled scales. Its American species are *H. mexicanus* D. & B.; *H. diplotropis* Gthr. and *H. saturatus* Cope. To Leptophis belong *L. bilineatus* (*Diplotropis* Gthr.), *L. occidentalis* Gthr., *L. sargii* Fisch., and *L. præstans* Cope. To Philothamnus must be referred *P. æruginosus* Cope; *P. modestus* Gthr. and *P. depressirostris* Cope.

30. ELAPS NIGROCINCTUS Gird. No. 14214; one specimen.

31. ELAPS MULTIFASCIATUS Jan. No. 14218; one specimen.

GENERAL REMARKS.

A general analysis of the Herpetological fauna of Nicaragua cannot yet be given, especially as the distribution of species within the State has not been furnished by explorers. It will however be of interest to note the following points:

Of the thirty-one species enumerated in the preceding catalogue four are widely distributed South American forms, viz: *Bufo marinus; Hypsiboas albomarginatus; Dendrobates tinctorius* and *Dendrophidium dendrophis.* Three are especially Mexican forms, although they extend as far south as Costa Rica, viz: *Bufo valliceps; Rhadinæa decorata* and *Ophibolus polyzonus.* The remainder are especially Central American forms, which have been found either in Guatemala, Costa Rica or Panama, or are new to science. Of these the number having a southern range is considerably in excess of those ranging to the north of Nicaragua.

II. PANAMA Nelson.

The following species were obtained at Panama by Dr. George W. Nelson, and sent to the National Museum at Washington. Two of the species are new to science.

BATRACHIA.

1. HERPELE OCHROCEPHALA Cope. Proceedings American Philosoph. Society, 1885, p. 171. *Cæcilia ochrocephala* Cope, Proceedings Academy Philadelphia, 1866, p. 132; Brocchi Mission Scientif. Mexique.

One specimen; No. 14116.

OPHIDIA.

2. RHADINÆA FULVICEPS, sp. nov.

Scales in seventeen longitudinal rows. Two preoculars, the inferior small and occupying a notch between the third and fourth superior labials. Preorbital part of head short. Internasals and prefontals broader than long. Frontals, supraorbitals and occipitals rather large. Rostral plate wider than high, rather prominent. Postnasal higher than prenasal, its posterior border an arc of a circle. Loreal higher than long. Postoculars two, the inferior the smaller. Temporals 1–2–3. Superior labials eight, all longer than high, excepting the sixth, which is as high as long; the fourth and fifth bounding the orbit. Inferior labials nine, fifth largest, and the last one in contact with the geneials. Postgeneials longer than pregenials. Gastrosteges 144; anal 1–1; urosteges 109.

Color above dark brown, with three darker brown longitudinal bands. The lateral one is on the second and third rows of scales, and the median stripe occupies four rows. Below yellow, with a serrate blackish border on each side, due to the presence of an angular spot at the extremity of each two gastrosteges, which covers the suture between them. Top of head yellowish-brown, quite distinct from the body, and without markings. Sides of head darker; lips yellow, each plate with a black border, and more or less numerous black spots. One of these, larger than the rest, extends upwards towards the line of the posterior extremities of the pariëtal scuta. Another extends a short distance posterior to the angle of the mouth.

Total length, M. .341; of tail, .148; to rictus oris, .007. Collection, No. 14118.

This small species is nearest to the *R. ignita* (Cope, Journal Academy Phila., 1875, p. 140), in technical characters, but the inferior preocular has a different position, and the coloration is entirely distinct. No. 14118.

3. Leptognathus stratissima, sp. nov.

This species belongs to the section of the genus with elongate colubriform geneial scuta, smooth scales, and a larger vertebral series. The scales of the vertebral series are longer than wide, and are truncate at the apex, and do not exceed the other scales so much as is seen in some species. This species differs from most of those of the same section, in having the loreal entirely separated from the orbit by the well-developed preocular.

Scales in seventeen series. Internasal and prefrontal scuta broader than long. Frontal large, wide. Pariëtals large, loreal as high as long at base. Oculars 1–2, the inferior postocular much smaller than the superior. Superior labials eight, the third, fourth and fifth entering orbit. Temporals 2–3. Inferior labials six, in contact with geneials, the sixth separated by a scale from the postgeneial for most of its length. Gastrosteges, 232; anal, 1–1; urosteges, 130.

Total length, M. .381; of tail, .100; to rictus oris, .008. Coll., No. 14121.

Ground color light gray, which is covered by the following markings: There are sixty-nine cross-bands of a deep brown, which narrow a little on the sides, and have broadly rounded extremities at the second row of scales. The centres of the spaces between them on the sides are occupied by a light brown spot. Each gastrostege has a dark brown spot on its extremity, and the rest of the scutum is thickly dusted with brown. Thirty-nine cross-bands on upper surface of tail. Three brown chevrons on the pariëtal region, directed backwards, the anterior commencing with the superciliary. Muzzle and sides of head brown speckled; throat and chin immaculate.

4. Dipsas cenchoa L. Nos. 14119–20.

5. Drymobius boddaertii Seetzen. No. 14117.

6. Elaps nigrocinctus * Girard. No. 14115.

7. Bothrops atrox L. No. 14114.

III. Chiriqui.

Hyla microcephala, sp. nov.

Fingers free; toes webbed nearly to the palettes of the third and fifth digits. Vomerine teeth in two fascicles between the nares, with their anterior edge in line with the anterior edge of the latter. *Membranum tympani* round, its diameter one-third that of the eye. The latter equals the length of the muzzle, which is short and rather deep, and not prominent. The external nostril is at one-fourth the length posterior to the apex. The head is small in its dimensions, its length to the line of the posterior border of the tympana entering the length of the head and body, three and a half times. The eyes are little prominent. The general form is slender, and the hinder legs are long, the heel reaching to beyond the end of the muzzle. The metatarsal tubercles are not distinguishable as dermal differentiations. Digital dilatations not so large as the tympanic membrane. Skin everywhere smooth on superior surfaces. Length of head and body, .0275; do. of anterior limb from axilla, .014; of posterior

*A species of this genus has been obtained by Francis Sumichrast, on the Pacific side of the Isthmus of Tehuantepec, which I believe to be undescribed. It is referred to in the Proceedings of the American Philosophical Society, 1869, p. 162, as *Elaps aglæope;* but it is distinct from this species. I propose that it be called *Elaps ephippifer*. It has the seven superior labials and fifteen rows of scales of the most of the American Elaps, and the labials are separated from pariëtals by one row of temporals. The rostral plate is transverse and not particularly prominent, and its posterior border is very openly angulate. The frontal plate has long parallel lateral borders, and much shorter posterior ones. Gastrosteges, 218; anal divided; urosteges, 43. There are seventeen black rings on the body, which encircle the abdomen, covering a length of four and a half scales and five or six gastrosteges. They are separated by nine or ten scales, and have a wide yellow border of one and a half or two scales in width. The entire space between these yellow borders is occupied by a large black spot, which descends on each side to the second row of scales. The remaining space between the yellow borders is red. There is a wide black entire collar, which cuts off the apex of the pariëtal shields. The muzzle and front are black as far as the anterior part of the pariëtals.

The wide yellow borders in this species are like those of the *E. euryxanthus*, while the black saddles represent the black spots of the *E. aglæope*.

limb from groin, .0415; do. of posterior foot, .019; of tarsus, .0095; of tibia, .0145. Width of head at anterior border of tympana, .008.

Rich cream-color on all the upper surfaces, on one specimen tinged with brown. Below lighter cream-color. A pale brown band with a narrow yellow superior margin from the end of the muzzle to the groin. The brown tint fades out rapidly below, and on the posterior half of the side is reduced to a narrow line. A narrow brown band on each side of the back, which extend as far forward as the orbit.

This species is well characterized, having little resemblance to any other member of the genus. It was taken along a mountain stream in the department of Chiriqui. Two specimens; No. 13473.

IV. City of Chihuahua, Wilkinson.

Information as to the character of the reptilian fauna of the central part of the State of Chihuahua, has been a desideratum. A few specimens from the region were sent many years ago to the Museum of the Smithsonian Institution by Mr. John Potts, and are recorded in the report of the Mexican Boundary Survey by Professor Baird. A collection from the southern part of the Sierra Madre in this State, from the mining district of Batopilas, was sent me for study by Mr. Wilkinson, and was reported on in the Proceedings of this Society for 1879, p. 261. That region is however much to the south of the one represented by the present collection, and is much more elevated.

The great plain in which the city of Chihuahua stands is arid, and the vegetation is generally sparse. Low mountains bound it on the east and west. The formation of the surface of the plain is a coarse drift composed principally of little or much rounded fragments of basalt, more or less cemented together by a calcareous mud. The same formation composes the plains of Southern New Mexico. The vegetation of this plain consists of mesquit, Fouquieria, Yuccas and Opuntias. South of the city is a considerable tract of grassy country. The city stands on a creek, whose waters are used by the inhabitants for supporting a cultivation which produces a most agreeable contrast to the general aspect of the country.

Mr. Wilkinson's collection indicates that reptiles are numerous, since he obtained, in a short time, 471 individuals. These only represent twenty-six species and subspecies. They are as follows.

Lacertilia.

1. Phrynosoma cornutum Harl. Abundant; Nos. 14228–52–90, 14300.
2. Phrynosoma modestum Gird. Abundant; Nos. 14229–51–91; 14301.
3. Holbrookia texana Trosch. Abundant. Nos. 14234–38–43–47, 14309.
4. Holbrookia maculata B. & G. Abundant. Nos. 14239–40–45, 14310.
5. Crotaphytus collaris Say. Moderately abundant. Nos. 14306–7.

6. Uta bicarinata Duméril. One specimen ; No. 14248. The most northern locality for this lizard.

7. Sceloporus torquatus Green & Peale ; subspecies poinsettii Bd. & Gird. Two specimens ; Nos. 14233–43.

8. Sceloporus undulatus Latr. Abundant ; many of the males are without the undulating cross-lines. The most southern locality in Mexico.

9. Sceloporus grammicus Wiegm. One specimen ; No. 14246. I mention here that the range of the *S. variabilis* has been recently extended a considerable distance to the northward of the limit, Monterey, which I gave in my synopsis of the species of Sceloporus in the Proceedings of this Society, 1885, p. 397. Mr. Wm. Taylor has found it near San Diego in S. W. Texas, and Mr. Eugene Aaron has procured it from near Corpus Christi. For specimens from the latter place I am indebted to my friend Mr. J. L. Wortman.

10. Cnemidophorus sexlineatus Linn. Very abundant in three principal subspecific forms, which received names from Messrs. Baird and Girard. The characters displayed by these forms are instructive as showing how a longitudinally striped coloration may pass by insensible gradations into a cross-banded one. The subspecies and their forms are distinguished as follows :

Six longitudinal narrow stripes with unspotted interspaces.............. subsp. *sexlineatus.*

Six stripes as above, the dark interspaces with small white spots......... subsp. *guttatus.*

Six stripes as above, wider, and very obscure ; small obscure spots....... subsp. *No. 3.*

Six stripes as above, but wider, and the spots enlarged so as to be confluent occasionally with the light stripes. ....subsp. *No. 4.*

The stripes wider, and the spots confluent with them, so as to reduce the dark ground color to a series of rows of short transverse cross-lines.. subsp. *No. 5.*

The short black cross-bars more or less confluent across the positions of the light stripes, forming transverse cross-bands, which are generally best developed on the sides..........................subsp. *tigris.*

Of the above forms all are numerously represented in the collection. The modification of the color pattern described, is not entirely due to age, as some of the largest specimens belong to subspecies *guttatus,* and No. 3. Nevertheless small specimens predominate in the subspecies *sexlineatus,* and large ones in the subspecies *tigris.* Subspecies No. 4 presents a good many small specimens. The form I described as *C. communis* (Proceedings Am. Phil. Soc., 1877, p. 95), from Southern Mexico, has the coloration of the subspecies *guttatus* and No. 4, but differs from them in possessing a frenoöcular plate. In a few cases, however, this plate is wanting in specimens from the same locality, so that the form *communis* had best be regarded as another subspecies of the *C. sexlineatus.* The latter is the only one which is found in the Eastern and Austroriparian districts of North America.

Subspecies SEXLINEATUS ; Nos. 14236–41–49–69 ; 14305.
Subspecies GUTTATUS B. & G. 14231–41–305–308.
Subspecies No. 3 ; 14231–50–308.
Subspecies No. 4 ; 14241–50–302–5.
Subspecies No. 5 ; 14237–50–302.
Subspecies TIGRIS B. & G. 14237–50–302.

11. EUMECES OBSOLETUS B. & G. Two specimens ; No. 14244.

OPHIDIA.

12. SALVADORÆ GRAHAMIÆ Bd. Gird. Two specimens ; Nos. 14255–95.

13. RHINECHIS ELEGANS Kenn. *Arizona elegans* Kennicott, U. S. Mex. Boundary Survey, Reptiles, page 18, Plate . *Pityophis elegans* Cope, Check List Reptiles N. Amer., p. 39.

This species exhibits all the characteristics of the genus Rhinechis, which is represented by a single species of Southeastern Europe, the *R. scalaris.* The genus agrees with Pityophis and Spilotes in its entire anal scutum ; but differs from the former in having but two postfrontal scuta, and from the latter in its prominent rostral plate.

The Chihuahua specimen of this rare species differs somewhat from the type. It possesses twenty-seven rows of scales. The sides are of the darker tint of the dorsal spots, from which it results that the light interspaces of the dorsal region are entirely enclosed. There is no distinct row of lateral spots. No. 14298.

14. PITYOPHIS SAYI Schl., subsp. MEXICANUS D. & B. Several specimens ; Nos. 14222–66–93–94.

15. COLUBER EMORYI B. & G. Five specimens, two with twenty-nine, and three with twenty-seven rows of scales. Most of them have the normal number of labial plates, eight ; but one has nine on one side, and one has abnormally, ten on both sides. Nos. 14223–53–62–84–99.

16. BASCANIUM TÆNIATUM Hallow. One specimen ; No. 14272.

17. BASCANIUM FLAGELLIFORME Catesby, subsp. TESTACEUM Say. Three specimens ; Nos. 14224–79–83.

18. EUTÆNIA MULTIMACULATA Cope. *Atomarchus multimaculatus* Cope, American Naturalist, 1883, p. 1300.

The large numbers of this species taken by Mr. Wilkinson shows that Central Chihuahua is its headquarters. The specimens display a remarkable variability in coloration, and also prove that the azygos plate which exists between the prenasal plates of the typical specimen, is an abnormality. In one of the Chihuahua specimens there is an azygos plate between the internasals, which is of shorter form than in the type ; while in another there is an azygos plate between the prefrontals. In all of the others azygos plates are wanting. The ocular plates are normally 3–3, but the following variations occur. 2–3—2–3, one; 2–3—3–3, one; 2–2—3–3, one. The loreal is normally quite elongate; in one specimen it is shortened. The color varies from uniform brown above, to spotted in two styles. In one of these there are seven rows of brown spots with paler or rufous centres; in the other the brown borders of the spots have disappeared, and the rusty centres are represented by small rusty orange spots. The under surfaces are yellow, the gastrosteges with dark shading at the ends. In young specimens the head is more or less marked with obscure blackish marks. This species is distinguished by its long compressed muzzle.

The teeth in this species are equal, so that the genus Atomarchus to which I referred it stands related to Eutænia, as Regina does to Tropidonotus.

19. EUTÆNIA MEGALOPS Kenn. Cope, Proceeds. Amer. Philosoph. Society, 1884, p. 173.

Evidently the most abundant snake of Chihuahua. The large number of specimens sent display very little variation, and agree with one from New Mexico, described by me as above. The lateral band generally occupies only the third row of scales, but sometimes borders the fourth. The dorsal band very frequently occupies but one row of scales, but occasionally covers the halves of the adjacent rows. Nos. 14226–27–58–59–60–67–77–85–89–92.

20. EUTÆNIA CYRTOPSIS Kennicott. Cope, l. c., 1884, p. 174.

Only one specimen; No. 14256. The number of urosteges is exactly intermediate between the figures representing the supposed species *cyrtopsis* and *collaris* Jan. As there is no other difference it is probable that the latter name must become a synonym of the former.

21 HYPSIGLENA OCHRORHYNCHUS Cope. One specimen; No. 14287.

22. TRIMORPHODON VILKINSONII, sp. nov.

Scales in twenty-three rows. Superior labials nine, of which the fourth and fifth enter the orbit, and of which all are higher than long excepting the fifth and the eighth. Loreals two; oculars 3–3; temporals 3–3–3. Rostral not prominent, but the apex is recurved on the summit of the snout. Frontal plate rectangular, the lateral and anterior sides equal. Pariëtals narrowed posteriorly. Inferior labials eleven, the fifth in contact with pregeneials, and none in contact with postgeneials. Postgeneials much shorter than pregeneials. Gastrosteges 231; anal 1–1; urostoges 77. The body is compressed, and the head is very distinct. Total length, M. .272; of tail, .045; of head to rictus oris, .0092.

General color gray; the back is crossed by narrow black cross-bands, at rather remote intervals. These bands are pale bordered, and narrow to an apex below, which is above the gastrosteges. They become narrower posteriorly, and on the tail form half-rings. On the extremity of every third or fourth gastrostege there is a small black spot, throughout the length to the tail. There is a larger black spot on the sides between the extremities of a few of the cross-bands. The superior border of the sixth, and the adjacent part of the fifth superior labial, is black. On the top of the head are three large round black spots ; one is on the centre of the frontal and one is on the anterior part of each parietal. No cross-bands on the muzzle. The dark cross-bands are only two scales wide on the posterior part of the body ; on the anterior part they are three or four scales wide. The interspaces vary from twelve anteriorly to seven posteriorly.

One specimen ; No. 14268. This species is nearest the *T. biscutatus* D. & B. in squamation, but differs greatly in coloration from this or any other species of the genus.

I have given a brief synopsis of the species of this genus in the Proceedings of the American Philosophical Society for 1869, pp. 151–2. In introducing two new species I give another synopsis, the more, as I have received a considerable addition to my material since that date.

I. Scales in 21 rows ; superior labials nine.

Head with brown chevrons above ; back with diamond-shaped spots..... *T. lambda* Cope.

Head with a lyre-shaped pattern above ; dorsal spots in pairs............ *T. lyrophanes* Cope.

II. Scales in 23 rows ; superior labials seven.

Top of head black with a white T-shaped spot ; dorsal spots entire transverse diamonds.......................................*T. tau* Cope.

III. Scales in 23 (4) rows ; superior labials eight.

Top of head brown, with a small brown Y-shaped mark ; dorsal spots transverse diamonds, more or less transversely divided by paler..... *T. upsilon* Cope.

IV. Scales in 23 (4) rows ; superior labials nine.

Top of head brown ; dorsal spots numerous transverse more or less divided diamonds.................................*T. collaris* Cope.

Top of head white, with three round black spots ; dorsal spot, few transverse undivided black rhombs, with pale edges ...*T. vilkinsonii* Cope.

V. Scales in 25 (7) rows ; superior labials nine. Top of head with chevron bands ; dorsal spots formed of four confluent spots and enclosing a pale centre.................................*T. biscutatus* Cope.

Of the preceding species I have before me one each of the *T. lambda ; tau* ; *collaris* and *vilkinsonii*. Of the *T. lyrophanes* there are six specimens ; of the *T. upsilon* six, and of the *T. biscutatus* four.

I append a description of the new species *T. lambda*. The muzzle is rather elongate, as in the *T. biscutatus*. There are three loreals, and the oculars are 3–3 ; the temporals are 3–4–3–4. The fourth and fifth labials enter the orbit, and the sixth, seventh and eight are higher than long. Pregeneials longer than postgeneials. Internasals small, wider than long ;

pariëtals rather short. Gastrosteges 234, anal 1–1; urosteges 83. Color above light gray crossed by brown transverse diamond-shaped spots, each with a pale transverse centre. Three or four of the most anterior spots are subhexagonal, being truncate at each side. All are surrounded by a pale shade. Each end of every second or third gastrostege is marked with a small dark brown spot, which extends upwards on the first row of scales, and sometimes is confluent with the lateral apex of the dorsal spot. Total length, .304; of tail, .054. From Guaymas, Sonora, presented to the National Museum by Mr. H. F. Emerich. No. 13487.

23 Crotalus adamanteus atrox B. & G.

One specimen; No. 14280.

24. Crotalus adamanteus scutulatus Kenn.

Five specimens; Nos. 14225–73–78. The tendency to the development of scuta on the head, especially on the pariëtal region, is greater than in any specimens I have seen from other localities.

General Remarks.

The preceding investigation shows that the reptile fauna of the plain of Chihuahua is that of the adjacent regions of Arizona, New Mexico and Texas, with the accession of a very few forms which are more distinctively Mexican. Only two species come under this designation, viz: *Uta bicarinata* and *Sceloporus grammicus.* The *Eutænia cyrtopsis* has also an extensive Mexican distribution.

An Obituary Notice of James Macfarlane. By J. P. Lesley.

(*Read before the American Philosophical Society, December 4, 1885.*)

The Society has suffered, by the recent death of its member, Mr. James Macfarlane, of Towanda, in Bradford county, Pa., the loss of a man of distinguished abilities and sterling virtue, universally loved, respected and confided in, a practical business man of the first rank, a lawyer of great reputation, especially for his conduct of railway litigation, a judicious geologist especially devoted to the subject of coal, the author of valuable books in extensive circulation, and a citizen of the Commonwealth entrusted at various times with the conduct of public affairs.

He was elected to membership in this Society, Jan. 19th, 1883, and regarded it with genuine pleasure and pride, as the best recognition of his standing among men of science and literature, not only in his native State, but in this and foreign lands. But his busy life and literary works prevented him from making communications to the Society, at its stated meetings, which he could not attend on account of the distance from his home, the multiplicity of his engagements, and his failing health.

He became a member of the American Association for the Advancement of Science, in 1880, and a fellow in 1882, and assisted at its meetings in Boston, Montreal, Minneapolis, Philadelphia and Ann Arbor, the latter but a few weeks before his death.

In 1872 Pennsylvania College conferred upon him the degree of Doctor of Philosophy.

He was appointed by Governor Hartranft, in 1874, one of the ten Commissioners for the Second Geological Survey, and was punctually present at all the quarterly meetings of that board up to the present year, taking the most lively interest in its proceedings, being an active member of its Publication Committee, and answering readily to every call for business consultation and official action in Harrisburg and Philadelphia around the year. In fact, he completely identified himself with the Survey and thought nothing a trouble which he could do to further its progress, or improve its operations. Its success has been largely due to the devotion of his singular intelligence and disinterested coöperation. His loss is felt severely in many places, but nowhere more severely than in the circle of distinguished men appointed to accomplish the will of the Legislature respecting the Geological Survey. His training in general geology, and his rare acquaintance with the coal measures, his experience in publishing his own scientific works, and his legal acumen, combined to make his appointment to this official post a fortunate event, and to make his sudden death a calamity. It may be said with truth that no other citizen of the State can be found to exactly replace him.

Shortly before his death he occupied another most useful and responsible office, that of Arbitrator for the general coal-trade centring at Buffalo in Western New York. His choice for such a post itself sufficiently marks the character of the man, and the distinguished consideration in which he was held by everybody, as a man of honor, intelligence and experience in affairs. He stood in the midst of many rival interests, both of capital and labor, a referee and mediator, an adjuster and a judge, armed with no powers but such as were voluntarily conceded to him by all concerned for the general good; and it is needless to say with what tact and skill, and integrity he fulfilled his difficult duties to the general satisfaction. That he was a good citizen, a loving friend and devout Christian will not explain it; for many a good man would fail to fill such a place for want of other qualities which he possessed. Some men are born to rule; others live to make themeselves the servants of mankind, and he was one of these, and died in the general public recognition of it; all honor be to his memory!

Middle Pennsylvania may be proud of its Scotch and Scotch-Irish settlement blood; its Hendersons and Hamiltons, its Rosses and Stewarts and Murrays, its McAlisters, McKinleys, McCormicks, McCauleys and McFarlanes; strong wills, bold hearts, long heads and stalwart bodies; great breeders of handsome and able children; a capable race for thinking strongly and executing vigorously the plans and purposes of men.

James Macfarlane was of this fine stock. His face wore the aspect of intense vitality; his forehead was high and massive; his voice was pitched low, and his speech was decisive; he had no hesitations. One could divine at a glance why he was an ardent Christian and why he was a powerful legal pleader. He lived the life of a perpetual thinker, whose will was as urgently exercised as his reason and his imagination; for he lived in the thick of the general battle of life. Such men always come to the fore, and formulate events, and qualify the next generation. They hold the plough by both handles, and deepen the furrow at every tillage, turning up the subsoil sooner or later; doing all things thoroughly.

I speak of James Macfarlane warmly as a personal friend to whom I owe much; but I may be permitted to say that I regard with a sentiment akin to veneration the Scotch courage which could suffice to deliberately face and execute such an enterprise as the description of all the Coal Regions of America, and follow it with such another enterprise as his geological guide to the Railways of the United States, he, a practising lawyer and practical coal operator, as if he were a man of leisure. Such operations are only for the world's workers, born and bred to much thought and many deeds.

His first home was in Gettysburg, where he was born, Sept. 2d, 1819, and graduated at Pennsylvania College in 1837. That same year he joined the corps of civil engineers on the line of the North Branch canal, with headquarters at Towanda. After several years of this employment, he went to Carlisle, read law with Judge Graham, was admitted to the bar in 1845, and settled to practise in New Bloomfield, Perry county, for eight years, serving three years as District Attorney. Here he married Mary Overton, daughter of the late Edward Overton, who survives to lament his loss. In 1851 he returned to Bradford county to practice law at Towanda, being in 1852 elected District Attorney of the county, until 1859. He then accepted the position of General Superintendent of the Barclay Coal Company, which he relinquished, in 1865, to organize the Towanda Coal Company, which afterwards passed under the control of the Erie Railroad. He then became General Sales Agent of the Associated Blossburg Coal Company, with offices at Rochester, Syracuse and Elmira. In 1880 he organized the Long Valley Coal Company and developed its mines. In 1885 he was selected, as I have already said, to be Arbitrator of the Bituminous Coal Combination at Buffalo. When the combination was broken up, he returned to Towanda to work on a second and enlarged edition of his Geologists' Traveling Hand-book, or American Geological Railroad Guide, when, without warning, he died of heart disease, Oct. 15th, 1885.

He leaves his work half done, about 200 pages being in type, and many pages of MS. in a more or less finished state.

The Coal Fields of America is his most noted work and has had a large sale on both sides of the Atlantic. This brought him a considerable practice as an expert in coal operations. He wrote several geological articles for the American Encyclopedia, and one on the Bituminous Coal Fields of Pennsylvania for Gray & Walling's Atlas. He wrote also for the Evangelical Review.

Sur le Rhinocheilus Antonii. Par Dr. Alfredo Dugés.

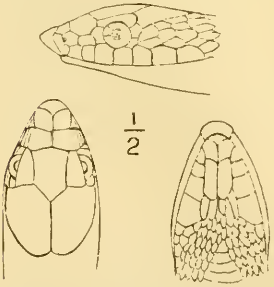
(*Read before the American Philosophical Society, January 1, 1886.*)

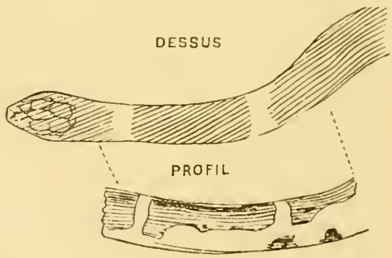
Je dédie cette nouvelle espèce de Rhinocheilus á la mémoire de mon père, le Prof. Antoine L. Dels. Dugès, bièn connu dans les sciences naturelles par ses travaux variés.

L'Ophidien qui fait le sujet de cette description avait été un peu sêché avant d'être mis dans l'alcool, de sorte qu'il est impossible de dire exactement quelle est la forme du tronc.

	M.
Longueur de la tête et du tronc........................	0.275
" " queue	0.035
Total....................................	0.310

La tête mesure un centimètre de longueur; la queue est contenue 10 fois dans la longueur totale. Il y a 17 rangs d'écailles lisses luisantes, rhomboidales, au milieu du tronc; les latérales plus grandes que les médianes. Deux-cents gastrostèges. Anale indivise. On compte 38 urostèges simples, suivies de trois doubles, la queue étant terminée par un petit bouton allongé et sillonné. Les sous-labiales sont au nombre de 9, dont 4 en contact avec les sous-maxillaires, la 5ème plus grande que les autres. Deux grandes sous-maxillaires allongées suivies de deux autres petites que sont séparées par de petites écailles. Rostrale en forme de cuillère déprimée, saillante, dépassant la mâchoire inférieure, coupée obliquement en dessous, et rabattue en haut où sa pointe pénètre entre les deux préfrontales antérieures (internasales) sans les sèparer entièrement. Préfrontales postérieures plus grandes que les antérieures. Frontale, à six pans, plus large en avant qu'en arrière, à angle antèrieur très-obtus. Suroculaires triangulaires. Pariétales grandes. Nasale double; la postérieure est plus grande et à son bord antérieur s'ouvre la narine. Frénale assez petite, plus longue que haute, largement en contact avec la préfrontale postéri-





eure. Préoculaire unique, allongée verticalement, et séparée de la frontale par l'angle antérieur de la supraoculaire. Deux postoculaires. Deux temporales assez grandes et allongées, suivies de six écailles semblables à celles du cou, mais que leur position indique comme des temporales. Huit labiales supérieures : la 1ère dépasse la narine ; la 2ème est en contact avec la nasale posterieure et la frénale ; la 3ème touche la frénale seule ; la 4ème est en contact avec la préoculaire et l'œil ; la 5ème avec l'œil et la postoculaire inférieure ; la 6ème avec la postoculaire inférieure et la temporale inférieure du premier rang ; la 7ème avec cette temporale et l'inférieure du second rang ; la 8ème avec les deux dernières temporales inférieures.

Les dents toutes égales n'offrent pas d'intervalle libre.

Le tête de ce serpent est á peine distincte du cou : elle est convexe à la région frontale, et le museau se relève légèrement en forme de groin. Les formes sont assez élancées. La pupille est circulaire.

Une grande tache noire couvre tout le dessus de la tête et s'étend en arrière d'une quantité égale sur le cou. La rostrale, le canthus rostralis, les postoculaires et les lèvres sont blanchâtres tachetées de noir ; le reste du dessous de la tête est blanc. Sur le corps et la queue on voit dix-neuf longues taches noires occupant chacune environ une vingtaine d'écailles en série longitudinale, séparées par des bandes blanches (sur l'individu en alcool, du moins) transversales qui couvrent 4 ou 5 écailles. Ces grands espaces noirs se continuent sous le ventre d'une manière très-irrègulière ; les uns interrompus, les autres formant comme un damier sans ordre.

Le seul exemplaire que je possède de cet Ophidien vient des environs de Mazatlán, côte du Pacifique.

GUANAJUATO, 17 Septembre, 1885.

A revision of the Section of Chemung Rocks exposed in the Gulf Brook Gorge at LeRoy, in Bradford County, Pennsylvania. By A. T. Lilley, of LeRoy.

(Read before the American Philosophical Society, January 15, 1886.)

	Feet.
1. Cap of Chemung with *Atrypa* and many unrecognizable forms in light shale, among which are *Spirorbis* and *Rhynchonella*	1
2. *Productella* bed in gray sand	10
3. Green shale	15
4. Red shale	4
5. Green Shale	20
6. *Grammysia elliptica* bed and gray shale	25
7. Iron ore, with *Spirifer*, *Pterinea*, *Crinoids*, *Grammysia*, *Spirorbis* and *fish remains*	4

		Feet.
8.	Green shale	20
9.	Red *fucoid* bed	8
10.	Green sandstone	20
11.	Red shale and sand with unrecognizable fossils	4
12.	Conglomerate with pebbles, lime, *Spirifer, Productella* and *fish* remains	6
13.	Green shale	10
14.	Pink shale	2
15.	Green shale	40
16.	Green sandstone	2
17.	Green sandstone	19
18.	Gray sandstone	1
19.	Green shale	52
20.	*Strophomena bed*	1
21.	Green sandstone	14
22.	Green shale	40
23.	Brown sandstone, with *Spirifer* and *Productella*	1
24.	Gray sandstone, with *Crinoids* and *plants*	8
25.	Green shale	6
26.	Green sandstone and shale, with *Crinoids* and *Spirifers*	8
27.	Gray sandstone and shale	60
28.	Green sandstone, with *mollusks* and *Bothriolepis*	53
29.	Red shale and sandstone, *Bothriolepis, Spirifera, Spirorbis, Rhynchonella* and *ferns*	14
30.	Brown sandstone, with *shells* and *Holoptychius*	39
31.	Green shale	6
32.	Red sandstone, with *iron ore* and *mollusks*	8
33.	Gray shale	8
34.	*Calcareous iron ore* and sandstone *with crinoids*	12
35.	Brown shale	20
36.	*Calcareous iron ore* (red) and sandstone, *Bothriolepis*	11
37.	Gray sandstone and shale, with *mollusks*, carbonized *plant stems*, iron and copper pyrites	2
38.	Brown sandstone, with *Cryptonella*	10
39.	Brownish sandstone, with *Spirorbis* and *Cryptonella*	35
40.	*Crinoidal limestone*	4
41.	Bluish shale	8
42.	*Calcareous* red sandstone	9
43.	Brown sandstone	18
44.	Green sandstone, *Pterichthys rugosus*	8
45.	*Calcareous* sandstone	4
46.	Green sandstone and shale	90
47.	*Calcareous* sandstone	5
48.	Light-gray sandstone and shale	130

		Feet.
49.	Gray shale	63
50.	*Conglomerate*, with *mollusks*	3
51.	Green shale	12
52.	Green sandstone and shale	270
53.	*Limestone* with *mollusks*	2
54.	Gray sandstone and shale, with *Zaphrentis* and *Grammysia circularis*	220
55.	Gray sandstone, with *fucoids*	1
56.	Green sandstone, with *Dictyophyton*	42
57.	Blackish shale, with *Lepidodendra* and *Calamites*	50
58.	Green and brown sandstone and shale	100
59.	Green shale	25
60.	*Upper Ambocœlia bed,* with *Laxonema, Spirifer, Grammysia* and *Bellerophon*	2
61.	Unexposed for	70
62.	*Lower Ambocœlia bed* in green shale	50
63.	Unexposed to line of Granville township	50
64.	Green and olive shale, holding *Orthis, Chonetes, Cypricardites, Tentaculites, Pterinea, Tregonia* and *Rhynchonella*	150
65.	Unexplored	183
66.	Blue shale and sandstone	13
	Total	2201

Mr. Lilley says in his letter that Granville Centre is on ground 250 feet lower (geologically) than the township line. Between the two is an exposure of about 150 feet of shale and sandstone containing *Orthis, Chonetes, Cypricardites, Tentaculites, Pterinea, Trigonia* and *Rhynchonella.*

He adds that Adam Dennis has recently bored a six-inch hole for water to supply his tannery, on the south side of the stream near Granville Centre. It is ninty-six feet deep; and the bottom thirteen feet was in blue shale and sandstone.

By combining these data the original section was enlarged and improved. But Mr. Lilley has used every opportunity during the last two years to increase its value, and has found forms which he is unable to name.

REMARKS ON INDIAN TRIBAL NAMES.

By W. J. Hoffman, M.D.

(Read before the American Philosophical Society, February 5, 1886.)

During the past fifteen years' experience with the numerous tribes of Indians of the United States, the present writer has frequently observed that certain tribes were not familiar with the names applied to them, as found in current literature, but that they had distinct tribal designations for themselves, which, for some reason unknown, were seldom met with outside of the tribe itself. Frequently a common term is met with, which may apply to a number of tribes, as the term Digger, which has been used with reference to at least fifty different tribes and bands along either side of the Sierra Nevada ; so also with the word Snake, being used for several tribes and bands in Nevada, Idaho and Oregon.

It is the intention here to present the names of a few well-known tribes, and to give their tribal designations with such explanations as is possible. Many others might be added, but the following are deemed sufficient to illustrate the preceding remarks, and may serve as a contribution to a general work on the Ethnography of North America, which should of necessity embrace a synonomy as complete as practicable.

Tsa′nish.

The tribe of Indians known as the Arĭ′karĕ or Rees, forms the northernmost branch of the Panian linguistic family, and has for a number of years lived in the vicinity of Ft. Berthold, D. T., on friendly terms with the Mandans and Hidatsa. The alliance formed by these three tribes was not based upon friendly feelings for one another, but for mutual resistance against the Sioux on the south, and the occasional incursions of the Crees on the north. At the present day it is seldom that a Mandan, or a Hidatsa, will select an Arikare wife, though the contrary is of frequent occurrence. The village consisted, at the time of the present writer's last visit in 1881, of one hundred and thirty-four lodges, the eastern half being entirely occupied by the Arikare, who numbered about seven hundred and fifty souls, while three-fourths of the other half was occupied by the Hidatsa, and the remaining dwellings by Mandans. The total population of the village was about fifteen hundred.

The word Arĭk′arĕ, is of Hidatsa origin, and was changed by the Mandans into Ai-dĭk′-a-da-hu. The word signifies "The-people-of-the-flowing-hair," from a′-ra—*hair ;* ka′-ra (or ka′-da)—*to run*, or *flowing*, and a-hŭts′ (a-hŭ′)—*many*. The word is abbreviated, by the Hidatsa, into A-rĭk′-a-hŭ, and by the Mandans into A′-rĭ-kă′-ră, from which the common term is derived.

The tribal designation is Tsa′nish, a word employed at all times to denote the tribe in general, or an individual member thereof. The word signifies *people*, according to themselves, but the tribal designation in gesture-signs signifies *corn-shellers*, and is made by loosely closing the left hand and holding it horizontally in front of the breast so that the thumb is directed forward; the right is then similarly closed with the thumb almost straight, and a motion made with the right against the left, as if shelling corn.

The following synonomy may serve for further study regarding this interesting tribe:

Tsa′nish.	Tribal designation.
Ta-nish. Sa-nish′.	Hayden. Eth. & Phil. of the Missouri valley. 1862. p. 356.
Stâr-râh-hé.	Lewis and Clark. 1806. p. 22. "Tribal name."
Starrahe.	Bradbury. Travels. Liverpool, 1817. p. 111.
Aracaris.	Gass. Journal, 1807. p. 400.
Aricaree.	Saxton, in Rep. N. P. R. R., 1854, p. 239.
Aricaris.	Gass, *op. cit.*, p. 48.
Aricas.	Prichard. Phys. Hist. Mankind, 1847. Vol. v, p. 408.
Arikara.	Brackenridge. Views of La. 1815. p. 76.
Arikkaras.	Maximilian. Travels. 1843. p. 143.
Arricaras.	Keating's Long's Exped. 1824. i, p. 424.
Arrickoras.	Webb. Altowan. i. 1846. p. 83.
Auricara.	Ind. Treaties. 1837. p. 447.
Black Pawnees.	Pritchard. *op. cit.*, p. 408.
Corn Eaters.	Culbertson. Rep. Smithsonian Inst. for 1850, p. 130. "Their own name."
Eokoros.	Coxe. Carolana. 1741, map.
Eskoros.	La Hontan (Schoolcraft's Travels in 1820). Albany, 1821. p. viii.
Pa-da′-ni. Pa-la′-ni. Pa-dai′-na. Pe-nai′-na.	So called by various bands of Sioux. Dialectic forms. Signifies *enemy*.
Pe-da-nis.	Warren. Nebraska and Arizona (1855–7), 1875, p. 50.
Pawnee-Rikasrees.	Nuttall. Journal. Philad'a, 1821. p. 81.
Racres. Recaro.	Lewis. Travels. 1809. p. 15.
Rees.	Franchere. Narrative. N. Y., 1854. p. 54.
la Ree.	Lewis and Clark. 1806. p. 22.
Rhea.	Hallam. In Beach's Ind. Miscellany. 1877. p. 134.
Ricara.	Lewis. Travels. 1809, p. 3.
Ricarees.	Maximilian. *op. cit.*, p. ix.
Ricaris.	Gass. Journal. 1807. p. 48.
Ricars.	Lewis & Clark. 1806. p. 24.
Rice Indians.	Franchere. *op cit.*, p. 54.
Rickaree.	Irving's Astoria. N. Y., 1849. p. 119.
Rikkaras.	Maximilian. *op. cit.*, p. 167.

Le Ris.	Maximilian. *op. cit.*, p. 167. "So called by Canadians."
O-no'-ni-o.	Hayden. *op. cit.*, p. 290. "So called by Cheyennes."
Ka'-nan-in.	Hayden. *op. cit.*, p. 326. "So called by Arapahos."
A-pan-to'-pse.	Hayden. *op. cit.*, p. 402. "So called by 'Crows.'"

SHO'SHONI.

The Sho'shoni tribe of Indians is a part of the Shoshonian ethnic division which formerly occupied the greater portion of country lying between the Sierra Nevada and the Rocky mountains, and from northern Idaho southward to the Moki villages, and across Southern California to the Pacific ocean. Within the last few centuries, another branch has extended toward the southeast, viz: the Comanche. According to Buschmann, and Gatschet, the Shoshonian tribes are an offshoot of the northern branch of the Nahuatl linguistic division.

The following brief synonomy is here presented for further investigation:

Sho'shoni.	Tribal designation.
Shoshonee.	Lewis and Clark. Allen's ed. 1817. ii, p. 587, *et passim.*
Shoshonie.	Parker (S.). Journal. Ithaca, 1842. p. 80.
Shoshocoes.	Ex. Doc., H. R., 31st Cong., 1st Session, pt. iii. 1849. p. 1002. — Schoolcraft, vi, p. 697.
Shoshokoes.	Irving's Astoria. 1836. p. 48.
Root Diggers.	Farnham. Travels. N. Y., 1843. p. 74.
Shothoucs.	Coke, Rocky mountains. 1852. p. 275.
Shirrydikas.	Ross. Fur Hunters. i, pp. 249, 251. "Are the real Shoshones."
Soshones.	De Smet. Letters. 1843. p. 36.
Alliatan.	Lewis and Clark, Exped. 1814. ii, p. 131.
Aliton.	Am. State Papers. IV. 1832. p. 710.
Serpentine Indians.	Lewis and Clark. Travels. 1809. p. 10.
Gens des Serpent.	" " " 1806. p. 60. So called by the French.
Slang Indianern.	Lewis and Clark. Van Kamper's Dutch ed. 1818. iii, p. 144.
Snake.	Ross. Fur Hunters. pp. 249, 251, and other authors.
Serpents.	De Smet's Voyage. p. 47.

Many other forms might be cited, but the above appear almost superfluous. The name Snake, it is said by one author, was taken from the Snake river flowing through the country of this tribe, on account of the numerous puff adders found upon its banks. Be that as it may, the word "snake" has no linguistic relationship whatever to the word "Shoshoni." The word ni^{n}'ama is used to denote the tribe as *people, first born*, but the word Sho'shoni, sometimes So'soni, is always given to designate the tribal name, at the same time the gesture-sign is added, by placing the closed right hand near the right hip, forefinger extended and pointing forward, palm down, then as the hand is pushed to the front and toward the left, the hand is rotated from side to side, giving the index a serpentine motion. This is also the *sign* for snake, as a reptile.

It is quite natural to suppose, therefore, that when Lewis and Clark's party met with these Indians they at once considered the tribe to designate itself as *Snakes*, thinking, possibly, that the word Sho′shoni meant the same.

The writer has at no time during his frequent visits to these Indians been successful in obtaining from themselves a clear interpretation of the word.

The Rev. J. W. Cook, gives the Yancton Sioux word, as applied to the Sho′shoni, as Pe-ji′-wo-ke-ya-o-ti—*Those dwelling in grass lodges.* This term may have originated at a time when the Sho′shoni still built their lodges in the primitive form, a process described to the writer by some of the tribe, a short time since. Four poles were placed upright, at equal distances to form a square, each having a fork at the upper extremity for the reception of cross-pieces upon which to construct a roof. The sides of the square were closed by placing thin willow poles, vertically side by side, after which the broad leaves of water-grasses and rushes—*sho′nip*—were woven into them, horizontally, from side to side. By passing the end of a leaf in and out, or alternately in front of and behind these thin poles, a serpentine motion is observed, when viewed from above, which exactly corresponds to the gesture-sign and which, strange to say, was made when illustrating this method of constructing the walls of a lodge. It is the belief of the present writer, that the sign has reference to the weaving or building of a grass lodge, and that the word Shoshoni signifies something of *a similar nature.*

The term Shoshocoe [Shosho′ki], has been met with in current literature so frequently that a few words respecting it may not be amiss. The word is generally applied to those who go *on foot*, in contradistinction to Sho′shoni who own horses. Should a Sho′shoni, therefore, lose or dispose of his horse, he at once becomes a Shoshocoe. The term as applied, to signify a tribe or portion of a tribe, *i. e.*, as a tribal designation in the strict sense of the word, is therefore erroneous. What were these people before they possessed horses?

According to the chief men of the western Sho′shoni, their tribe was formerly composed of seven bands—which may, in reality, have been gens, as follows, viz:

I. Tu′kuari′ka. Mountain-Sheep-Eaters.

= *Sheepeaters.* Rep. Ind. Affairs for 1871, 1872, p. 432.

= *Tookarikkahs.* Bancroft. Nat. Races. i, p. 463.

= *Mountain Shoshone, or "Sheepeater" band.* Jones' Wyoming Exped. p. 275.

=*Tuka-ri′ka, "Mountain-sheep Eaters."* U. S. Geog. Surveys W. of 100th Meridian. vii, p. 410.

II. Taza′aigadi′ka. Salmon-Eaters.
= *Aggitikkahs or Salmon-Eaters.* Bancroft. Nat. Races. i, p. 463.
= *Warareekas, Fish-Eaters.* Ross. Fur Hunters. i, p. 249.

III. Ti′vati′ka. Pine-Nut-Eaters.
= *Yampatickara.* Brownell's Ind. Races. pp. 533, 537.

IV. Sho′nivikidi′ka. Sun-Flower-Seed-Eaters.

V. Ho′handi′ka. Earth-Eaters.
= *Hohandikahs, Salt Lake Diggers.* Bancroft. Nat. Races. i, p. 463.
= *Hohan-tikara.* U. S. Geogr. Survey W. of 100th Meridian. vii, p. 409.

VI. Sho′hoaigadi′ka. Cottonwood-Salmon-Eaters.
= Boise. Rep. Ind. Affairs for 1871, 1872. p. 432.

VII. Ya′handi′ka. Ground-Hog-Eaters.

Of the above, the Tu′kuari′ka formerly occupied the country about the headwaters of Yellowstone river, the present head of the band Ten′doi, being also chief of the tribe. By birth he is a half Banak—or more properly Panai′tĭ. The Ti′vati′ka occupied the southern interior of Nevada, and were found, in 1871, living principally in the mountainous regions where there was an abundance of the Nut Pine (*Pinus edulis*), upon the fruit of which they subsisted to a great extent.

Panai′tĭ.

This tribe was formerly located west and north-west of the area appropriated by the Sho′shoni, embracing the eastern half of Oregon, Western Idaho and possibly a part of Washington Territory. According to extensive vocabularies collected by the writer, the languages of the two tribes are linguistically closely related, much more so than one is usually led to believe. The general designation for these Indians, as well as for many more along the coast side of the Sierra Nevada, is Digger. The following is a brief synonomy :

Panai′tĭ.	Tribal designation.
Banai′ti.	So called by the Sho′shoni.
Bwanacs.	Rep. Ind. Affairs for 1849–50. 1850. p. 49.
Bonarks.	Sen. Ex. Doc., 31st Cong., 2d Session, i, 1850. p. 198.
Bonacks.	Wilkes' Narrative U. S. Explor. Exped. iv, p. 502.
Bannacks.	Rep. Ind. Affairs, for 1871, 1872. p. 432.
Banattees. Robber Indians.	Ross. Fur Hunters. i, pp. 249, 251.
Ponashta.	Sen. Ex. Doc., 31st Cong., 2d Session, i (1st part), 1850. p. 158.

Poor Devil Indians. } De Smet. Voy. ii. pp. 45, 46.
Les dignes de pietié. }
Banak. } By authors generally.
Bannock. }
Snake. }

But four bands exist at this day, which are known as the

Kutsh′undika.	Buffalo-Eaters.
Sho′hopanai′ti.	Cottonwood-Banaks.
Yam′badi′ka.	Yampa (root)-Eaters.
Wara′dika.	Rye-Grass-Seed-Eaters.

It is more than probable that seven bands existed in earlier times; but owing to the union of the Panai′ti and western Sho′shoni, it may be that the remaining three bands affiliated with similarly named bands of the latter, resembling in this respect frequent occurrences of like character among other tribes, notably so among those of the Dakotan linguistic division.

Coman′che.

This tribe is more nearly related to the Sho′shoni, linguistically, than any other of the Shoshonian family. According to several old and intelligent members of the tribe, the Comanches came to the country they now occupy, from the Northwest, since the introduction of horses. During their migration the tribe consisted of seven bands. A new band was formed, after leaving the Rocky Mountain divide, which was composed of individuals from all of the seven, and known as the Nau′niĕm—*Ridge People*, who remained behind to catch wild horses. When a sufficient number of animals had been captured they followed the tribe and the different individuals joined their respective bands. What length of time may have been required for horses (which were brought from Mexico by the early explorers, Coronado and his successors) to escape, and to increase sufficiently in number to run in herds along the eastern spurs of the Rocky mountains, is a subject difficult to solve. It may be presumed, however, that, if the story of the Comanches is correct, that their migration must have been made during the latter part of the 16th century.

Seven bands exist among the Coman′chĕ, as follows:

I. Yam′pari′ka. Yampa (root)-Eaters.
= *Yampah Indians*, of authors.
= *Yam-pa-se-cas.* Rep. Ind. Affairs. 1848. p. 574.
= *Sampariclca.* Maximilian (of Wied). Travels. 1843. p. 510.

II. Pe′nete′ka. Honey-Eaters.

III. Ko′stshote′ka. Buffalo-Eaters.

IV. Tist′shinoie′ka. "Bad-Movers," *i. e.*, Those who move with difficulty.

V. Kua'hadi. Antelope People.

VI. Tini'ema. Liver-Eaters.

VII. Ti'tsakanai. The-Sewing-People, *i. e.*, Those who sew moccasins.

The temporary band, before mentioned as the Nau'niem—*Ridge People*—are given in Schoolcraft as Par-kee-na-um. Two other names of bands occur in literature, as well in the recollection of some of the Indians, but as individuals in those bands had the same name as that of the band to which they belonged, it became necessary at their death to rename the band, as the name of a deceased Comanche is never pronounced aloud. Therefore, the No'koni—*Movers*—became the Tístshnoie'ka—Bad-Movers, and the Wiuini'em—*Awl-People*, were renamed as the Títsakanai—*The-Sewing-People.*

The following brief synonomy will suffice for further reference and information :

Ni^{n}am.	Tribal designation. Signifies *people.*
Ayutan.	Brackenridge. Views of La. 1815. p. 80.
Bald Heads.	Long's Exped. Rocky Mts. 1823. i, p. 155.
Camanche.	Brackenridge. Views of La. 1815. p. 80.
Cannensis.	French. Hist. Coll. ii. 1875. p. 11. Note.
C̆a'-tha.	Hayden. Eth. & Phil. Mo. River Valley, 1862. p. 326.—Refers to their having many horses.
Comandes.	Maximilian. Travels. 1843. p. 510.
Cumanche.	Farnham. Travels. 1843. p. 8.
Cumancias.	Long's Exped. Rocky Mts. 1823. i, p. 478.
Hietans.	Lewis and Clark. 1806. p. 76.
Iatans.	Irving's Astoria. 1849. p. 160.
Ietan.	Pike. Travels. 1811. p. xiv.
Iotan.	Irving (J. T.). Indian Sketches. 1835. p. 136.
Itean.	M'Kenney. Wrongs and Rights of the Indians. ii. 1846. p. 94.
La Paddo.	Lewis and Clark. 1806. p. 64.
La Plais.	Long's Exped. Rocky Mts. 1823. i, p. 155.
La Play.	Lewis and Clark. 1806. p. 17.
Na-uni.	Coues and Kingsley. Standard Nat. Library. 1883. pt. 6, p. 186.
Paducas.	Lewis. Travels. 1809. p. 15. [Said to signify wet noses.]
Padducas.	Pike. Travels. 1811. p. 347.
Padoucas.	Brackenridge. Views of La. 1815. p. 80.
Padoucar.	Lewis. Travels. 1809. p. 15.

Ni'^{n}am is the tribal designation, the word Comanche being of Spanish (?) origin, and the definition unknown. The Indians themselves generally pronounce it *Comántsh.*

Those who are familiar with the language spoken by most of the *Greasers,* or lower class Mexicans, know how corrupted the Spanish language has become in the south-west portion of the United States. The Castilian words caballo, *horse*, becomes kawa′yo; cuchillo, *knife*, kutshi′yo, etc., the *ll* invariably becoming *y*. So also with numerous other words and phrases, as mucho, *much*, becomes muncho [or mu′ntsho]; muchos *many*, munchos; Adonde va Vd?—*Where are you going?* is abbreviated into *Unde va?* Upon the same basis of corruption and alteration, it is *possible* that the word Comanche may be an abbreviation for *many horses*, from the *greaser* words Kawa′yos—*caballos*, and mu′nchos—*muchos*, *i. e.*, many horses. Another suggestion might be offered with regard to the word, viz: c̆a (= casa), an antiquated Spanish word for house, or chief branch of a family, and mancha, a spot, stain, soiled, dirty; thus by slight alteration and corruption gradually becoming ca-manches—*soiled* or *dirty houses* or *lodges*. These suggestions are mere passing impressions, and are given for what they may be worth.

Kawĭ′a.

The numerous bands of Indians formerly scattered over the marshy country bordering on Tulare lake, the plains and western spurs of the Sierra Nevada, and the tributaries of the head of San Joaquin river, Cal., were known as the Tulareños, and later as the Tules. The most important band, being known as the Kawi′a, was located on "Kaweah" creek, and this name was, later on, applied to the Tule Agency bands generally. The various names comprising the sub-divisions of the tribe, given by Powers, in Contrib. N. Am. Ethnol., iii, are chiefly geographic terms and relate to some peculiarity of the region occupied, or to an abundance of some particular kind of vegetation, food, etc.

The term Yo′kŭt or Yo′kuts, previously employed to designate this tribe, as well as a distinctive term for a linguistic family, appears to be erroneous and inappropriate. To more clearly illustrate what may be stated below, it is necessary to present the subdivisions of the Kawi′as linguistically. The entire group of sub-tribes comes, at this date, under two heads, the Kawi′a proper, or Tule Indians, and the Tĭn′lĭu or Tejon Indians, the latter being divided, a portion of them living near Tule Agency, and the remainder scattered along the various settlements as far southward as Tahachapi pass.

The Kawi′a are composed of the following bands or sub-divisions, viz:

Yawitshĕn′nĭ. The Tule Indians proper.

Wĭktshŏm′ni.

= We-chummies. Rep. Ind. Affairs for 1857, 1858. p. 399.

= Wichumnies. " " 1872. p. 381.

Yo′ko.

Bâdwī′sha.

Bŏdĕr′wiūm′ĭ.

Bo[n]galaa′tshi.

Ya′wĕdmŏ′nĭ.

Tĭn′lĭu. Tribal designation of Tejon Indians.

The word Tejon undoubtedly originated with the Spanish and is merely a translation of the Indian word Tĭn′lĭu, *a badger hole;* in Spanish spelled Tejon from *Texon* (Portuguese *Teixugo;* Provençal *Tais, taiso′*), and does not originate from the many depressions found in the country occupied by this people, but from a myth having allusion to their origin in peopling the country by coming out of the earth through badger holes, and consequently calling themselves *Badger-hole People.*

The Yawitshĕ′nnĭ or Kawi′a, are called Yawĕdĕn′tshi by the Wĭktshŏm′ni, and the following brief synonomy may be of interest.

Kawi′a.	
Keawahs.	Rep. Ind. Affairs. 1872. p. 381.
Cowiahs.	*ibid.* " " 1854. p. 11.
Chow-chillas.	*ibid.* 1856, 1857. p. 252.
Cow-illers.	*ibid.* 1857, 1858. p. 400.
Cowwillas.	*ibid.* 1861. p. 218.
Tulare.	By authors generally.
Tule.	By authors generally.

About the year 1867, the Manache Indians, who had been living with the above named tribe, returned to their "old home" in Owen's Valley, Cal., about one hundred miles distant. It is singular that two tribes of apparently distinct linguistic families should voluntarily unite and live in harmony, especially when there are no hostile tribes from whom to fear attack. A great deal of friendship is also manifested between the Kawi′a and the Panamint Indians (who are also of the Shoshonian linguistic family). These facts would not be of sufficient consequence by themselves, but during the present writer s visits to Tule Agency, in 1882, and again in 1884, for the purpose of studying the magnificent pictographs, an astonishing similarity in many characters and figures was found, which had previously been observed in other portions of California, and in Arizona and Nevada, and which had been recognized as the work of various tribes belonging to the Shoshonian stock.* In addition to this, a number of bands belonging to the western Pah-Utes (of the Shoshonian family) lived, until quite recently, in various portions of the country assigned to the Kawi′a. The dialects of these bands was so far removed from the western Shoshoni language of Nevada and Idaho, the parent stem, as to be almost unrecognizable unless followed through the Pah-Ute and its various dialects.

Tentative comparisons of Kawi′a vocabularies with those of several bands of the western Pah-Ute, present some striking coincidences, more particularly in grammatic structure, but not sufficient to warrant any conclusions respecting linguistic affinity, as the material at present available is entirely too meagre.

* For further information, see papers by the present writer in Trans. Anthrop. Soc. Washington. ii. 1883, p. 128, *et. seq.*; Proc. Davenport Acad. Nat. Sci. iv, 1885, p. 105, *et seq.*

Absa'roka.

This tribe is generally known as the Crows, a word originating no doubt from the gesture-sign used to designate themselves, which is made by placing the flat hands, palms down, in front of and outward from the shoulders, then imitating the movement of a bird's wings when flying. The first portion of the word absaroka is from *abita*, ab, an arrow-point, i *mouth* and 'ta *to kill*, *i. e.*, to kill with an arrow-pointed mouth, clearly signifying the habit of an accipitrine bird. The Indians stated to the writer that the true Absa'roka was a white, or nearly white, bird, exactly resembling the sparrow-hawk—*Falco spariverius*. No specimen of the true absa'roka has been seen for many years, and it appears probable that the bird is a mythic one, particularly as it is described as white, or partly white. Animals and birds held as sacred are invariably white, and albinos, probably on account of their rarity, being deemed as endowed with supernatural and mystic powers. A partial synonomy is herewith added :

Absa'roka.	Tribal designation.
Absoroka.	Drake. Book of Indians. 1848. p. v.
Absarakos.	Warren. Nebraska and Arizona (1855–7) 1875. p. 50.
Upsàraukas.	Brown (J. M.). Beach's Ind. Miscellany. 1877. p. 83.
Apsaruka.	Maximilian. Travels. 1843. p. 174. "Their own name."
Atsharoke.	De Smet, Letters. 1843. p. 51.
Gens des Corbeau.	Lewis and Clark. Disc. 1806. p. 41. "So-called by the French."
Kee-kat-sa.	Bradbury. Travels in America. Liverpool. 1817. p. 19.
Keeheet-sas.	M'Vickar. Hist. Exp. Lewis and Clark. 1842. i. Map.
Kiqatsa.	Am. Naturalist, Oct. 1882. p. 829.
Crows.	By authors generally.

On the Hebrew Word ShD1 (Shaddai), translated "The Almighty." By J. P. Lesley.

(Read before the American Philosophical Society, January 15, 1886.)

Several years ago I was led to examine all the Hebrew texts containing this word, and was surprised to see that they lend no countenance to the common translation of it; and that they teach a derivation of it from sources foreign to the Hebrew theology.

In the seven centuries which elapsed between the Seventy translators in Egypt and St. Jerome's Latin translation Christianity effected a great change in the view men took of things, both sacred and profane. The παντοκρατωρ of the LXX had a very different meaning from the *omnipotens* of the Vulgate. The "power" of the first was not the "power" of the second. What was destructive ability before Christ became constructive ability after Christ. The terrible had been presented as the beneficent. *Παντοκρατωρ* was to be feared, for what strength could resist his blows, what coat of mail turn the point of his arrow? Omnipotens was to be confided in; for the universe was his handiwork; and he was able to do for his creatures more and better than they could ask or think. In his name there was no hint of violence; it meant absolute and infinite ability of action as against any conceivable hindrance.

On the contrary *κρατος* meant destructive, or at least violent force; as we see from *κραδαειν*, *κραδαινειν* to brandish weapons; *κραζειν* to scream; *κραταιος* resistless; *κρατερος* valiant, cruel, violent; *κρατειν* to rule, subdue, seize; allied to our words *crush* and *crash*. In view of this Greek habit of language we have a right to say that, when the LXX selected *παντοκρατωρ* as their synonyme for the Hebrew divine name ShDI, they must have conceived of him as an all-destroyer; at least as one who had exhibited his power in a violent manner; if they did not actually regard him as the divine spirit of evil; which is hardly to be supposed; although, I have been led by my study of the contexts to believe that this conception lay behind that of which they were avowedly conscious. For they wrote in Egypt, and this was the recognized character of the almighty Set. The Greeks of the Delta identified Set with the typhonic spirit of the universe.

The LXX translators being exiles and descendants of exiles from Judæa, must have been perfectly acquainted with the etymological force of the word, and to an extent somewhat, perhaps much, greater than we can be; for it is not likely that the whole Hebrew language of their day, much less of Salomonic and Mosaic days, was represented in our codex of their sacred books. How many words and phrases are lost we do not know, but the *ἁπαξ λεγομενα* tell a story of loss. But our reasoning must be based upon the language as preserved in those books, and it happens to be very rich in words for *power*. Some of them are pure metaphors, such as finger (אצבע), hand (יד), right hand (ימן), arm (זרע), horn (קרן), shoulder (שכם), thunder (רעם), a firman (שמר), chariot (הצן). Some of them represented purely passive power, strength to endure or resist assaults (like that of a bone) or wealth, or high position (עזם, תקף.) Many of them represented the delegated power of a magistrate, or ruler, or hereditary prince (שלט, שרה, רשין, רשת, נעח, מעצר.) Several of them meant heroic power, strength of body, stalwartness (גבורה, חסן: כוח) and especially as put forth in acts of strength (עז, עזן, חזק; compare עזיה strength of Jehovah, עזיאל God's power, עזי my strength). The word "very" (מאד) is used as a noun, with the meaning *power* (מאדו, his power). The word "god" (איל,אל) is used in the same sense (לאל; and מ־חיל). But the abstract idea of *strength* was expressed by רבא (Ecc. 9 : 16), translated with nice exactness by the LXX into *ισχυς*, which of itself shows that they did not confound it with *κρατος*.

None of all these words have a basis of ideal violence, but merely involve violence as an accident of the exercise of strength, not necessary but occasional.

For *violence* they used גזל, רין, עשׁק, חמס, פרק, פרך, מערצה, חמא; all in reference to violation of peace and law, robbery, plunder, destruction of crops and goods, oppression by rulers, &c. For a violent rage they used רגז. But their special word for wasting and desolation, plunder and destruction, oppression, persecution, devourment, demolition and utter destruction was שׁוד, ShUD (Masoretic ShOD), the verbal form being ShDaD. Hence they called the *demons* ShDIM (Deut. 32 : 17), and *robbers* ShDDI-ShDDIM.* Even in composition ShD keeps its terrible meaning, for ShDF in Gen. 41: 23, 27, means the *blasting* of grain by the desert wind; and ShDFUN in Gen. 41 : 6, 1 K. 8 : 37, Amos 4 : 9, Deut. 28 : 22, the same.†

The point on which I wish to fix attention is this: The LXX translators must have been alive to the two facts: 1. That if the name of the deity for which they were to find a Greek correlative was a Hebrew name and had a Hebrew etymology, they must select from the list of Hebrew words meaning power the only one which was like ShDI, namely ShD, a demon, or ShDD, to commit violence, lay waste, desolate, oppress, destroy.

2. That in adopting this etymology they did it with the knowledge that ShDD never meant to be strong, powerful, except in a bad sense. For Gesenius himself admits this, while advocating the opinion that El ShDI was a *pluralis excellentiæ*, an epithet of Jehovah as almighty, omnipotent, against the contrary opinion of Verbrugg (De nominorum Hebræorum, 1752) and Ewald (Heb. Gram. pp. 298, 423).‡ Without the points the word is not necessarily a plural; ShDIM would be plural. It would perhaps be treating the Masorites too harshly to suspect that they pointed the word Shaddai intentionally to assimilate it with Adonai; but even if the charge was just it would not prove a plural.

The ShDI, *παντοκρατωρ* of the LXX, must necessarily therefore if derived from a Hebrew root, carry a malign, dreadful, destructive meaning, and it only remains for those who believe it to be an epithet of Jehovah to explain its use by reference to that terrible side of his character so often painted in the Hebrew scriptures.

The opposite aspect of Jehovah as a god of long suffering, abundant in goodness and truth, is also frequently presented. A common tone is given

*As the Hebrew PRK is represented in the Latin *frangere*, *fractum*, English *break*, *broken*, so the Hebrew ShD is represented in the English *shatter*, but not in Latin.

†The proper name ShDIAUR of Num. 1 : 5, 2 : 10, is translated by Gesenius the Darting of Fire.

‡In Ps. 17 : 9, Prov. 11 : 3, Is. 33 : 1, Jer. 5 : 6, 47 : 4, 48 : 1, 49 : 29, it means to practice violence, oppress, destroy. In Is. 15 : 1, 33 : 1 it expresses the horrors of a foreign invasion. In Ob. 5, "robbers of the night." In Judges 5 : 27, murdered. In Ps. 137 : 8, Jer. 25 : 36, 48 : 8, 18, 51 : 55, 56, to desolate a land. In Micah 2 : 4, and other prophets, to lay waste.

to all the Hebrew writings by the frequent adoration of Jehovah in his two moods of affection for his people and violent hatred for those who are not his people. This tone is very harsh in the earlier books, but softens and sweetens in later times, until the modern idea of God as the all-father is almost completely developed.

But that is not the subject of this paper. I wish to keep in view the sole question, whether ShDI could have been an epithet of Jehovah; or whether, on the contrary, he was not a different deity, more ancient, and foreign to Palestine. To help settle this question I shall quote every passage in which the word occurs, both in the earlier and later books, to see what the context in each instance suggests. I hope in another communication to discuss the question in a broader way, by comparing data obtainable in countries outside the limits of Palestine.

It is necessary however to add one more item to these prefatory statements, viz: the fact that the Hebrew language had two words written ShD, which must have been differently pronounced, although it is impossible to say what the difference was. In the early Christian centuries Hebrew scribes distinguished these two words by marking one to be pronounced short and the other long, Shad and Shâd, or Shed and Shēd, like the English ship and sheep. But whether this Masoretic punctuation preserved correctly the tradition of the ancient difference of pronunciation is a matter of debate among the best scholars.* It is, however, a very convenient way of distinguishing the two words: ShêD, a demon, as above described, and ShaD, the female breast or teat,† from which I would derive a word for wife, ShDE, which occurs only once in the Hebrew Scriptures (Ecc. 2 : 8). It is a curious fact, and bears upon our subject, that Gesenius rejects this plausible etymology and prefers to derive ShDE, from the other ShD (which he now says means simply *power*, although he has elsewhere said that it never meant *power* except in a bad or destructive sense), translating it not *wife*, but *mistress, domina*.

I leave to others to explain how two such irreconcilable ideas came to be expressed by the same word; how ShD could be used to express both destruction and nutrition, a midnight robbery and a woman's breast, the invasion of savage enemies and the suckling of children. But I will show that both these two irreconcilable ideas are involved in the texts relating to the deity ShDI, who is regarded (sometimes in the same passage) as the god of vengeance and destruction and as the god of covenant promise of

* I cannot see how it can be of any value, seeing that it is not consistent with itself; for in Lam. 4 : 3, the word is pointed short, שַׁד; in Job. 21 : 9, Is. 60: 16, long שֹׁד, and in Hosea 9 : 14, Cant. 4 : 5, Gen. 49 : 25, also long שָׁדַיִם the two breasts. Gesenius derives this ShaD from an obsolete Shadah, allied to the Chaldee and Arabic verbs "to cast, shoot, pour, moisten, irrigate." In other words, it has no known Hebrew etymology. It certainly has nothing to do with the old Egyptian BNTT (Benti), the two dugs (Pierret's Dict., p. 131), nor with the Coptic form MNOT, mamma.

† ShD in Hebrew exactly corresponds to τιτθη, and teat.

boundless prosperity and posterity; that he is in a very especial manner regarded as the god of generation and increase, and in so striking a form is he thus presented, that his name might without any violation of logic be derived from ShD the female breast or teat.

Gen. 17 : 1. This is the first appearance of ShDI in the Mosaic books. If El Shaddai meant God the Almighty, his appropriate first appearance would be in the stories of the creation. But the word is not used until the story of the Covenant with Abram is reached.

This covenant is sealed by a change of Abram's name to Abraham. First a son, and then a countless progeny is promised ; nations and kings are to come from him ; Caanan is to be possessed ; circumcision is enjoined ; Sarai's name is changed to Sarah ; Isaak is only promised ; but Ishmael is blessed, and twelve princes are to come from him and a great nation ; and the story winds up with the act of circumcising Ishmael and the rest of the household.

This remarkable story, of unknown date, opens with the words : "And when Abram was ninety-nine years old, Jehovah appeared to Abram and said to him, 'I am *El SheDI*, keep walking before me and be faultless.'" After this, Jehovah is not again mentioned, nor is *El Shedi* repeated, but *El* recurs eight times.

It is evident that the story was borrowed by the Hebrews from the Arabs, for *Ishmael* is its hero, and Isaac is of no account. A great nation, subdivided into twelve tribes each, with its own princedom is to descend from Ishmael, for whom Abram pleads, and whom *El* specially blesses. The promise to Abram of a countless posterity is apparently to be realized through Ishmael ; Isaak is not yet born. The Hebrew compiler seems to have imitated the two great features of the Arab story (the change of Abram's name and the blessing of Ishmael) with the only materials left to him, to save the amour propre of the Hebrews, by changing Sarai's name and promising Isaak.

If the story be one thus borrowed, it is easy to understand why the Hebrew writer glossed the first verse in a Hebrew sense by the insertion of the word Jehovah and the explanation that he, Jehovah, was *El Shedi*. The original story, as told of their own ancestral beginning by the Children of the Desert, probably began : "When Abram was ninety-nine years old the god *Shedi* appeared to him and warned him to continue always to be his faultless servant." As to circumcision, it is well known that the Egyptians and Libyans practiced it in ages preceding any date assignable to Abram.

Gen. 28 : 3. The next appearance of *El Shedi* occurs in an Idumæan legend : Esau is overheard by Rebecca threatening to kill Jacob. She advises Jacob to fly, and pretends to Isaac that she fears Jacob will marry some Hittite girl, that is, some young beduine of the Kadish Barnea country. Isaac therefore sends his son to Mesopotamia for a Chaldean wife, saying : "and *El Shedi* will bless thee and make thee the fruitful sire of a horde of nations, and give thee Abraham's blessing and his promised lands."

After describing Esau's marriages and settlement, the story of Jacob's journey is taken up, and then, and not until then, comes in the name Jehovah, "I am *Jehovah Elohi Abraham,* thy father," &c., who promises him a great covenant people. Jacob, awakened and affrighted, erected a stone and called the place, not *Bethjah,* but *Bethel.*

Gen. 35 : 11. The third time *El Shedi* appears it is under precisely similar circumstances ; Jacob returns from Mesopotamia to Bethel, with a great household and builds an altar, this time dedicating it by the name of (not Jehovah, but) *El-Beth-El,* "because El had appeared there to him when he fled from his brother." And El now again appears to him and repeats the blessing ; changes his name from Jacob to *Isra-El,* saying, "I am *El Shedi,* be fruitful and multiply ; a nation, a horde of nations shall be of thee, and kings shall come from thy loins ;" the land was again promised, and then "*El* ascended from him in the place where he talked with him."

Gen. 43 : 14. The fourth place the name appears is in the story of the famine, and from Jacob's mouth. "Take also your brother (Benjamin) and arise, go back to the man (Joseph, now prince of Egypt) and *El Shedi* give you mercy before the man, that he may send back to me your other brother and Benjamin too.* But if I be bereaved (of my children) I am bereaved." *i. e., El Shedi* promised them to me at Bethel, and if he takes them away again, I must be resigned. There is here again no mention of Jehovah. *El Shedi* is evidently the tutelary deity of the Abrahamic nomades. And he is evidently in some mysterious way the god that gives increase.

Gen. 48 : 3. The next occurrence of the word carries out this idea exactly. It is again Jacob who says to Joseph "*El Shedi* appeared unto me at Luz (Bethel) and blessed me and said to me, 'Lo, I make thee fruitful * * * a host of peoples, and give this land to thy seed forever.'" There is no reference to Jehovah.

Gen. 49 : 25 is very remarkable. *El Shedi* here occurs in Jacob's blessing, and in that part of it addressed to Joseph (Ephraim and Manasseh, the ten tribes, and not at all to Judah), but he divides the *El* from the *Shedi,* and assigns them two separate tasks :—"By the *El* of thy father who shall *help* thee, and by the *Shedi* who shall *bless* thee with blessings," &c. &c. If *Shaddai* be as the commentors fancy "the Almighty," then Jacob ought to have reversed the parts of his blessing, and said : "By *Shedi* who shall *help* thee, and by *El* who shall *bless* thee," &c. It is clear that the idea of a blessed posterity, fruitfulness, &c., is organically involved in the word *El Shedi* as used six times in Genesis.

It must be noted no article is prefixed to *El* nor to *Shedi ;* but a curious poetic balance is preserved by inserting את before *Shedi.* It really means

*If Joseph was under the Hyksos, he also must have had the god Seth as his god, and this reference to Shedi's influence over Joseph has a double value.

nothing, but it balances the אל *El* of the first division of the verse. In the five previous occurrences, which are all prose, *El* and *Shedi* occur in combination; in this sixth occurrence, in a poem, the *El* and the *Shedi* are separated, but instead of *El Shedi* the poet writes *Et Shedi.*

Exodus 6 : 3. Here we have a legendary commentary on the use of *El Shedi* in Genesis. "Then Jehovah said to Moses * * * I am Jehovah. I appeared to Abraham, Isaac and Jacob as (ב)* *El Shedi,* and by my name Jehovah was I not known to them; and I established my covenant with them to give them the land of Canaan * * * I remember my covenant * * * I will bring you out of Egypt," &c., &c. It is surprising how the ideas of covenant and land cling to this term *El Shedi,* and how not a suggestion of violence, or the need of almightiness, is made in any of the legends which carry the term *El Shedi.* The god thus named is evidently the family or tribal deity of the Abrahamidæ, quite different from the Jehovah of the later Jewish cult. This is the only place in the book of Exodus where *El Shedi* appears, nor does it appear at all in Leviticus. But in

Numb. 24 : 4, it turns up again and significantly enough in the rhapsody of the Chaldean prophet Balaam Ben Beor: "And he took up his parable and said: Balaam Ben Beor speaks; the man of open eyes speaks; he speaks who hears the words of *El,* who sees the vision of *Shedi,* entranced (?) open eyed," &c. Here again *El Shedi* are poetically parted for sake of the rythm. But the same old theme is harped upon. It is always *El Shedi's* covenant and promise of Canaan to Abram: "How goodly are thy tents oh Israel! * * * As the valleys * * * gardens * * * trees * * * planted * * * pour water from his buckets * * * seed in many waters * * * his king higher than Agag, his kingdom exalted. *El* brought him out of Egypt, strong as a unicorn, he shall eat up the nations his enemies, break their bones, pierce them with arrows, crouching like a lion," &c.

Here we see the first and current idea of *fertility* (*shet*), supplemented at length by the idea of *violence* (*shet*), and the two combined in the most poetic style. It is needless to add that all thought of Jehovah is absent. The story belongs to Moab or the lands east of the Dead sea.

Ruth 1 : 20, 21. We meet with no *El Shedi* in Deuteronomy, which is wholly given up to Jehovah worship, nor in Joshua, nor in Judges. But in another Moabite legend—that of Ruth—Naomi says to her old acquaintances in Bethlehem, after her return from Moab: "Call me not Naomi (the pleasing), call me Mara (bitterness), for *Shedi* has dealt very bitterly with me. I went out full and Jehovah has brought me home empty. Why call me Naomi, since Jehovah has testified against me, and *Shedi* has afflicted me.

In the Arabic poem of Job (included among the sacred books of the Jews) we might expect *El Shedi* to appear frequently, from the facts already mentioned, and also from the striking fact that the name Jehovah occurs

* If this ב were a כ we could account for it; but an exact translation with ב should read "I appeared to Abraham . . . *in El Shedi,*" as if it were the name of a place, *i. e.* Bethel. It is hardly possible that באל should here be Baal.

only once in the whole book: "Then Job arose (after hearing of the utter destruction of his whole family and all his possessions) and rent his mantle and shaved his head and fell on the ground and worshiped, and said: Naked I issued from the womb of my mother, and naked shall I return thither; Jehovah gives and Jehovah takes, let the name of Jehovah be blessed. In all these Job sinned not, and gave not spit (תפלה) to *Elohim.*"

This single allusion to Jehovah occurs in an evidently *proverbial* form, at the close of a historical prose introduction to the original poem; an introduction which may or may not be ascribed to the Jewish compiler. At all events the total absence of the name of the Jewish deity from the poem itself renders its occurrence in the prologue sufficiently suspicious.

In strong contrast to this absence of the name Jehovah is the constant use of the names *Eloeh, Elohim,* and *Shedi.* The introduction opens thus (Job 1 : 1): "There was a man * * * who * * * feared *Elohim* and avoided sin." And in the beginning of the poem (Job 3 : 4): "Job opened his mouth and cursed his day * * * Let that day be darkness; let *Eloeh* not look at it from above," &c. It is evident that the race to which Job belonged worshiped a deity called *Elohim* (or worshiped gods, *Elohim,* it would be hard to decide which), for in the opening verse of the 2d chapter they are called *Beni Elohim,* just as the Hebrews were habitually called *Beni Israel.*

The deity name *Shedi* occurs (not in the introduction, nor in the conclusion, but) in the poem itself *thirty-one times,* and the deity bearing this name is described as inscrutible (11 : 7, 37 : 23), omniscient (24 : 1, 40 : 2) giver of inspiration and life (32 : 8, 33 : 4), just in judgment (8 : 3, 31 : 35, 34 : 10, 34 : 12), paying no regard to complaints that are silly (35 : 13), open to prayer (8 : 5, 13 : 3), punishing the wicked (27 : 13), wrathful when offended (21 : 20), building up, defending, delighting and being with his worshipers (22 : 23, 25, 26, 29 : 5).

At the same time Job complains that "the arrows of *Shedi* are (sticking) in him (5 : 4), that *El* has killed his heart (הרך for הרג) and *Shedi* has troubled him (23 : 16), that *Shedi* hath vexed his soul (27 : 2). But apparently he vents these complaints without feeling any disrespect towards the deity.

In the same mental mood, Eliphaz the Temanite, says (5 : 17) "Lo! Happy the man whom *Eloeh* correcteth, and the chastisement of *Shedi* (מוסר שׁרי) despise not." Job replies (6 : 14): "To the afflicted from a friend pity! and (but) the fear of *Shedi* he forsaketh." "The wicked man" (15 : 20) is described by Eliphaz as "stretching his hand against *El* (nateh el *el* ido) and making himself a hero against *Shedi*" (v el Shedi ithgabar) (15 : 23). And Job in his turn describes "the wicked" (21 : 7) as saying, "What is *Shedi* (meh Shedi) that we should serve him, and how shall we profit by praying to him?" Of the hypocrite he asks (27 : 10) "Will he delight himself, or rather, does he make himself an object of pleasure to *Shedi* (im ol Shedi ithonan), does he ever call on *Eloeh* (iqra eloe b'col oth)?"

Eliphaz seems to have a very unanthropomorphic notion of *Shedi.* He begins one of his discourses thus (22 : 2) "Can a hero (geber) be profit to *El.* as a sage is profit to himself? Is it delightful to *Shedi* that thou art righteous (zedek), and is it gainful (to him) that thy ways are good (tam)?" And then he goes on to show Job that *Shedi* simply regards him as a sinner and punishes him as such, and not at all out of any personal considerations.

One more reference to *Shedi* is made in this poem, and it requires separate consideration, because it takes us back to the ideas of covenant and inheritance. Job (31 : 2) is attesting his uprightness. "I made a covenant with my eyes, and why should I think on a maid, and what has *Eloeh* allotted (as my portion) from on high, and what *Shedi* as my inheritance? Is not destruction the lot of the unrighteous, and misfortune that of the evil doers? Does he not see my ways, and count my steps?" &c.

It remains only to draw attention to the poetical balancing of *El* (*Eloeh*) against *Shedi,* proving that the full name was *El Shedi,* or *Eloeh Shedi,* throughout the book.

The absence of any article would prove the vulgar translation of *Shedi* as "the almighty," to be a mistake, apart from all other arguments. It would be just as reasonable to expect an article with *El* or *Eloeh,* "the god." *Shedi* is evidently as personal a proper name, as *Baal,* or *Jehovah,* or *Seti.* The translation "the almighty" falls to the ground with the etymology of *Shedi,* from *Shed* strong ; and we have seen that *Shed,* among its various meanings, has one which does not mean strong, but *violent.*

It is true that the *El Shedi* of the poem of Job is rather an amiable deity. But this he would undoubtedly be in the eyes of his original worshipers in Arabia. The poem hints plainly enough that he could be a typhonic demon to "the wicked," that is to people who worshiped other deities and cared nothing for *Shedi.*

In the Psalms the name *Shedi* occurs only twice.

Ps. 68 : 14. This superb chant, beginning "Let *Elohim* arise, let his foes be scattered ; let his haters flee before him. As smoke is driven, as wax is melted, let the wicked perish from the face of *Elohim;* but let the righteous rejoice," &c. "Extol the cloud-rider by his name *Jehovah.*" "Jehovah gave the song of victory, messengers of victory to the great host." "The kings of the hosts flee, they flee, and the housewife divides the booty; when ye rest among the cattle stalls, where doves' wings are silver white, with golden feathers." "In *Paras Shedi,* kings therein, it snowed in Salmon." No clear meaning can be made out of this part of the Psalm, but either *Paras Shedi* was the name of a place "the scattering of Shedi," or *Shedi* was supposed to rout the kings on the snow-covered Salmon. At all events the mixture of *Jehovah, Elohim* and *Shedi* in this wild war song is very remarkable.

Ps. 91 : 1. We have in this song no mention of *Elohim,* but a mingling of *Oliun, Shedi* and *Jehovah,* none of them with an article : "Sitting beneath the protection of *Oliun* (the highest), resting in the shade of *Shedi,* I say to *Jehovah*, my safety place, and my fortress, my god (אֱלֹהַי), I confide in him." It is evidently a song of the desert. The angels bear him up lest he stumble among the rocks; he is saved from the lion and the snake and the dragon (whatever that was). It looks as if "under the shade of *Shedi*," was a proverbial expression among the Beduin.

Isaiah has *Shedi* only once (13 : 6): "Howl! for the day of Jehovah comes, it comes like devastation from *Shedi* (k-ShD m-ShDI). The alliteration suggests that *Shedi* was the Typhonic demon, and nothing could be more appropriate; for Isaiah is prophesying against Babylon's utter destruction, to be produced by an invasion from the mountains of many nations. DeWitte translates *ShD* "verheerung." It is not to be supposed that Isaiah would not have frequently employed *Shedi*, if it meant "almighty" as an epithet for Jehovah. This is the only time he uses the word.

Jeremiah appears not to have known the word.

Ezechiel uses it only once (1 : 24), in describing the four-visaged creatures which appeared to him out of the fiery cloud in Chaldea; their heads supported a platform (firmament) of crystal, on which was a throne of sapphire, and on the throne sat a man of amber-colored fire, over-arched by a rainbow; "this was the appearance of the likeness of the glory of Jehovah," a well-guarded expression. The creatures had living wheels, self-intelligent, "their spirit being in the wheels," and "the voice (קול) of their wings was like the voice of mighty waters, like the voice of *Shedi*" (*k-qol Shedi*); probably meaning "like a roaring storm wind in the desert." Compare "qol Jehovah" breaketh the cedars of Lebanon. "When they moved they made a noise like a whole host."

Daniel. This book does not mention Shedi, but it makes mysterious reference to a "god of forces" (11 : 38).

Joel alone among the prophets of Palestine speaks of *Shedi*, and that only once (1 : 15), and then in the sense of a destroyer. "Alas the day! for the day of *Jehovah*, and it will come like destruction from *Shedi* (*u·k· ShD m·ShDI ibua*).

Joel repeats precisely the phrase in Isa. 13 : 6, with its alliteration; which seems to settle it beyond doubt that Isaiah and Joel used *Shad Shedi*, as a well understood formula; perhaps a popular expression for a *razzia* of Beduins, or perhaps for a sandstorm. But whatever special meaning it had must have been based on a conception of the typhonic demon of destruction like the *Seti* of the Egyptian monuments, and the *Shaitan* (devil) of Mohammedan literature.*

* It is interesting to compare *Seti*, *cut stone* and *heap of stones* with the modern Mohammedan practice of *throwing stones at Sheitan*, resulting in the accumulation of piles of stones, at certain fixed places, all of them regarded as either sacred or accursed.

Stated Meeting, November 6, 1885.

Present, 18 members.

President, Mr. Fraley, in the Chair.

Mr. William John Potts, a newly-elected member, was presented to the Chair and took his seat.

Donations for the Library were received from the Deutsche Geologische Gesellschaft, Berlin; Naturhistorischer Verein and Prof. J. Lehmann of Bonn; Schweizerische Naturforschende Gesellschaft, Luzerne; R. Accademia dei Lincei, Rome; R. Istituto Veneto di Scienze, &c., Venice; Académie Royale de Belgique; Royal Geographical Society, Meteorological Council, Royal Meteorological Society, Nature, Messrs. Joseph Prestwich, C. W. King, Wm. Barlow and Dr. Benjamin Ward Richardson of London; the Philological Society, Cambridge, England; the Canadian Institute, Toronto; Natural History Society, Montreal; Essex Institute, Harvard University, Museum of Comparative Zoölogy, Cambridge, Mass.; and American Antiquarian Society, Worcester, Mass.; American Journal of Science, New Haven; American Chemical Society, Meteorological Observatory of New York; the Young Men's Library at Buffalo; Mr. John B. Smith of Brooklyn; the Engineers' Club, Franklin Institute, Historical Society of Pennsylvania, Dr. J. M. Hays, Prof. E. D. Cope and Messrs. Henry Phillips, Jr., McCalla & Stavely, and Rev. H. Clay Trumbull, of Philadelphia; Johns Hopkins University and Prof. Ira Remsen of Baltimore; the United States Fish Commission, National Museum, Naval Observatory, Geological Survey, the Department of State and War Department; Mr. Jed. Hotchkiss of Staunton, Va.; the Elliott Society of Science and Art, Charleston, S. C.; and the Society of Natural History, Cincinnati.

Letters of envoy were received from Die Schweiz. Gesellschaft (Berne); Wm. Barton (London); United States Geological Survey (Washington, D. C.); Museum of Comparative Zoölogy (Cambridge Mass.); Canadian Institute, Toronto (with Vol. XXXI, 143), and requesting exchange; which, on motion, was granted and the Society placed on Exchange list.

Letters accepting membership were read from W. J. A. Bonwill, M. D. (October 28, 1885, 1721 Locust St., Philadelphia); Thomas M. Cleemann, C. E. (October 19, 1885, 2135 Spruce St., Philadelphia); Wm. John Potts (529 Cooper St., Camden, N. J., October 20, 1885); Prof. Edward North, LL.D. (October 26, 1885, Hamilton College, Clinton, N. Y.); Prof. M. Schele DeVere (October 20, 1885, University of Virginia).

Letters acknowledging receipt of diploma were read from Prof. Henry S. Frieze (Ann Arbor, Mich.); Isaac Sharpless (Haverford College P. O., Pa.); Prof. John W. Mallet (University of Virginia); Prof. Walter LeConte Stevens (Hoboken, N. J.).

Letters were received from the Chief Signal Officer, U. S. A., Washington, D. C., requesting certain Proceedings and Transactions.

On motion the Signal Office was placed on the Exchange list and ordered to receive Proceedings.

A letter was received from Prof. E. C. Pickering of Harvard College Observatory, requesting a copy of Transactions, Vol. IX, containing a paper by the late Robert Treat Paine, which was ordered to be sent.

Letters were received from the Geological Survey of Canada, Ottawa, acknowledging Nos. 116 and 119; E. W. Claypole (Akron, Ohio), acknowledging Nos. 117, 118, 119, 120; Wm. John Potts (Camden, N. J.), acknowledging Nos. 117, 118, 119, 120; Mr. Thomas M. Cleemann (Philadelphia), acknowledging Nos. 117, 118, 119, 120.

Dr. W. S. W. Ruschenberger read, by appointment, a sketch of the life of the late Robert E. Rogers, M. D., LL.D., with biographical notices of his father and brothers; after which the President and Dr. Horn made some appropriate and feeling remarks on the subject,

The death of Thomas Davidson (Brighton, England), was announced as having taken place on October 16, 1885, in the 69th year of his age.

Nominations Nos. 1064, 1065 and 1066, were read.

The Publication Committee, pursuant to the request of the Society of June 19, 1885, made a report which, after discussion, was laid over to the next meeting.

Permission was granted to Prof. Cope to withdraw the paper read by himself at last meeting on the Eocene fishes of Wyoming Territory and the action of the Secretaries in permitting its withdrawal was approved.

Prof. Cope presented estimates for plates for his paper read at last meeting on the Structure of the Brain, &c., * * * of a Theromorphous Reptile, which, on motion, was referred to the Finance Committee for action.

The President reported that he had received and paid over to the Treasurer $132.43, amount of Michaux legacy due October 1, 1885.

And at ten minutes after ten o'clock, P.M., the meeting was adjourned by the President.

Stated Meeting, November 20, 1885.

Present, 16 members.

President, Mr. FRALEY, in the Chair.

Dr. W. J. A. Bonwill, Mr. Thomas M. Cleemann, Prof. S. W. Gross, newly-elected members, were presented to the Chair, and took their seats.

Donations for the Library were received from the Mining Department, Melbourne; Royal Society of Victoria; Royal Asiatic Society (North China Branch); Geological Survey of India; Zoölogischer Anzeiger, Leipzig; Verein für Geographie und Statistik, Frankfurt-am-Main; Prof. G. vom Rath, of Bonn; the Nordisk Oldkyndighed og Historie Selskab, Copenhagen; Statistika Central Byrån, Stockholm; Musée Teyler, Haarlem; the Ministère de l'Interieur and Commission Centrale de Statistique, Bruxelles; R. Accademia dei Lincei, Rome; Société Nationale des Sciences Naturelles, Cherbourg; Société des Antiquaires de France; Société Americaine de France; Société d'Anthropologie; Société Zoölogique and Société de Geographie, Paris; R. Academia de la Historia, Madrid; Royal Astronomical and R. Geographical Societies, Meteorological Council, Journal of Forestry, and Nature, London; Literary and Philosophical Society, Liverpool; Philosophical Society, Glasgow; Boston Society of Natural History, Mr. Robert Nixon Tophan, Cambridge, Mass.; American Antiquarian Society, Worcester; Meteorological Observatory of New York; the Mercantile Library Association of Brooklyn; Academy of Sciences of Philadelphia, Mercantile Library and Mr. Henry Phillips, Jr.; Johns Hopkins University; Department of the Interior, United States Fish Commission and Mr. Samuel H. Scudder, of Washington; Washburn College, Topeka, and the University of California.

Letters of envoy were read from La Société Nationale des Antiquaires de France (Paris); Geological Survey of India (Calcutta); Fondation de P. Teyler van der Hulst (Harlem); Ministère de l'Interieur (Bruxelles).

Letters of acknowledgment were read from Königliche Bibliothek, Berlin (117, 118, 119); K. K. Sternwarte, Prag (116); Harvard College Observatory, Cambridge, Mass. (Transactions IX); Chief Signal Officer U. S. A., Washington, D. C. (Proceedings 96–121; Transactions XV, XVI, i); Fondation van der Hulst, Harlem (Proceedings 117, 118, 119); Japetus Steenstrup, Copenhagen (116, 117, 118, 119); Royal Society of London (116); Royal Society of Victoria, Melbourne (114, 115).

Letters accepting membership in the Society were read from Prof. Guiseppe Sergi (Nov. 3, 1885; via Pastrengo 1, Roma, Italia); Prof. Louis Pasteur (Paris, Nov. 5, 1885); Prof. Ernst Haeckel, Jena, Nov. 4, 1885); Prof. Dr. Josef von Lenhossek (Buda Pesth, Nov. 4, 1885); Prof. J. Pomialowsky (St. Petersburg, Oct. 21, 1885); Dr. Hermann Rollett (Baden bei Wien, Nov. 5, 1885).

Letters acknowledging receipt of diploma were read from Lord Coleridge, London, England; Sir John Lubbock, High Elms, Hayes, Beckenham, England.

A letter was received from Dr. Asa Gray and Mr. C. S. Sargent, requesting permission to have a copy made of the diary of the elder Michaux, which was presented to the Society by his son in 1824. The request was granted, with the restriction that the copy was to be made in the Society's rooms under the supervision of the Librarian.

The Special Committee appointed October 16, 1885, to examine the paper on Iguanidæ presented by Prof. E. D. Cope, for the Transactions, reported it to be worthy, and recommended its publication with a suitable plate or plates.

On motion, the report was adopted, and the Committee discharged.

A letter was read from Prof. Cope, requesting that the paper should be printed in the Proceedings with a view to its more speedy publication.

The Secretaries stated that in the present condition of the publications of the Society, Prof. Cope's paper would be more speedily printed if, as originally intended, in the Transactions.

On motion of Dr. Frazer, it was resolved that the Secretaries be requested to inform Prof. Cope of the facts of the case, and to ascertain in which form he prefers that the paper shall appear.

The death of W. B. Carpenter (London, Nov. 11, 1885) was announced as having taken place in the seventy-third year of his age.

The President reported that, pursuant to resolution of the Society, he had appointed Prof. J. P. Lesley to prepare an obituary notice of the late James Macfarlane, and that Prof. Lesley had signified his willingness.

A letter was read from Prof. Weir Mitchell declining, for sufficient reasons, the appointment to prepare an obituary notice of the late George Leib Harrison.

Dr. Brinton presented a paper on the Mangue language.

Prof. Cope (through the Secretaries) presented the Thirteenth Contribution to the Herpetology of Tropical America.

Prof. Houston presented a paper on Photography by a Lightning Flash during the storm of October 29, 1885.

Dr. Frazer presented a résumé of the proceedings of the recent International Congress of Geologists held at Berlin, which he had attended as one of the delegates from the American Association for the Advancement of Science. Dr. Frazer exhibited an improved prismatic compass (made by Elliott, of London), and a device for printing boundary lines automatically, and explained their advantages.

Dr. Frazer also presented four track charts of the North Atlantic ocean, made in 1882, 1883 and 1885.

The minutes of the proceedings of the Board of Officers and Council were submitted.

Nominations Nos. 1064, 1065, 1066, and new nominations Nos. 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, were read.

The Committee of Finance, to which was referred the application for a plate for Prof. Cope's paper on the brain of a Theromorphous reptile, reported that the Society had in hand funds sufficient for that purpose. The Committee stated that its business was not to pass upon the merits or desirability of any such application, but only upon the question if the Society had funds available for such a purpose. That the ordering of the plates was at the discretion of the Secretaries in their disbursement of the annual appropriation made by the Society for its publications.

On motion, the plate was ordered by the Society at estimate price, furnished by Breuker & Kessler.

Dr. Frazer exhibited the Geological-Geographical Dictionary of Señor Juan de Villa Nueva y Piera, and *L'Annuaire Geologigue Universelle* of D'Agincourt, and offered the following resolution, which was adopted:

Resolved, That a Committee, consisting of Prof. Lesley, Prof. Cope, Mr. Franklin Platt, Mr. C. A. Ashburner and Dr. Frazer be appointed to consider the propriety of assisting the International Geological Congress in extending the works of MM. Villa Nueva and Neumayer, and the means of doing so, and that the Committee be requested to report to the Society at as early a date as possible.

And the meeting was adjourned by the President.

Stated Meeting, December 4, 1885.

Present, 16 members.

President, Mr. FRALEY, in the Chair.

Dr. Horace Jayne, a newly-elected member, was presented to the Chair, and took his seat.

Donations for the Library were received from the Naturforschende Gesellschaft and the Zoölogischer Anzeiger, Leipzig; K. P. Akademie der Wissenschaften, Berlin; Société de Géographie and L'Alliance Scientifique Universelle, Paris; Nature; Society of Antiquaries, London; Canadian Institute; Geological and Natural History Survey of Canada; Boston Society of Natural History; Museum of Comparative Zoölogy, Cambridge; Mr. Charles S. Sargent, of Brookline, Mass.; Yale College; American Chemical Society and the New York Academy of Sciences; Mr. W. J. Potts, of Camden, N. J; Franklin Institute, the American Fire Insurance Co., Drs. W. S. W. Ruschenberger and Persifor Frazer, Messrs. Alex. E. Harvey, Henry Phillips, Jr., McCalla & Stavely, and Francis Jordan, Jr., of Philadelphia; Johns Hopkins University, Baltimore; United States National Museum, United States Geological Survey and the Chief Signal Officer of the United States Army, Washington, D. C.; Mr. Jed. Hotchkiss, of Staunton, Va., and Mr. G. W. Hough, of Chicago.

Letters of envoy were read from the Canadian Institute, Toronto; the Johns Hopkins University, Baltimore; U. S. Geological Survey, Washington, D. C.

Letters of acknowledgment were read from the Statistical Society, London (117, 118, 119); the Smithsonian Institution, Washington, D. C. (120); Annales des Mines (97–120); Royal Society of Edinburgh (116, 117, 118, 119).

Letters accepting membership in the Society were read from Horace Jayne, M.D. (Phila., 1826 Chestnut St., November 26, 1885), Gaston Planté (Paris, April 12, 1885).

A letter was read from Prof. Lesley declining the appointment as chairman of the committee appointed at the last meeting on the works of Villa Nueva and Neumayer.

A circular was read from the Trustees of the "Elizabeth Thompson Science Fund," calling attention to the provisions under which the fund was administered.

Prof. Frazer, from the Committee on the Works of Villa Nueva and Neumayer, reported progress.

An obituary notice of the late James Macfarlane, prepared by Prof. J. P. Lesley, was read by the Secretaries.

A MS. record book of the Wistar Association, 1824–1839, was returned to the Society by Prof. Lesley, with a letter stating he had just discovered it among a mass of papers.

Dr. Frazer presented a paper entitled a Résumé of the Geology of York County, Pa.

The Treasurer presented his annual report, which was referred to the Committee on Finance.

The Board of Officers and Council submitted certain proposed changes in the Laws and Regulations of the Society, which were read, and under the laws laid over until December 18, 1885.

Pending nominations Nos. 1067–1075 were read.

On motion, permission was given to Prof. Cope to withdraw his paper on Iguanidæ, presented and accepted for the Transactions, and the Secretaries were requested to add to it his paper "Thirteenth Contribution to the Herpetology of Tropical America."

And the meeting was adjourned by the President.

Stated Meeting, December 18, 1885.

Present, 21 members.

President, Mr. FRALEY, in the Chair.

Mr. Francis Jordan, Jr., a lately-elected member of the Society, was presented to the Chair and took his seat.

Donations for the Library were received from Prof. J. Pomialowsky, of St. Petersburg; the Astronomische Nachrichten, Kiel; Zoölogischer Anzeiger, Leipzig; Flora Batava, Leiden; the Académie R. de Belgique; R. Accademia dei Lincei, Roma; Ecole des Mines and Société de Geographie, Paris; R. Academia de la Historia, Madrid; Geological Society, Meteorological Council, Journal of Forestry, and Nature, London; Philological Society, Cambridge, England; the publishers of the American Architect and Every Other Saturday, Boston; American Journal of Science; the publishers of the Critic; Brooklyn Entomological Society; Brooklyn Library; College of Pharmacy, Messrs. Edward L. Wilson, Henry Phillips, Jr., and R. S. Culin, Drs. W. S. W. Ruschenberger and Charles A. Oliver, and the executors of Mr. Henry Seybert, of Philadelphia; Second Geological Survey of Pennsylvania; Johns Hopkins University, editors of the Journal of Philology, and the Chemical Journal, Baltimore; the War Department and the United States Coast and Geodetic Survey; editors of the Hoosier Naturalist, Valparaiso, Ind.; Rev. Stephen D. Peet, of Chicago, Ill.; the Iowa State Historical Society; University of California; Observatorio Astronomico Nacional de Tacubaya, and the Muséum National de Rio de Janeiro.

Letters of envoy were received from the R. Society of Melbourne, Australia; the Meteorological Commission, London; the Philosophical Society of Cambridge; the Canadian Institute, Toronto, Canada.

A circular was read from the Nat. Hist. and Physical Society of Geneva, with the conditions of the *De Candolle* prize.

A circular was read from Stearns & Co., Detroit, Mich., offering for sale a collection of South American antiquities and inviting bids for the same.

The deaths of Dr. Albert H. Smith (December 14, 1885, æt. 51), and Henry S. Hagert, Esq. (December 18, 1885, æt. 52), were announced and, on motion, the President was authorized to appoint suitable persons to prepare their obituary notices.

Prof. Cope presented for the Transactions a paper by Miss Helen C. de S. Abbott, entitled "A Chemical Study of *Yucca angustifolia*," which was referred for examination to a committee consisting of Drs. Brinton, Genth and Houston.

Prof. Cope made a communication to the Society on the subject of the physical conditions of memory.

Nominations Nos. 1064–1075 were read.

The proposed change in the Laws and Regulations of the Society, submitted by the Board of Officers and Council at the last meeting, were taken up, and proof having been made that advertisements had been inserted in two daily Philadelphia newspapers, and that full notice had also been sent to the resident members of the Society, and it appearing that a quorum of at least three of the Officers and Council, and at least thirteen members of the Society were present, the Society proceeded to the consideration of the proposed alterations, which, after discussion, were unanimously adopted, as follows:

That Chapter I, Section 1, shall read as follows:

"The election of members shall be by ballot, and shall form part of the stated business of the meetings on the third Fridays of February, May, October and December."

That Chapter I, Section 5, shall read as follows:

"The names of the candidates and their places of abode shall be designated on the ballots. In voting, the names of the officers shall be called in the order of their seniority by the acting Secretary, the members thereafter depositing their ballots. The name of a candidate struck from any ballot or not voted for, shall be considered as a vote adverse to that candidate."

That Chapter I, Section 6, shall read as follows:

"After all the other business of the meeting shall have been disposed of, the ballot-box shall be opened by the Secretaries, or in their absence by two Tellers to be appointed by the presiding member, who shall then declare to the Society the result of the poll."

That chapter I, Section 13, be struck out.

That Chapter VII, Section 1, shall read as follows:

"The Officers and Council shall meet together statedly on the second Friday of February, May and November, respectively, at the same hour in the evening at which the stated meetings of the Society are appointed to be held, and specially at such times as they may judge proper."

That Chapter VIII, Section 5, shall read as follows:

"He shall give notice of the meetings of the Society and of the Officers and Council, and of all elections, and shall make all such publications on behalf of the Society as are not otherwise devolved by law or special order."

That Chapter IX, Section 1, shall read as follows:

"The ordinary meetings of the Society shall be on the first and third Fridays of every month from September to June at 8 o'clock in the evening. Special meetings may be called at any time by order of the President, or in case of his absence or disability, by order of a Vice-President. And it shall not be lawful to take up, consider or transact at such special meeting any business other than that which is specified in the call and the notice for the meeting. And no business shall be taken up, considered or transacted at such special meeting, except by such number of qualified voters as would be requisite for a quorum, according to the Laws and Regulations of the Society."

That Chapter IX, Section 2, shall read as follows:

"The Chair shall be taken by the presiding member at the hour appointed for the meeting."

That Chapter IX, Section 6, shall read as follows:

"The Hall of the Society shall be open on every stated meeting at half-past seven o'clock in the evening."

That the item "stated business of the meeting" in the Rules of Order (p. 19, Edition 1866) shall be transposed so as to immediately follow "Obituary notices of members read and announcements of the decease of members made and acted on;" and that the numbers prefixed to the respective items in the said order of business be altered to correspond with the said change.

That Section 12 of the said Rules of Order (p. 20, Edition 1866) be struck out and the following section be numbered 12.

Mr. Phillips presented a list, which he had prepared, of Officers and Councilors of the Society from 1769 to 1886, which was ordered to be printed.

On motion, the Secretaries were directed to have the Laws and Regulations of the Society, as adopted this evening, printed for the use of the members.

The report of the Finance Committee was presented and accepted and the appropriations passed for the year 1886.

And the meeting was adjourned by the President.

Stated Meeting, January 1, 1886.

Present, 11 members.

President FRALEY, in the Chair.

Donations for the Library were received from the Royal Observatory, Cape of Good Hope; Asiatic Society of Japan; Anthropologische Gesellschaft, Wien; Deutsche Gesellschaft für Anthropologie, &c., München; Astronomische Nachrichten, Kiel; Zoölogische Anzeiger, Leipzig; Archives Neèrlandaises, Hærlem; R. Accademia dei Lincei, Rome; Osservatorio della Università di Torino; Société de Géographie, Société d'Anthropologie, Musée Guimet, Institut de France and Ecole des Mines, Paris; the Royal Society, Zoölogical Society, Geological Society, Royal Meteorological Society, the Lords Commissioners of the Admiralty, Meteorological Council, Greenwich Observatory and Nature, London; Canadian Institute; Mr. Parker Pillsbury of Concord, N. H.; the publishers of the American Architect and Every Other Saturday, Boston; Meteorological Observatory, New York; Journal of Medical Sciences, Dr. J. W. Holland, Prof. E. D. Cope, Messrs. Henry Phillips, Jr., E. A. Barber and R. S. Culin, Philadelphia; Johns Hopkins University, Baltimore; Philosophical Society, Washington; the War Department, National Academy of Sciences, United States Coast and Geodetic Survey and the Bureau of Ethnology, Washington, D. C.; State Board of Health, Tennessee; Prof. H. S. Frieze of Ann Arbor, Mich.; Nebraska State Historical Society; Mr. Wm. M. Stewart of San Francisco; publisher of the West-American Scientist, San Diego, Cal.; and the Observatorio Meteorológico-Magnético Central de México.

The Société Entomologique de Belgique (by letter dated Bruxelles, Dec. 9, 1885), requested exchanges. On motion, it was placed upon the list to receive Proceedings from No. 96.

Geological Society of Glasgow, by letter requested certain missing numbers of the Proceedings, which was referred to the Secretaries with power to act.

Letters of envoy were read from the U. S. Coast and Geodetic Survey; U. S. Bureau of Ethnology; La Société Hollandaise des Sciences, Hærlem.

Mr. Everard F. im Thurn, of British Guiana, accepted membership by letter dated Torquay, England, Dec. 19, 1885.

The President reported that he had appointed Dr. Harrison Allen to prepare obituary notice of the late Dr. A. H. Smith, and Mr. Henry Phillips, Jr., of the late Henry S. Hagert, Esq., and that both had accepted the appointment.

The death of Samuel Birch, LL.D. (London, Dec. 29, 1885), in the 72d year of his age, was announced.

The judges of the annual election reported that the following officers and council had been elected for the year 1886, viz:

President,
Frederick Fraley.

Vice-Presidents,
E. Otis Kendall, Pliny E. Chase, W. S. W. Ruschenberger.

Secretaries,
J. P. Lesley, G. F. Barker, D. G. Brinton, Henry Phillips, Jr.

Councilors,
Oswald Seidensticker, Richard Wood, Wm. V. McKean, Persifor Frazer.

Councilor for one year, in lieu of W. S. W. Ruschenberger, resigned,
Thomas H. Dudley.

Curators,
Geo. H. Horn, Charles G. Ames, John R. Baker.

Treasurer,
J. Sergeant Price.

On motion, Henry Phillips, Jr., Esq., was renominated for Librarian, and the nominations were closed.

Prof. Cope presented for the Transactions a paper "On the Intercentrum of the Terrestrial Vertebrata," which was referred to Dr. H. Allen, Dr. H. Jayne, and Dr. Geo. H. Horn.

Prof. Allen made a communication on the result of experiments on electric light used in photographing animals in motion.

Prof. Cope presented for the Proceedings a paper by Dr. Alfredo Dugês of Guanajuato, *Sur le Rhinocheilus Antonii.*

Pending nominations Nos. 1064–1075 and new nominations Nos. 1076–1080 were read.

Report of the Publication Committee presented November 6th, 1885, was taken up and considered, and the recommendations therein contained were unanimously adopted, as follows:

1. That the Quarterly numbers of the Proceedings shall be confined as nearly as possible to 125 pp. each.

2. That papers containing more matter than will fill about 24 pp. of the Proceedings shall be considered as offered for the Transactions.

3. That all papers requiring engravings or plates of full page size shall be considered as offered for the Transactions.

The committee appointed at last meeting on the paper on *Yucca angustifolia*, reported progress and was continued.

After the reading of the rough minutes the meeting was adjourned by the President.

Stated Meeting, January 15, 1886.

Present, 25 members.

President Fraley, in the Chair.

Letters of envoy were received from the Societas pro Fauna et Flora Fennica, Helsingfors; Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte, Rotterdam; Royal Society of Victoria; Société de Naturalistes de la Nouvelle Russie, Odessa, and asking for exchanges (on motion, ordered to be placed on the list to receive Proceedings from No. 96).

Acknowledgments were received from the Royal Society of Tasmania for Proceedings Nos. 114, 115, 116; Proc. 120, South Kensington Museum, London; University Library, Cambridge; Radcliff Observatory, Oxford, also for five duplicate volumes of its publications returned to the Observatory; Trübner & Co., London.

Acknowledgments for Proceedings No. 121, were received from the Portland Society of Natural History; New Hampshire Historical Society; Essex Institute; American Antiquarian Society, Worcester, Mass.; Rhode Island Society for the Encouragement of Domestic Industry; Connecticut Historical Society; New York Hospital; Library of the U.S. Military Academy; Vassar Brothers' Institute; New Jersey Historical Society; Numismatic and Antiquarian Society of Philadelphia; Engineers' Club of Philadelphia; Historical Society of Pennsylvania in Philadelphia; Wyoming Historical and Geological Society; Virginia Historical Society; University of Virginia; Leander McCormick Observatory; Georgia Historical Society; Cincinnati Observatory; Chicago Historical Society; Rantoul Literary Society; State Historical Society of Wisconsin; Chief Signal Officer, Washington, D. C.; California Academy of Sciences; University of California; Davidson Observatory, San Francisco, Cal.

The Davenport Academy of Natural Sciences acknowledged the receipt of Proceedings No. 121, also preceding numbers, commencing with No. 81.

Acknowledgments for Proceedings No. 121 were received from Prof. Charles Henry Hitchcock, Hanover, N. H.; Hon. R. C. Winthrop, Boston, Mass.; Prof. Walcott Gibbs, Cambridge, Mass.; Mr. James B. Francis, Lowell, Mass.; Mr. Benj. Smith Lyman and Dr. Pliny Earle, Northampton, Mass.; Drs. J. J. Stevenson and Austin Flint, Jr., Prof. Henry M. Baird and Mr. J. Ericsson, New York; Prof. James Hall, Albany; Prof. T. F. Crane, Ithaca; Dr. C. F. H. Peters, Clinton, N. Y.; Rev. Joseph F. Garrison and Mr. William J. Potts, Camden; Dr. G. D.

Boardman, Prof. J. P. Lesley, and Messrs. Henry Phillips, Jr., James C. Booth, Isaac Norris, Jr., H. Clay Trumbull, and Russell Thayer, Philadelphia; Dr. Henry Hartshorne and Mr. Thomas Meehan, Germantown; Hon. Washington Townsend, West Chester; Andrew S. McCreath, Harrisburg; Prof. J. W. Moore, Easton; Prof. Leo Lesquereux, Columbus; Professors Henry Turner Eddy and James Morgan Hart, Cincinnati; Prof. Robert Peter, Lexington; Prof. Henry S. Frieze, Ann Arbor; Prof. Joseph L. LeConte, Berkeley, Cal.

Photographs for the Society's Album were received from Prof. J. Morgan Hart and Prof. H. Turner Eddy of Cincinnati, Ohio; Prof. James Hall of Albany, N. Y.; Prof. James C. Booth, Philadelphia.

Donations for the Library were received from the Royal Society of New South Wales; Mining Department, Melbourne; Royal Society of Victoria; Hong-Kong Observatory; Société des Naturalistes de la Nouvelle Russie, Odessa; Society of Naturalists, Riga; Society for the Finnish Fauna and Flora, Helsingfors; Prof. R. F. Reuleaux of Vienna; the Astronomische Nachrichten, Kiel; Statistika Central Byrån, Stockholm; Bataafsch Genootschap van Proefondervendelijke Wijsbegeerte, Rotterdam; K. Bibliothek, S'Gravenhage; Bataviaasch Genootschap van Kunsten en Wetenschappen, Batavia; Musée Royale d'Histoire Naturelle de Belgique; R. Accademia dei Lincei, Rome; Muséum d'Histoire Naturelle, Société de Geographie and Société Americaine de France, Paris; Journal of the Society of Arts, Nature, London; Royal Irish Academy, Dublin; Mr. W. Douw Lightfall and the Natural History Society of Montreal; Boston Society of Natural History; Prof. Eben Norton Horsford of Cambridge, Mass.; American Journal of Science, New Haven; Essex Institute, Salem, Mass.; American Chemical Society and New York Academy of Sciences; Brooklyn Entomological Society; Prof. E. North of Clinton, N. Y.; New Jersey Historical Society; Library Company of Philadelphia; Franklin Institute, Pennsylvania Museum and School of Industrial Art, the American Naturalist and Messrs. Henry Phillips, Jr., E. A. Barber, R. S. Culin and Wm. V.

McKean of Philadelphia; Prof. Ira Remsen of Baltimore; Naval Institute, Annapolis; Mr. J. H. Hickcox, the United States Naval Observatory and the Light-house Board, Washington; Mr. Jed. Hotchkiss of Staunton, Va.; and the Cincinnati Society of Natural History.

The Committee appointed to examine the paper of Prof. Cope on the Intercentrum of the Vertebrata, reported it worthy of publication in the Transactions. The report was accepted and the Committee discharged.

The Committee appointed to examine Miss Helen C. de S. Abbott's paper on *Yucca angustifolia*, reported in favor of its publication, and was discharged.

On motion, the Society ordered the publication of both of the above papers in its Transactions.

The death of Joshua B. Lippincott was announced as having taken place at Philadelphia on January 5, 1886, in the seventy-fourth year of his age, and, on motion, the President was authorized to appoint at his discretion a suitable person to prepare the usual obituary sketch.

The stated business of the meeting was then taken up and Henry Phillips, Jr., Esq., was re-elected Librarian for the ensuing year, and the following Standing Committees appointed:

Finance,

Henry Windsor, J. P. Wetherill, W. B. Rogers.

Publication,

D. G. Brinton, C. M. Cresson, George H. Horn,
Persifor Frazer, J. Blodgett Britton.

Hall,

J. Sergeant Price, Wm. A. Ingham, Philip H. Law.

Library,

Henry Phillips, Jr., E. J. Houston, Wm. V. McKean,
Thomas H. Dudley, John R. Baker.

Mr. Lesley read a paper "On the evident Beduwin origin of the *Shedi* deity in the Hebrew Scriptures, commonly translated 'the Almighty'"; in which he discussed every text in which it occurs, and drew the conclusion that it bore a manifest relationship to the deity *Seti*, introduced into Egypt and into Palestine from Arabia.

After which, a discussion ensued participated in by Messrs. Weil, Law, Trumbull, and Garrison.

Mr. Lesley communicated a revision of the section of the LeRoy (Chemung) beds in Bradford county, originally read before the Society, Dec. 7, 1883, giving additions to the list of its fossils and extending it downwards nearly 350 feet, to include a horizon very rich in characteristic forms.

Mr. Ashburner made a verbal communication in reference to the late severe storm which began here on Friday, January 8th, and was general over the United States, showing the course of the barometer during its progress.

Dr. Persifor Frazer made a communication on the application of composite photography to handwriting for which, on motion, the Society ordered a plate to cost about $25.

The Society ordered that a map to illustrate the paper on the Geology of York county should be printed at a cost of about $40.

Dr. Harrison Allen exhibited a specimen of the *Chlamyphorus truncatus* from Mendoza in the Andes, which is now rapidly becoming extinct. He stated that it was described in the Transactions of the Society by Dr. Harland about the year 1825.

On account of the lateness of the hour, nominations for membership were not read, and, after reading the rough minutes, the Society was adjourned by the President.

Stated Meeting, February 5, 1886.

Present, 9 members.

Curator, Dr. Horn, in the Chair.

Donations were announced from the following: Sälskap. Fauna et Flora Fennica, Helsingfors; Astronomische Nachrichten, Kiel; Zoologischer Anzeiger, Leipzig; Verein für Erdkunde, Dresden; Senckenbergische Naturforschende Gesellschaft and Verein für Geographie und Statistik, Frankfurt-am-Main; Fondation Teyler, Harlem; Académie Royale de Belgique; Société Royale des Antiquaires du Nord, Copenhagen; Statistika Central Byrån, Stockholm; R. Accademia dei Lincei, Rome; Société de Geographie, École Polytechnique and Société Linnéene de Paris; R. Academia de la Historia, Madrid; Royal Astronomical and Geographical Societies, Meteorological Council, Kew Observatory, Journal of Forestry, Nature, London; Radcliffe Observatory, Oxford; American Academy and Boston Society of Natural History; Harvard University and Professors Eben Norton Horsford and B. M. Everhart of Cambridge, Mass.; American Antiquarian Society, Worcester; American Journal of Science, New Haven; New York Historical Society, American Oriental Society and Prof. J. S. Newberry of New York; Franklin Institute, Numismatic and Antiquarian Society, College of Pharmacy, Editors of The American Naturalist, Indian Rights Association, Mr. Henry Phillips, Jr., and Dr. Isaac Lea, of Philadelphia; Johns Hopkins University and the American Journal of Archæology, Baltimore; United States Geological Survey and the Anthropological Society of Washington; Prof. Henry S. Frieze of Ann Arbor, Mich.; and the Editors of The West-American Scientist, San Diego, Cal.

Dr. Pliny Earle presented an engraving of himself for the Society's Album.

Letters of envoy were received from Societas pro Fauna et Flora Fennica, Helsingfors, Finland; Royal Society of Northern Antiquaries, Copenhagen; Fondation Van der Hulst, Haarlem, Holland; Meteorological Office, London, England; U.S. Geological Survey, Washington; Prof. Henry S. Frieze, Ann Arbor, Mich.

The Physikalisches Central-Observatorium, St. Petersburg, requested by letter Proceedings No. 109, which, on motion, was granted. A circular announcing the programme of the U. S. Naval Observatory for the year 1886 was submitted. A letter was read from Henry M. Hugunin (Chicago, Jan. 26, 1886), suggesting that the beginning of the year should more properly be taken from December 21st, as on that day the southward march of the sun is terminated and its journey to the north begins.

Acknowledgments were received for Proceedings No. 121 from the Museum of Comparative Zoölogy (Cambridge, Mass.); Messrs. Isaac Burke and Lewis A. Scott (Philadelphia); U. S. Naval Institute, Annapolis; J. H. C. Coffin, Surgeon-General's Office, U. S. Geological Survey, Smithsonian Institution (Washington); Prof. Henry S. Frieze (Ann Arbor, Mich.); State Historical Society of Wisconsin; John F. Carll (Pleasantville, Pa.); also from the Philosophical Society of Cambridge (England), for No. 120; Annales des Mines, Paris (117, 118, 120).

Dr. A. S. Gatschet (Washington, D. C.), by letter, acknowledged the receipt of his diploma.

Prof. Cope presented for the Transactions a paper on the structure and affinities of the Amphiuma, which was referred to Dr. Harrison Allen, Dr. George H. Horn, and Mr. Charles A. Ashburner to examine.

For the Proceedings were presented a paper from Dr. Hoffman of Washington, on some Indian Tribal Names, and a paper by Prof. A. S. Packard of Providence, R. I., on the discovery of thoracic feet in a carboniferous Phyllocaridan.

Dr. Horn exhibited sketches of Chrysobotheris and anatomical details.

Nominations Nos. 1064 to 1080 were read.

On motion, the Society resolved to appoint a committee to revise its work and to examine into its condition and suggest what, if any, measures are necessary to increase its efficiency. The Chair was desired to announce the committee at the next meeting of the Society.

On motion of Prof. Cope it was resolved that the Secretaries be requested to publish the proceedings and papers read before the Society in each year, so far as practicable, within the volume for that year.

On motion of Prof. Cope the Committee on Publication was requested to report on the desirability of increasing the size of the edition of the Transactions from 500 to 1000.

The rough minutes were read and the Society was adjourned by the presiding officer.

Stated Meeting, February 19, 1886.

Present, 19 members.

President, Mr. FRALEY, in the Chair.

Donations were received from the following: Geological Survey of India; Magyar Tudományos Akademie, Buda-pesth; Numismatische Gesellschaft, Wien; Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Munich; Astronomische Nachrichten, Kiel; Zoölogischer Anzeiger, Leipzig; Naturforschende Gesellschaft, Frieburg; R. Accademia dei Lincei, Rome; École des Mines and Société de Geographie, Paris; R. Academia de la Historia, Madrid; Royal Geographical Society, Journal of Forestry, "The Asclepiad" and "Nature," London; Royal Geographical Society of Ireland; Harvard University; Rhode Island Historical Society; New York Academy of Sciences and the Astor Library; Brooklyn Entomological Society; College of Pharmacy, Dr. Daniel G. Brinton and Messrs. W. S. Baker, Henry Phillips, Jr., and Charles A. Ashburner, of Philadelphia; Second Geological Survey of Pennsylvania; War Department, Department of the Interior, Bureau of Education and U. S. Commission of Fish and Fisheries, Washington, D. C.; State Board of Health of Tennessee; Chicago Historical Society, and the California Academy of Sciences.

Letters of envoy were received from the Magyar Tudomanyos Akademie (Buda-Pesth), and the California Academy of Sciences, San Francisco.

Letters of acknowledgment were received from the Naturforschende Gesellschaft, at Emden.

A letter was read from the California Academy of Sciences enclosing a list of its duplicates for sale.

An obituary notice of the late George Whitney, written by Mr. William Sellers, was read by the Secretaries.

The Committee on Prof. Cope's paper, appointed at the last meeting of the Society, reported progress, and was continued.

The President announced that he had appointed as the committee which he was authorized to appoint by resolution of Dr. Frazer, at the last meeting, Dr. Frazer, Mr. Law, Dr. Horn, Dr. Brinton and Mr. McKean.

Dr. Frazer from the committee reported progress, and the committee was continued.

The minutes of the Board of Officers and Council were submitted to the Society.

This being the regular evening for ballotting for members, an election was held, and the following persons were declared duly elected members of the Society.

2059. Dr. Edward Pepper, Paris.
2060. Prof. Serge Nikotin, St. Petersburg.
2061. Lieut. A. B. Wyckoff, U. S. Navy.
2062. Lieut. A. B. Murdock, U. S. Navy.
2063. Ensign Louis Duncan, U. S. Navy.
2064. Lieut. George B. Anderson, U. S. Army, West Point, N. Y.
2065. Robert Noxon Toppan, Cambridge, Mass.
2066. Prof. Hermann A. Hagan, Cambridge, Mass.
2067. Prof. F. A. Genth, Jr., Philadelphia.
2068. Prof. J. W. Holland, M.D., Philadelphia.
2069. Prof. John H. Brinton, M.D., Philadelphia.
2070. Inman Horner, Philadelphia.
2071. I. Minis Hays, M.D., Philadelphia.
2072. Charles A. Oliver, M.D., Philadelphia.

A paper was presented through the Secretaries by Prof. John C. Branner, entitled, "*The Glaciation of the Wyoming and Lackawanna Valleys*," for which the Society ordered two maps.

Prof. Cope presented through the Secretaries a paper on Two new species of three-toed Horses from the Upper Miocene, with notes on the Fauna of the Ticholeptus beds.

New nominations Nos. 1078, 1079, 1080 and 1081 were read.

The President reported that he had received and paid over to the Treasurer, $133.07, the amount of the *Michaux rentes* due January 1st, 1886.

The minutes were read, and the meeting was adjourned by the President.

Stated Meeting, March 5, 1886.

Present, 22 members.

President, Mr. FRALEY, in the Chair.

Dr. I. Minis Hays, Dr. John W. Holland and Mr. Inman Horner, newly-elected members, were present and took their seats.

Donations were announced from Anthropologische Gesellschaft, Wien; Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, München; Astronomische Nachrichten, Kiel; Zoölogischer Anzeiger, Leipzig; Academie Royale de Belgique; Société Americaine de France and Institution Ethnographique, Paris; Royal Society, Meteorological Council, Royal Astronomical Society, and "Nature," London; American Academy of Arts and Sciences, Boston; American Journal of Science, New Haven; American Chemical Society, and the publisher of "The Forum," New York; Hon. Thomas H. Dudley, Camden, N. J.; Academy of Natural Sciences; Mercantile Library; publishers of the American Naturalist; Messrs. William Dennis Marks, William S. Auchincloss, Samuel Wagner, Henry Phillips, Jr., and Hon. Richard Vaux, Philadelphia; Mr. Waters S. Chillson, Palo Alto, Penna.; Mr. H. B. Plumb, Peely, Penna.; Johns Hopkins University, Baltimore; Chemical Society, Bureau of Education, Census Office and United States Geological Survey, Washington; State Historical Society, Iowa, and University of California.

Letters were read from the Laboratory of Natural History and Biology of Dennison University, Granville, Ohio, requesting exchanges, which, on motion, was so ordered, to begin with No. 121 of the Proceedings; from Rev. T. P. Hughes requesting the subscription of the Society to his Dictionary of Islam.

Letters accepting membership were read from Lieut. J. B. Murdock, U. S. Navy (Norfolk, Va., Feb. 27th, 1886); Dr. H. A. Hagan (Cambridge, Mass., Feb. 26th, 1886); Robert N.

Toppan (Cambridge, Mass., Feb. 22, 1886); Lieut. A. B. Wyckoff, U. S. Navy (Philadelphia, Feb. 24th, 1886); Dr. Charles A. Oliver (Philadelphia, Feb. 20th, 1886); Dr. I. Minis Hays (Philadelphia, Feb. 20th, 1886); Dr. J. W. Holland (Philadelphia, Feb. 24th, 1886); Dr. John H. Brinton (Philadelphia, Feb. 24, 1886); Inman Horner (Philadelphia, March 2, 1886).

Letters of envoy were read from the U. S. Geological Survey; Wm. S. Auchincloss, C. E., Philadelphia.

Letters of acknowledgment were read from Observatorio Nacional, Mexico (Proceedings 120); Statistical Society, London (Proceedings 119); Société de Physique et Histoire Naturelle de Geneva (Proceedings 115, 116); Maryland Historical Society (Proceedings 121).

The Committee on Prof. Cope's paper was, on motion, continued.

Mr. Henry Phillips, Jr., presented an alphabetical list of the living members of the Society which he had been requested to prepare by the Board of Officers and Council.

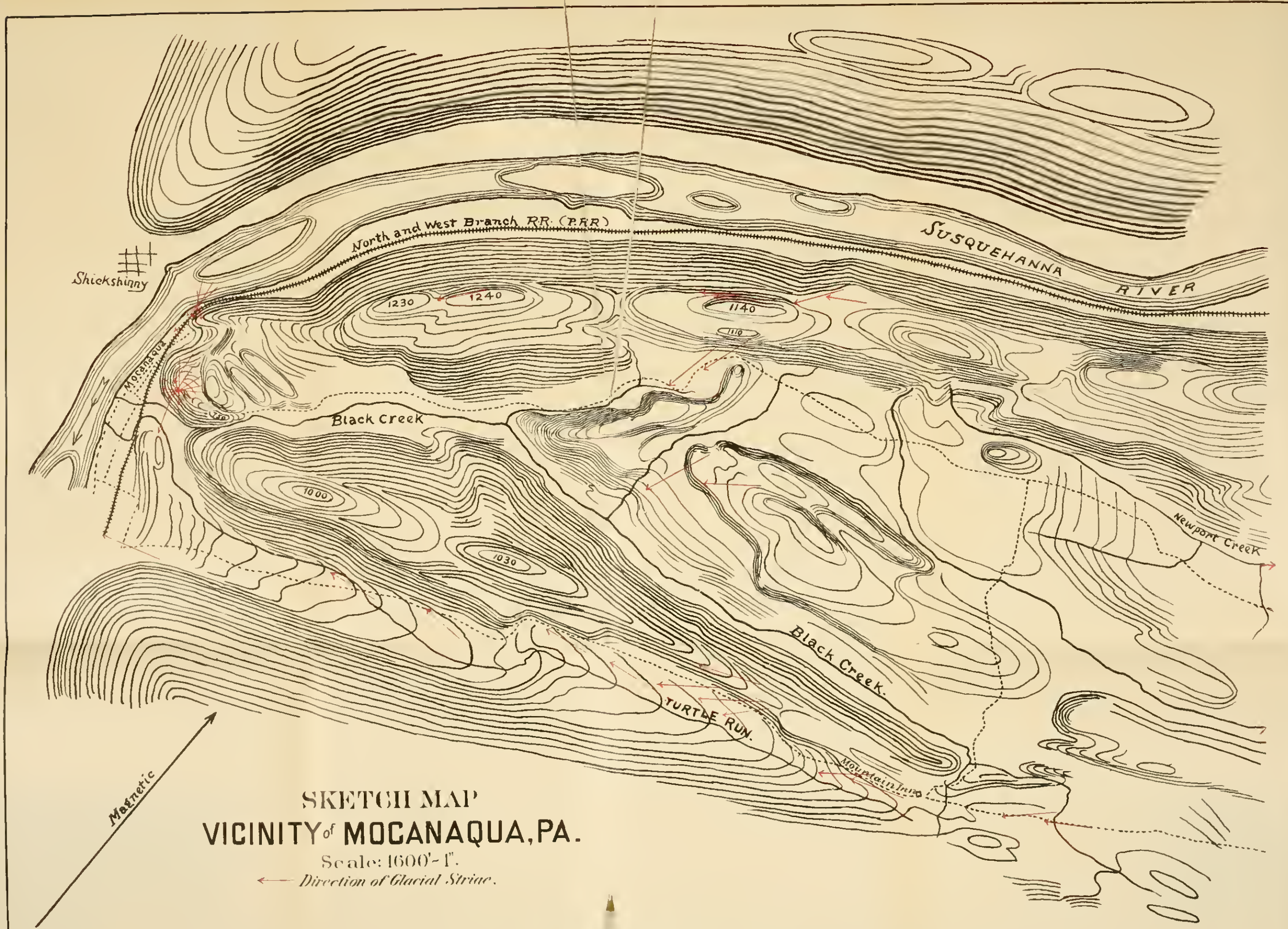
The Treasurer presented the report of the Trustees of the Building Fund.

The Special Committee appointed on February 5, 1886, "to revise the work of the Society, and to examine into its condition, and to suggest, what, if any, measures are necessary to increase its efficiency," made a report, which, after discussion, on motion of Mr. McKean was referred to the Board of Officers and Council for its consideration, and, on motion, the committee was discharged.

Pending nominations Nos. 1078, 1079, 1080 and 1081 were read.

New nominations Nos. 1082–1103 were read.

The rough minutes were read, and the meeting was adjourned by the President.



SKETCH MAP
VICINITY of MOCANAQUA, PA.
Scale: 1600'-1".
← Direction of Glacial Striae.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXIII. JULY, 1886. No. 123.

The Glaciation of Parts of the Wyoming and Lackawanna Valleys. By John C. Branner, Ph. D.

(Read before the American Philosophical Society, February 19, 1886.)

PREFATORY.

It has long seemed to me that the careful study of limited glaciated areas would add some valuable information to our present knowledge of the subject of continental glaciation. By a limited area I mean one sufficiently large to have a varied and well-defined topography, when taken in connection with the surrounding country, and small enough to admit of thorough examination, and of a representation upon the map of details which cannot be admitted into maps of large areas without obscuring the subject instead of throwing light upon it. The Wyoming and Lackawanna valleys, with their bordering mountains, form such an area, and the work necessary to make of this region a topographical map of unusual detail gave me an excellent opportunity for making the necessary observations.

I have hesitated though about presenting observations that would be so much more valuable had they been extended, with the same care and detail, over a wider territory, and especially over the high lands that bound the valley to the north and north-west on one side, and to the east and south-east on the other; but as I shall, in all probability, have no opportunity for completing the work, and as all knowledge is cumulative, I offer these notes in the hope that others may be induced to add to them, and thus render them more valuable.

The glacial geology of this region is exceedingly varied and interesting. The Shickshinny end of the basin, on account of its bold and well-defined topography, is particularly so, especially in the study of the ice currents in their relation to topography. In studying the area under consideration, however, I have never lost sight of the fact that I was dealing with a very small portion of the glaciated part of the continent, and with localized parts, localized movements, and localized facts in a continental glacier.

Although the work done and the explanations offered here are entirely original, I find that the influence of topography upon the movement of the ice was given, as an explanation of double striation, by Mr. C. E. Hall in the Proceedings of the American Philosophical Society, November 5, 1875 (pp. 633–4). The expression in this place of his theory upon the subject, is the most explicit I have seen. Prof. N. H. Winchell published an article in the *Popular Science Monthly* in 1873 upon "The Drift Deposits of the Northwest," in which he refers to the influence of valleys upon the edge of the ice. Mr. T. C. Chamberlin, in his "Terminal Moraine of the Second Glacial Epoch," refers in many places to the influence of topography on the direction of glaciers, and no doubt there are many other references to, and observations upon this subject which I have not been able to consult.

If, in recording the facts observed, I have been led to what may possibly be regarded as theorizing, my only defence is that it was quite impossible to see all about me the evidences of so wonderful, so awe-inspiring phenomena without coming to some conclusions regarding them. Then, too, in his letter transmitting Report Z of the Second Geological Survey of Pennsylvania, Professor Lesley has thrown no little doubt over the physical questions connected with glaciation, and, whether his suggestions there be open questions or not, they are calculated to make young geologists observe the evidences of glacial phenomena with a view to arriving at rational conclusions in regard to these questions.

The accompanying maps are necessarily upon a scale too small to convey a proper idea of the influence of the topography upon the movement of the ice. To show this a map would need to be very detailed and exact, and upon an unusually large scale, or better still, a large model would be required.

I take great pleasure in acknowledging here the kind encouragement of Professor Lesley and of Mr. Ashburner. To Mr. Geo. M. Lehman I am indebted for a number of valuable observations upon the direction of striæ in various places, and to Sheldon Reynolds, Esq., of Wilkes-Barre, for some observations made in the vicinity of that city.

Physical Features.

The Wyoming and Lackawanna valleys are, properly speaking, a single closed and curved synclinal valley, about fifty miles long by about five miles wide at its widest part, and bounded by mountains which coalesce at the extremities of the valley.

The concave side of its crescent form faces toward the north-west, the north-east end of the basin bearing about N. 20° E., and the south-west end bearing S. 70° W. Its mountain barriers thus presented themselves to the ice sheet at various angles, and now offer a valuable opportunity for observing the influence of such barriers upon the ice flow. Within this great basin are many secondary or miniature basins with a general resemblance to the large one, and many low, gently undulating and regularly sloping hills, some of which are anticlinals, and some are ridges with steep sides and abrupt faces, the latter being somewhat characteristic of the south-west end of the basin, the former of the end north-east of Wilkes-Barre. These irregularities diversify the interior of the basin, and add beauty to its natural scenery, while, in some cases, they have produced marked effects in the glaciation and in the distribution of the drift material.

The Susquehanna river enters the basin at Pittston, passes out of it again at Nanticoke, and, flowing thence, parallel to its bordering mountains, to Shickshinny, it here cuts square across the end of the basin. The north-eastern end of the basin is traversed by the Lackawanna from above Forest City to Pittston, where it flows into the Susquehanna. In the end of the valley north-east of Scranton there is a striking parallelism of the larger streams that run into the Lackawanna, and, inasmuch as it has been thought that this parallelism was due to drift deposits, I shall give here what appears to be its explanation. The streams referred to run in one of two general directions, which form an angle of about 77° with each other. The first of these is followed by the upper part of Eddy creek, Von Storch's creek, etc., and by the Lackawanna from where it bends, below Archbald, to Olyphant. It should be noted that these streams are parallel with the axes of the anticlinals in this part of the coal basin. The second direction is followed by the Lackawanna from Jermyn to the bend below Archbald, and by Fall brook, Coal brook, Elk creek, etc. None of these streams are in the drift, but in the solid rock, or rather, they flow between well defined hills of solid rock, and their courses have been determined largely, if not entirely, by the jointed structure of the rocks, possibly by faults in some instances.

The south-western end of the basin is crossed by a water-shed that drains it in two directions. The Nanticoke and Mocanaqua road crosses this water-shed about two and a half miles above the latter place, and about a quarter of a mile west of Uplinger's. On the northern side of the road this water-shed reaches the top of the river mountain in a north-westerly course. On the south side of the road it runs nearly half a mile south, when it turns east, and keeps this general direction for nearly two miles; then turning south again, it crosses the Mountain Inn road, just three-quarters of a mile above the Mountain Inn. Here it turns east, and in this bearing reaches the top of the Little Wilkes-Barre mountain. The lowest elevation, or gap, in this water-shed is on the south side of the axis of the coal basin, and a little more than half a mile north of the old Mountain Inn. According to Rothwell's map of this region, this gap is about 375′ above the Susquehanna at the Nanticoke dam. The lowest point in the water-shed next after this one, is near where it is crossed by the river mountain road at Uplinger's, and not far from the axis of the basin. This gap, according to the same authority, is about 415′ above the water at the Nanticoke dam. To the south and west of this water-shed the water reaches the Susquehanna just below Mocanaqua through Black creek and Turtle run. To the north and east it drains into the Susquehanna at Nanticoke through Newport creek and its tributaries. These streams, especially two of the largest of them, have, at some time in the past, borne an important part in the transportation, modification and rearrangement of the drift material. Their influence at present, however, is very insignificant as compared with what it doubtless was as the glacial epoch drew to a close.

The Surface Rocks.

The exposed or surface rocks of this region include the Carboniferous shales and sandstones, some of them easily decomposed, the Pottsville conglomerate, the sub-carboniferous red shales, and the Pocono sandstones, while the Catskill shales and sandstones lie just beyond the border of the basin. The Carboniferous shales are of various degrees of hardness and resistance, spots here and there preserving the striæ remarkably well, while in other places the same beds have disintegrated two inches or more below the polished surfaces that remain.*

Many of the sandstones have decomposed so rapidly that it is a very common thing to find surfaces that were once rounded, smoothed and striated in the characteristic way, now preserving not a single line that can be identified beyond doubt. But in some places, where these same sandstones have been protected by a considerable layer—say two feet or more—of drift, and only recently uncovered, the striæ are still well preserved.

As a rule, the Pottsville conglomerate preserves its ice record most faithfully, and frequently, too, under adverse circumstances. Cropping out around the border of the coal basin, and just inside of the mountains that limit the valley, this formation lies a little below the crest of these ranges, forming a continuous shoulder where the disintegration of the softer rocks, both above and below, has exposed it to the weather along the greater part of its outcrop. In many places this exposed rim has been so thoroughly polished that it is next to impossible to determine the direction of the striation. Indeed not a few of these highly polished rocks had to be passed over, especially during the early part of my observations, without my being able to detect a single well defined line, and not until my work was about drawing to a close did I hit upon a method for detecting the markings upon such surfaces.†

*I would not be understood as implying here that two inches represent the total general erosion that has taken place in this region since the glacial epoch. In such places as the one referred to, the surfaces are comparatively well preserved, while there are others in which the rocks have flaked off to the depth of many inches, or even feet, by the action of frost, and from which, of course, all evidences of glaciation have long since disappeared.

†A thin covering of soil sometimes permits a slow disintegration of the conglomerate, which leaves a few of the quartz pebbles in their original position, fast in the body of the rock, with their upper parts cut away and polished by glacial action. Examination of these polished pebbles, under a lens of low power, may show minute striæ, but it more frequently happens that these

The Mauch Chunk red shales are wanting about the north-east end of the basin, but they form thick beds in the Shickshinny end. When uncovered and exposed to the action of air, water and frost, these rocks have gone to pieces rapidly, but they have preserved the striation remarkably well wherever they have been covered up by a considerable thickness of earth. Striation on these shales therefore, as indeed upon most of the rocks, is only found along the roads and cuts where they have been recently uncovered.

The Pocono sandstones, forming the crests of the mountains on both sides of the valley, lie, for the most part, in a desolate, uncultivated, uninhabited and untraveled region, in which but few striated exposures are to be found. This is particularly unfortunate, for we must, of course, look to the markings upon these high points for the indications of the direction of the ice sheet when it had attained its grandest proportions, and before its margin was here reduced to the condition of local glaciers. This formation is the limit of my observations on the glaciation of this region.

Striation; its Indications of Flow, Change and Wear.

Scarcely a place can be found in the valley, which, if the rocks have been protected from the weather by a covering of earth, does not retain some signs of wearing by ice. Where the rocks have been long exposed to the action of air and water the well defined lines have, for the most part, been defaced. But even in these cases, the rounded faces of the rocks are often still preserved. But though the striæ are, in all probability, well preserved over almost the whole of this region, the drift and soil, covered, for the most part, with forest and undergrowth, render it impossible to make the record as complete as desirable. Most of the observations made upon the direction of the striæ have been placed upon the accompanying maps, and it is unnecessary to speak of them in detail. Some of the observations have been omitted in cases where several similar ones were made too near each other to warrant drawing several arrows upon the map parallel to the first one. Where there are two or

markings cannot be detected. I found that by gently rubbing a hard (6 H) pencil across the worn surfaces until they were quite covered with the lead, the fine striæ would stand out as white lines. Mr. George M. Lehman of the Survey, who has rendered me valuable assistance by noting the striation in places that I did not visit personally, also found that on a large polished surface, the lines could be detected by the observer taking such a position that the sun would be reflected from it to his eyes. It is necessary in this case, however, that the plane of incidence and reflection should be parallel with the direction of the striæ. I have found this method a useful one, though it is open to the objection that one cannot always have the sun in the desired position. This difficulty may be obviated by making the observations at night, and using a lantern for the reflections. When good exposures, sufficiently close to each other, can be had, it is not necessary that so much pains be taken to get an observation, but it not infrequently happens that it is very desirable to have one in some particular spot, and where the nature of the rock and the striæ require some such methods as the ones mentioned.

more sets of striæ in one place, they are represented by the arrows crossing each other at the proper angle. In a few instances the change in the direction of the striæ, either in the same place, or in places not far removed from each other, has been so great that it might well be asked upon what grounds I conclude that the flow of the ice was in the direction represented, and not exactly in the opposite direction. In such cases I have depended upon the topographical features and the nature of the scratches to settle the question—the lines frequently deepening in the direction of the movement of the ice—and, as far as I am able to see, the results have been satisfactory, though sometimes striking.

The striæ themselves are of the usual character, modified by the rocks upon which they occur. Those on the harder sandstones and conglomerates are shallow, and frequently so fine as to produce a high polish, while those upon the shales and softer sandstones are well defined and deep. They are approximately parallel to each other, though often crossed by other parallel sets of striæ pointing in different directions. Individual marks frequently deepen toward the south, and end in a deep gouge. Instances occur of what were at first considered to be glacial grooves, but, upon further and more careful study, these grooves were always found to be channels in the rocks, polished and more or less modified by ice. In one instance the impression of the trunk of a large Lepidodendron, lying in the direction of striation, had been worn out so smoothly that it was for some time mistaken for a glacial groove. The best defined striæ are found where the glacier moved along upward, horizontal, or gently downward gradients, and least prominent upon the steeper faces of hills that slope in the direction in which the ice moved. Evidences of "upward flow" are quite abundant, and where two or more sets of striæ occur in such a place, those pointing upward are frequently, though not always, the deepest. Furthermore, where the striæ indicate an upward movement the glacier appears to have moved forward with little or no regard to the smaller details of topographical features. I would emphasize these *smaller details* in this connection, for they had their share of influence later, as I hope to show.

The explanation of this upward movement and of these variations in the direction of the ice stream must be sought in the topography of the region and the varying thickness of the ice; indeed, unless these matters be taken into consideration, such phenomena are utterly meaningless. In the conglomerate ledge east of Carbondale are a great many depressions, or shallow holes, across which the ice has moved, to all appearances, without being impeded or deflected perceptibly from its general course. These depressions are of various sizes and depths, many of them being from a few inches to two or three feet wide and one or two inches deep. Such inequalities in the surface of the rock are not uncommon all through the region under consideration, and they are doubtless to be found in all glaciated countries. No one appears to be surprised that the ice should move down one side of these shallow depressions and up the other, and when the rim of the depression is a thousand feet, or more, above the bottom, why should not the same physical law hold good? It certainly does, to all appearances. But while ice only a few feet in thickness might flow across an inequality in its rock floor one or two inches deep, it would require a sheet proportionally thick to cross a valley like the Wyoming and Lackawanna without being deflected. And whenever varying sets of striæ in high altitudes were found, they go to show that, when the ice was at its greatest thickness, it moved across this valley without being turned from its general course, influenced only by the continental topography, in comparison with which the bordering ridges of the valley were insignificant, and scoring the evidences of its course deeply in the rocks. In other words, the only topography ignored by a continental glacier is that of local details. As the ice-sheet grew thinner, these mountains—the topographical details—influenced its course more and more, until it was reduced to the condition of local glaciers along its retreating southern margin.

The author of Report Z of the Second Geological Survey of Pennsylvania refers to "upper striæ" and "lower striæ" (Z, p. 106), and appears to think that the latter were made by under-currents in the ice, while he explains the different sets, when found together, by referring some of them to a sort of land-slides, which are said to produce "creep striæ" (Z, p. 84).

I have found no evidences in the region under consideration of striæ having been produced otherwise than by ice moving as a glacier. That some of them, indeed all of them, were produced by masses moved by "gravity" (Z, p. 85) is quite admissible, inasmuch as gravity is the force which causes the ice of all glaciers to move, and is as accountable for its moving down a great general or continental incline with surface irregularities a thousand feet deep, as over a limited one having depressions only an inch deep.

Many instances might be mentioned of a variation in the direction of the ice current, caused by little irregularities in the surface of the bed rock, without the glacier becoming localized. These are doubtless glacial under-currents. Evidences of this kind of a current are to be seen above Dunmore, at the quarry near the head of Plane No. 7. Here, a block of conglomerate having been removed from the wall of rock, the ice in the bottom of the glacier was caught beneath and below the projecting ledge, and forced forward and upward at an angle which I did not measure, but which, as nearly as I can remember, is about fifteen or twenty degrees. The horizontal bearing of these striæ is S. 40° E., while immediately above, on top of the ledge, and ten feet away, the striæ point S. 10° W.

Another interesting example of this character is found on Kelly's island in Lake Erie, and is described by Charles Whittlesey in vol. xxvii of the Proceedings of the A. A. A. S., pp. 239–245. It is also well figured by Chamberlin in his "Preliminary Paper on the Terminal Moraine of the Second Glacial Epoch."* But the existence of such diminutive under-

* Third Annual Report of the U. S. Geol. Survey, p. 336.

currents can hardly be regarded as evidence that there was an under-current filling and flowing down the Wyoming valley, while another upper-current flowed over the tops of the mountains. The existence of different sets of striæ in the same place, pointing one set across the mountain, and another down the valley, make such a theory unnecessary at least. Evidence that there were no great or extensive undercurrents in the ice may be seen in the gap through which the Lackawanna runs at Archbald. Just above the village, where the track of the D. & H. Gravity railway track crosses the old plank road, the striæ show beyond question that the ice in passing through this gap was not deflected by the topography into undercurrents, but that it was pushed straight ahead, and when there was not room for it in the narrow gorge, it was forced obliquely up and over the steep side of the hill, while the main body of the ice moved square across the hill that here stands out across the valley. If it had been moving in currents, it would have gone around the end of the hill, and the striæ would converge in the narrowest part of the gorge.

Again, at Mocanaqua, a quarter of a mile from the bridge, up the railway track, the striæ on the red shale point up the side of the steep hill at an angle of at least 30°, showing that the ice at the side of this gap flowed straight forward and up the hillside, instead of turning as an undercurrent and going down the channel as water would have done.

Just east of Mocanaqua, on the top of the hill above the West End breaker, a few hundred feet from it, and near the side of the road, are exposures of striæ with the following bearings:

S. 30° E.
S. 25° E.
Due South.
S. 45° W.
S. 65° W.
Due West.

Those pointing S. 30° E. and S. 25° E. appear to be the oldest of the ones now preserved, while those pointing due south predominate. It seems probable therefore that the oldest striæ were made when the ice came over the Shickshinny mountains, and when it was thick enough to disregard such a topographical feature. As the ice became thinner it ran due south, the later striæ almost obliterating those previously made. Further thinning of the ice sheet subjected it more and more to local influences until nothing was left here but a thin and narrow body of ice that came down the valley of Black creek, and being turned by the conglomerate ledge, left these last faint striæ that point west over the edge of the precipice.

In the Lackawanna end of the valley are several cases of double sets* of

* Striæ sometimes cross each other at well-defined angles without occuring in sets. Such variations may possibly have been caused by the cutting material having been turned in the grasp of the ice. No account was taken of striæ of this character.

striæ. One of these exposures is near the village of Jessup, on the hillside between Dolph's drift and its air shaft. Here they point due south, S. 25° W., and S. 30° W. Where there are several sets of striæ it is not always easy, and indeed it is sometimes quite impossible, to determine, by the striæ alone, which of the sets is the oldest. In this case, those pointing south appear to be the oldest, from which it is to be inferred that they were made when the ice was least influenced by the hills to the south, and that those veering to the west were made when the thinner ice began to feel the influence of the topography. In both cases the movement of the ice was up the side of the mountain. Another case of double striation was found above the track of the Erie and Wyoming railway, and about 1500 feet above the Scranton reservoir on Roaring brook. At this place one set points due south, while the other points S. 15° W. It was impossible to determine which of these sets was the older, though the striæ pointing south were the more numerous.

At the Nanticoke gap is a striking instance of local topographical influence upon the glacier. Near the mill-pond on the south side of the Susquehanna, and on the low ground, the striæ point N. 70° W., and on the north side of the river, near the railway station, they point N. 80° W. and due west. On top of the conglomerate ledge that rises above Nanticoke, near the gap, and just south of the river, the striæ point south, from five to twenty degrees east. Within a mile of each other horizontally, and five hundred feet vertically, these two sets of striæ differ in their bearing by 130°. Directly north of those on top of the conglomerate and at the foot of the steep ridge, Mr. Lehman informs me, the striæ are parallel with the river. The explanation of these contrasts in the direction of the striation is naturally suggested by the bold and well-defined topography of this region. The earlier ice probably moved nearly south across these ridges, while the localized glacier followed the depressions of the valley and, a part of it, at least, flowed through the Nanticoke gap and down the present channel of the Susquehanna river.

The south pointing striæ on the mountain west of Nanticoke contrast strongly with those on the top of the same ledge near Mocanaqua.

It will be noticed that where the water-shed from across the basin reaches the top of this mountain the striæ are parallel with the ridge. When they occur below the crest of the ridge, they are, doubtless, due to the ice moving down the deep, narrow valley, now occupied by the Susquehanna river. The explanation of the direction of those near Nanticoke must be sought in the topography to the north of where they are found.

The topography of the surface of the great glacier itself probably had its influence in directing the movements of the ice. If we imagine a perfectly even surface with the ice flowing across it, and a deep gap or notch made in the margin of the ice, it is evident that the tendency would be for the ice to flow toward this gap from both sides, while an ice promonotory between two such gaps would move along lines having a palmate radiation.

Mr. Chamberlin has happily represented the glaciers of the second epoch as moving in this manner. I would suggest that the scratches referred to on pp. xxi and xxii of Report Z may have been varied by such means, if the topography itself of the region cannot account for the change.

The glacial striæ, wherever observed in this valley or along its borders, seem, in every instance, to prove :—

1st. That the glacier, when at its greatest thickness, was influenced only by the great average topographical features of the glaciated region, and, consequently, that what appears to have been the upward movement of the ice is upward only in a local sense.

2d. That as the ice-sheet began to grow thinner and to retreat, its southern margin came more and more under the influence of local topography, and ended in local glaciers.

3d. That when more than one set of striæ are found in the same place, they are due to the direction of the thinning ice having been changed by topography.

Wearing Power.

The variation in the direction of striation in the case above the West End breaker at Mocanaqua amounts to 120°, without the original (?) striæ being obliterated. Other instances of double striation have also been referred to. I was at first inclined to think that such cases might be taken as conclusive evidence of the small wearing power of ice. But such a conclusion would evidently be unwarranted, for, whatever the original wearing power of the ice may have been, that power certainly diminished as the ice grew thinner and the glacier retreated. The later striæ cannot fairly, therefore, be taken to represent the wearing power of the ice when it was thickest. Indeed it is quite evident, from almost any one of the cases found, that the furrows made by the ice when thickest, were very deep, while later ones were so shallow as to fail to entirely obliterate the former ones. Furthermore, we have no means of knowing the comparative length of time the ice was moving in the different directions recorded. It may have moved for a long period in the direction indicated by the oldest of the preserved striæ, and, so moving, may have worn what the most extravagant claim for it (at least as far as any evidence to the contrary, found in this region, is concerned) ; while motion in the other directions may have been only of long enough duration to leave the markings we now see upon the rocks.

The Drift, its Character, Origin, Distribution and Arrangement.

The material composing the drift found through this region appears to be almost entirely local. In no instance did I find a single boulder of granite, or of any other archæan rock, though I watched carefully for such specimens. Only along the Susquehanna river did I find a few pebbles of archæan origin, but these were so small and water-worn that I am obliged to believe they were brought down by the river from the glaciated regions lying farther north, rather than by the ice. Even fragments from the Catskill shales cannot be regarded as very common, when compared with those from the Pocono sandstone, the Pottsville conglomerate, and the carboniferous shales, sandstones and coal. Especially is this true of the Lackawanna end of the valley north-east of Scranton. In a cut about forty feet deep, where the Winton Branch of the D. L. & W. railway passes through the drift near Eddy creek, many fragments of the reddish shales and sandstones of the Catskill may be seen. Judging by the lithological characters of these fragments, and by the direction of striation, they probably came from the tops of the hills just south of the Susquehanna County line, near Crystal Lake, in which case they must have traveled at least fifteen miles.

The character of the arrangement of the material changes with its elevation. That in the deeper parts of the valley is generally water-worn, and shows, by its being assorted and more or less stratified, that it was deposited in, or frequently washed by water. Kames of this material are, in some cases, nearly or quite a hundred feet in height. Higher up the sides of the valley no regular arrangement of the material appears, and the fragments that lie heaped in many of the hollows are rough and angular, and bear no signs of having been worn in a glacier, but appear to have been transported upon its surface. Of the latter kind of drift there is comparatively but little, while the former kind appears to have originally filled the deeper depressions along the trough of the valley. Here, the streams, seeking their natural channels, have washed away much of the original drift, and spread it out over the flood plains and alluvial lands down stream, leaving our present kames for the most part lying along the foot of the hills. In the upper or north-eastern end of the valley there are comparatively few kames, and these are generally of coarser material, while toward the lower end of the valley, below Scranton, they are more abundant, and have more sand and fine material in them.

The valley of the Lackawanna above Carbondale is so narrow, and the fall of the stream so rapid, that but little drift now remains along its course from the gap through which it enters the coal basin above Forest City to Morss' tannery near Carbondale. Below this point the bottom of the valley is restricted at several points, so as to form a series of dams, or, more properly speaking, of narrows, which have acted as dams to spread the floods of post glacial times out over low lands, or flats, immediately above them. The first of these dams below Carbondale appears to have been caused by the proximity of the drift on the south-east side of the valley to the little hill on the north-west side, at the base of which the bridge of the common road now crosses the Lackawanna in the town of Jermyn.*

In this case the dam may have been at or near where Rush brook now

*The dams in this part of the valley do not appear to have been as well defined as some of them further down the river.

enters the Lackawanna, or it may have been in the gorge above Archbald. In the latter case the narrowness of the valley between Jermyn and Archbald would not admit of a widespread deposit of silt, while the rapid descent of the stream must have combined with this narrowness to cause the washing away of nearly all the sediment that was thrown down between these two places. The rather unusual deposit of large quantities of drift on the east side of the river below the Archbald gorge may have been carried down from this narrow valley. This material, composed for the most part of large cobble-stones, and with but little sand and gravel in it, once filled the lower part of the Laurel Run hollow. But this stream has gradually cut it away, until its southern face is now a steep bank from ten to thirty feet high. Below Archbald the valley is narrow, and the current rapid, as far as Peckville. The next dam appears to have been at Olyphant. Here the flood plain of the valley narrows very considerably, the rocky hill upon which part of the town is built standing out from the south-east side across the valley, and thus confining the river to a comparatively narrow channel. The damming back of the floods here probably helped to form what are now the meadow lands between Olyphant and Peckville.

Following down stream, the next case of this kind appears to have been at Scranton. The city of Scranton is built upon a wide terrace of glacial drift, which, possibly, closes now the original channel of the Lackawanna river at this place. Opposite this terrace the hill upon which Hyde Park is built stands out across the valley, leaving a channel only about three hundred feet wide between the two, and through which the Lackawanna now flows. At or near the close of the glacial epoch, the drift must have dammed up the channel in this narrow neck almost entirely, and the muddy waters that have poured down this valley since the retreat of the ice, spreading out over the flats, have precipitated and deposited upon them the sand, silt, and alluvium of which they are formed. But as the river gradually descended to its present bed, it cut away the western side of the Scranton terrace, until it left its edge the abrupt, high bank along which Mifflin avenue now runs.

It is particularly true of this, the north-eastern, end of the valley, that the drift has been left, for the most part, along the foot of the hills. On the north-western side, along the old plank road, these kames may be seen all the way from Providence to Winton, cut through by the streams flowing down the sides of the mountain. On the opposite side of the valley they are not so well exposed, and are, for the most part, overgrown with forest; but the drift is even deeper and more widespread on this, than on the north-west side.

The influence of the drift upon the course of the streams in this region has not been so marked as it would have been in a flatter country, the courses of only a few of the smaller ones having been determined by it.*

*The change in the bed of the Susquehanna between Pittston and Kingston is referred to elsewhere.

Drift in the South-west End of the Valley.

Having had no opportunity for examining the drift between Scranton and Wilkes-Barre, I shall pass over this part of the valley, and speak of its south-western extremity.

The great body of the drift in this end of the valley, especially between Nanticoke and the water-shed that crosses it two and a half miles above Mocanaqua, lies below the elevation of the gap in the water-shed. Most of this drift is assorted. The largest and most interesting kames in the whole valley, as might have been expected, are found in the vicinity of Nanticoke.* Two of these were cut into in making the Newport colliery branch of the Susquehanna Coal Company's railway, one opposite the bridge of the Lehigh and Susquehanna railway over Newport creek, the other three-quarters of a mile further up Newport creek. The horizontal stratification of the material forming the kames south-west of Naticoke, and particularly those about the Newport colliery, show an absence of any strong current in the waters by and in which it was deposited. The sand of these kames shows, by the presence of much coal in it, that a large part of the material is near its original source. Here may also be seen good examples of distorted bands or strata of sand lying between straight or horizontal ones.

The distribution of assorted drift throughout this end of the basin, from Nanticoke to the gaps in the water-shed, seems to show that the water was once backed into this space by a dam, or gorge, in the Susquehanna at, or below the Naticoke water gap. The topography and the disposition of the drift also, indicate that the water was backed into this end of the basin, and that some of it, at least, flowed over the water-shed at the gaps already mentioned, and reached the river below Mocanaqua, by the way of Black creek and Turtle run. The valley through which Black creek runs is too narrow, and its fall too great to permit the accumulation of much drift along the stream, and as a matter of fact but little has been left along it above where it passes the conglomerate ledge. Below the ledge and between the West End breaker, and where the Mountain Inn road turns off to the east, are some very large kames.

Kettle-holes.

But few kettle-holes have been observed, and it is probable that the narrowness of the valley through which the glacial floods were obliged to pass has caused most of them to be filled up or otherwise obliterated. The half dozen observed are all small. One of them is in the town of Jermyn, just north of the school-house, and is now partly filled with water. Another smaller one is south of, and about a thousand feet from the residence of Mr. Richmond, of Richmond Hill farm, near Providence. Three

* In making this statement it is possible that I should make an exception of the kames in the vicinity of Pittston, which I have had no opportunity of examining.

others are on the water-shed near Uplinger's, in the south-west end of the basin. They are in the fields near the road, and are visible from it. The largest of these is nearly round in outline, from ten to fifteen feet deep, and about seventy-five feet wide. The smallest one is oval, and about twenty-five feet wide, while the intermediate one lies nearest the road and is pear-shaped in outline.

Boulders.

Large boulders are common throughout the valley, but especially so along the sides and top of the mountain that bounds the south-eastern side of the basin. They are generally of Pottsville conglomerate, and have been brought, at farthest, only across from the outcrop of this formation along the north-western rim, and left stranded where they now stand. Most of them are angular, and show few or no signs of glacial wearing. The largest seen by the writer are grouped together two and three-quarter miles due south-east of Peckville, but within the outcrop of the conglomerate, on the side of the basin. They are about $8' \times 10' \times 10'$, some larger and some smaller. Judging from their thickness and general appearance, their position and the course of the ice hereabout, they appear to have been carried up hill from the outcrop of conglomerate along the edge of a small valley about a thousand feet to the north-east of where they now stand. Smaller boulders, both of conglomerate and Pocono sandstone, are also widely distributed in this region, while they are especially common in some of the little hollows that head high up the sides of the mountains on the east. Here they lie heaped together promiscuously. These fragments are also local, and generally angular, being but little worn, or not worn at all, as if they had been brought here upon the surface of the ice. When boulders are found heaped together in this way lower down in the valley, they are invariably worn by ice, or water, or both. A striking example of this kind is exposed in the shallow cut along a branch of the Delaware, Lackawanna and Western railway where it runs in toward Dolph's breaker, near Jessup. Here boulders from one to three feet in diameter, and well rounded, are heaped together in the greatest confusion, and often without enough sand and gravel to fill the spaces between them.

Soil as Affected by Glaciation.

While the soils of drift-covered regions are frequently very fertile, those of the Wyoming and Lackawanna valleys are, for the most part, poor. The principal exceptions to this are the narrow, broken strips of alluvial lands along the Lackawanna river from just below Carbondale to its mouth, and the broad bottom lands of the Susquehanna. The finer material of the drift generally being spread out over the south-west end of the valley, and the coarser in the north-east end, the country below Wilkes-Barre is, on the whole, better adapted to agriculture than that along the Lackawanna. The reason for the prevailing barrenness of the soil in this region will be understood when it is remembered, that, as I have already stated, the drift here is almost entirely local, and that these carboniferous rocks have but little or no lime in them.*

I am decidedly of the opinion, however, that the soil of the Lackawanna valley is not so poor as it is generally believed to be. Very little effort has been made to reclaim and improve the land in this end of the valley. This is doubtless due in some part to the fact that the mining companies, which own the land, object to paying damages to owners or renters of the surface when abandoned workings cave in. They therefore prefer to allow the surface to lie idle.

Moreover the great mining and manufacturing interests of this region have tended to draw the population away from less remunerative agriculture. The greater part of the uplands now under cultivation—that in the vicinity and to the south-west of Wilkes-Barre—was cleared and tilled before the importance of anthracite coal was known. There is no essential difference between the upland soil above Scranton and that below Wilkes Barre, and yet, comparatively, there is very little under cultivation in the valley north-east of Scranton.

Local Changes—Black Creek.

Closely connected with the subject of glaciation are certain local phenomena and changes that have taken place, either during or immediately following the glacial epoch, that should be spoken of in this connection. The interesting changes in the bed of the Susquehanna river between Pittston and Kingston are described by Mr. Ashburner. Doubtless similar ones have taken place elsewhere, both in the Susquehanna and in other streams in this region. I would put on record here the evidences that have come under my observation of certain changes in the lower part of Black creek. From the head of the West End breaker the conglomerate ledge to the east and south-east forms a steep precipice, cut through at one point, about 1500′ from the breaker by Black creek, and making here a fall some twenty-five feet in height. Below the falls the walls of conglomerate spread apart, forming a V-shaped gorge with the fall at its apex. This gorge is filled with large, angular fragments of conglomerate, the fallen remains of the original conglomerate ledge. The water of Black creek, after falling over the ledge, ordinarily runs, partly underneath and partly over these fragments, for about one hundred and fifty feet, when it enters a pot-hole in the red shale. This pot-hole is about fifteen feet in diameter. Further down, two hundred feet below the fall, is another pot-hole from fifteen to twenty feet in diameter, likewise in the red shale. As these holes are both full of débris, it was not possible to ascertain their depth. Judging from the position and size of the pot-holes, and from the appearance of the material with which they are filled, they could not have been made by the

* To this same fact Scranton owes the excellence of the water supplied to the city. The streams from which this clear, soft water is brought, rise in and flow for their whole length over the Catskill and Pocono formations, both of which and especially the latter, are poor in lime.

current of the stream that now runs through them. The force of the stream, even when it is swollen to unusual dimensions, is quite broken by the time it reaches these holes, by the large and small fragments through and over which it flows. It cannot stir the stones in these holes, and consequently it is incapable at present of wearing them. A little further to the west a reservoir dam has been built across the stream, and, for some distance along the pipe line leading from it, the bed rock has been uncovered, in places more than one hundred feet above the stream, as it flows below the reservoir. This uncovered surface has the soft, half-decayed and smoothly rounded appearance characteristic of the rocks in the beds of streams, or where they have been worn by water set with stones. There is no confusing this peculiar smoothing of the surface with that done by ice—a subject referred to below.

The form of the ravine through which this stream now runs, the character of the débris which fills it, the pot-holes so far below the present position of the fall, and the water-worn surface of the rocks even below these pools are evidences that the falls were once farther to the south-west than at present. But as the conglomerate here dips to the north and northwest, the ledge over which it falls must have been proportionately higher than at present.

Such an elevation of this conglomerate rim—say ten to fifteen feet—would back the water of Black creek until it would leave its present channel near where the road crosses the narrow-gauge railway track, a quarter of a mile above the head of the West End breaker, and send it to the right down the gap through, or near, which the railway is built.*

Further evidence that the water once followed the course mentioned is found in the fact that, in mining beneath this old channel, either a pothole or the bed of an ancient stream, filled with sand and water-worn drift material, was cut into by the miners of the West End colliery. The material in this hole was struck some twenty (?) feet below the present surface, but as the workings were abandoned in its immediate vicinity, on account of the inconvenience caused by it, no further developments were made that throw light upon the origin or character of this hole or channel. The removal of some of the drift from the bottom of the mass caused a falling in of the surface. This surface depression made by the hole may be seen north of the track near, and just west of the crossing of the railway track and the dirt road.

But this gorge, if it did exist, was a very narrow one. and easily choked up, and when the floods of the ice age poured over the water-shed at Uplinger's and near the Mountain Inn, the stream down Black Creek valley was probably too large to flow readily through this narrow channel, and so it swept over the low conglomerate barrier which stood more directly in its pathway, and soon wore for itself a broader channel, smoothed the rocks below the falls, and ground out the pot-holes.

*The railway does not run exactly through the original gap. This has been quite filled up by drift and débris from the overhanging cliffs, and the railway passes through a cut a little to the south of the old channel.


SKETCH MAP
OF THE
LACKAWANNA VALLEY
FROM
Scranton to Forest City
PENNSYLVANIA.
Scale.
1 mile 1 inch
1885.
Position of Pot holes
The arrows show the direction of the striae
J.C. Branner.
Scranton
Dunmore
Olyphant
Peckville
Jessup
Archbald
Carbondale
Forest City
Lackawanna River
D L & W Ry
D & H C. Co Ry
Magnetic

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Pot-holes.

Among the interesting local phenomena related, in one way or another, to the glaciation of this valley, are the great pot-holes found near Archbald.

As the first one of these pot-holes is described in detail by Mr. Ashburner, I will only mention here, in speaking of the second one, what appear to be some of the important facts that relate to, or bear upon, their common origin.

The first of these holes was discovered in February, 1884, by the miners of Jones, Simpson & Co. cutting into it where it had penetrated the Archbald bed of coal in the Ridge mines. It was full of sand and water-worn material, and the surface of the ground, being covered with forest, showed no evidence of its presence. It is situated near the foot of the mountain, two miles due north-west of the town of Archbald, and nearly a mile south-east of the Callender gap. The little hollow in which both the holes are situated is half a mile long, and, in this distance, rises about ninety-five feet in the direction of N. 32° E. At the lower end this hollow broadens out, the hill-tops on either side being about five hundred feet apart, and about seventy feet above the top of the first hole, which is at the lower end of the hollow. A small, wet-weather stream runs down this hollow during the greater part of the year.

The second pot-hole is in the bottom of the same hollow 1100′ N. 33° E. from the first. At this point the hill on the north-west is only about ten feet above the level of the stream, while the one to the east rises almost perpendicularly about sixty feet above it. The location of the second or upper hole was discovered in May, 1885, in the same manner, and by the same parties that discovered the first one. Sand and water-worn drift, in every way similar to that found in the first hole, fell into the breast when the opening was made. To prevent further inconvenience in working this part of the mine, the material was propped up, and confined with pillars, to keep it out of the breasts. Not having been cleared of its contents it is impossible to describe this hole in detail, but with the aid of information kindly furnished me by Mr. Edward Jones of Jones, Simpson & Co., the operators of these mines, I am able to give its position and depth. The former, was determined by the mine map. The depth was obtained by using the mine levels, which give the elevation of the bottom of the hole, and my own topographical survey of this vicinity, which gives the elevation of the surface at this point.

Elevation A. T. of the rail at the mouth of the drift......	1077.95′
Rise to the bottom of the second or upper pot-hole........	49.50′
Elevation A. T. of the bottom of second or upper pot-hole.	1127.45′
Elevation A. T. of Topographical Survey station 3372, which is almost exactly over the hole.............	1192.07′
Total depth, including surface.........................	64.62′
Surface—say..	14.62′
Approximated depth of pot-hole.........................	50.00′

From the first, or lower hole the débris was all removed by the mining company, and before it was employed as an air-shaft, it could easily be examined both from above and below. The general profile of this hole along its greatest diameter is rudely that of an inverted riding-boot, the toe pointing about N. 80° E. It is thirty-four feet deep, and, at the top, about twenty feet wide in its smallest diameter, while its longest diameter —the length of the foot of the boot—is not known, the drift filling this prolongation never having been removed. It is not cut straight down, but leans considerably in the direction of the greatest diameter, that is, N. 80° E. In a foot-note on page 111 of Report Z, Professor Lesley refers to this first pot-hole (the second one not having been discovered at that time), and expresses the opinion that it is a glacial pot-hole, caused by the water falling over a crevasse in the glacier. After having gone over the ground repeatedly, and after having made a thorough study of the topography of this region, and of what appear to be all the questions that throw any light upon the subject, the more firmly am I convinced that his is the true and only possible explanation of it.

The theory advanced by Mr. Ashburner, was to the effect that this first hole was made by water flowing down the hollow in which it is situated, at a time when the stream was larger than it is at present, or by a stream coming from the direction of the Callender gap.

In regard to the latter suggestion, it may be replied, that, whatever the possibilities or probabilities may be of a stream having, at any time, flowed into the valley through the Callender gap, the position, inclination, and the direction of the greatest diameter of the top of the pot-hole preclude the possibility of its having been formed by a stream from such a quarter. The inclination and prolongation of the top of the hole point about N. 80° E., while the Callender gap lies N. 55° W. from this place.

That a pot-hole of such dimensions could not possibly have been made by the stream that now runs down through the hollow in which the hole occurs, is too plain to require demonstration ; and indeed no such claim, as far as I am aware, has been made. That this stream was once much larger than at present is doubtless true, but, with the present topography, the greatest possible area drained into the hole is less than a quarter of a square mile, or, to speak more exactly, twenty-three hundredths (.23) of a square mile. The torrential rains of the tropics would not be sufficient to produce, upon this surface, a stream big enough to grind out such a pot-hole. If we suppose that the two streams that cross the Callender gap road north of the hole, and the upper part of Tinklepaugh creek may have, at one time, drained into this hole (and, while the first two may have done so, there is scarcely a possibility that this last ever did), the greatest possible area so draining would have been less than two square miles, or, more precisely, 1.85 square miles.*

*These calculations are based upon the topographical map of this region made by the writer, and are known to be trustworthy.

It is scarcely credible that such pot-holes could have been formed by a stream smaller than the Lackawanna at Archbald, and this falling from a considerable height. I say "falling from a height" because, while I know that pot-holes may be, and are, formed in eddies by currents capable of whirling the wearing material inside of them, I do not imagine that any one will claim that even the Lackawanna could whirl the stones in the bottom of even the smaller of these pot-holes, at a depth of thirty-four feet without striking the water in it from a considerable elevation. But even admitting that such a stream might have done this, we should still need to account for such a stream at this place and elevation.

At the Archbald iron bridge the Lackawanna contains the water drained from a hydrographic basin having an area of one hundred and four (104) square miles, and, when at an average height, this stream has, at this point, a volume of 83.441 cubic feet per second. To produce such a stream as this upon an area of less than two square miles, to say nothing of a quarter of a square mile, would require a precipitation surpassing anything of which we have any knowledge. Finally while the difference of elevation between the upper and lower pot-holes is about sixty-five feet in a distance of 1100 feet, the head of this hollow is much flatter, there being but thirty-five feet fall between the head of the hollow and the upper hole—a distance of about 1800′—which is clearly not enough to produce a current sufficiently powerful to move the stones in the bottom of a pot-hole fifty feet deep.

In support of the explanation offered by Professor Lesley, I would call attention to an important, and somewhat remarkable topographical feature in this part of the valley—a feature even more striking when looked at upon the ground, than when seen upon the map. This is a hill that projects, from the vicinity of the pot-hole, directly across the whole valley, in the direction of Archbald, and is only interrupted at this place by a narrow gorge, through which the Lackawanna flows.

Where the "back road," leading from Olyphant to Jermyn, crosses this hill, it is 310′ above the level of the river at Archbald, while 1500′ north-east of the lower pot-hole, it (the hill-top), is 380′ above the river, and 125′ above the mouth of the lower hole, which is *just below the crest of the hill.*

The ice moving down the Lackawanna valley, and over the top of this hill, must have been broken by it into crevasses into which the streams that formed these pot-holes must have plunged. As the ice moved forward, the crevasse would occur at, or about, the same point every time, and so keep the water fall stationary, or nearly so. The shallow prolongation of the upper part of the lower hole was probably caused by the occasional withdrawing of the stream, as it cut the ice more rapidly than it was pushed forward.

The surfaces of the rocks on the top of the hill above the upper pot-hole have been worn smooth by the ice, but being friable sandstones they have failed to preserve any striæ, and although most careful search was made, no striated exposed surfaces were found anywhere in the immediate vicinity of these holes.

Exactly why the stream flowing over the ice should come from N. 80° E., and not from some other precise point of the compass to the north-east, we have no means of knowing. We do know, however, that very insignificant influences may determine the direction of a stream beginning to form upon the surface of melting ice.

Exactly why there should have been a crevasse above the lower pot-hole is another problem we have no means of solving. The hill to the east of the hole runs to a point just here, and is only sixty feet high. The crest of this ridge is more than a thousand feet to the north-east, and it is here *under its very brow* that one would naturally expect to find a pot-hole, if anywhere in the vicinity. And it is interesting to know that, as a matter of fact, *the second and deeper pot-hole is exactly at this point.*

In considering this question of the origin of these pot-holes I have taken into account the possibility of the water having been thrown over the ridge at the place in question by an ice-dam in the Archbald gorge toward the close of the glacial epoch. While I admit the possibility of such a dam, I do not find that it simplifies the explanation in any way ; but, on the contrary, that it would necessitate a great many subordinate hypotheses.

It seems probable also that the circumstances must have been more favorable for the formation of these holes after the ice sheet had begun to retreat, and after it had come somewhat, but not wholly, under the influence of local topography.

As far as I have been able to learn, these two are the only pot-holes of this character that have been discovered in this valley. The one referred to by Prof. Lesley (Report Z, p. 111), as having been mentioned in the *Scranton Republican*, is a small and simple one, made by Laurel run in the soft shales of its bed. Such pot-holes are not uncommon in this region. Besides those referred to on Black creek the writer has seen several along Laurel run near Archbald and in White Oak run between the reservoir and where this stream runs into the Lackawanna. Mr. George M. Lehman found several in Mill creek lower down the valley. Two of these, he says, "are side by side, exactly alike, about the size of a stove-pipe, and just as round."

Water-wearing.

Further evidence that these pot-holes were made by water falling from a considerable height, may be seen in the water-worn condition of the preserved rock surfaces in the vicinity of the lower hole. All the preserved surfaces of these rocks have the rounded and worn appearance that is imparted by falling water. There can be no confusing these with glaciated surfaces. The latter, whether preserving their striæ or not, generally have a regularly rounded appearance, the tendency of the ice being to reduce all irregularities. This smoothing, as has already been said, is most marked upon upward, level, or gently downward gradients. Water, on the other hand, does its principal wearing on down grades, and especially in cataracts, or, where falling over precipices or obstructions, it can dash the stones, or other grinding material with which it may be charged against the rocky bed below. In such places the erosion caused by ice would be very insignificant or nil. Every one is acquainted with the fantastic forms and miniature pot-holes made in the rocky bed of a stream where it pitches down a cataract. Such cases are common in the carboniferous shales along White Oak run and Laurel run near Archbald, and in the Chemung and Portage rocks of Central New York. In addition to these more specific differences, there is an indefinable one in the softer outlines and appearances of a water-worn surface which generally aids the experienced eye.

Immediately to the north of the lower pot-hole a ledge, that is now breaking up, has this water-worn appearance. Some of the best evidences of the action of water may be seen about 500′ N. 40° W. from the mouth of this hole, and at the foot of the little hill that rises to its north. Here the evidences of wearing by a large stream are unquestionable, although there is now no considerable stream nearer than the Lackawanna at Jermyn, more than a mile and a half away, and 210′ below this level.

On Two New Species of Three-toed Horses from the Upper Miocene, with Notes on the Fauna of the Ticholeptus Beds. By E. D. Cope.

(Read before the American Philosophical Society, February 19, 1886.)

Anchitherium ultimum, sp. nov.

Unusual interest attaches to this horse since it is the latest representative in time of the genus to which it belongs. It is from a horizon above the John Day Miocene, which contains several Loup Fork genera and species, as Protolabis, Hippotherium and Dicotyles. As, however, the *Blastomeryx borealis* Cope occurs at the same locality and horizon, the bed is probably to be referred to the Ticholeptus epoch, which I have shown to be between the John Day and Loup Fork epochs in age, with greater affinities to the latter.* The principal locality is the valley of the Deep river, Montana, but the present species is derived, with those above mentioned, from Cottonwood creek, Oregon.

The *Anchitherium ultimum* is represented in my collection by a nearly complete superior dentition, with palate and sides of skull to the middle of the orbits, and top of skull to above the infraorbital foramen. The size is less than that of the *A. præstans* Cope and *A. equiceps* Cope (? *A. anceps* Marsh) of the John Day bed, and the dental series has the same length as that of the *A. longicriste* Cope. also of the John Day. The animal is adult, and anterior teeth are considerably worn. The posterior molars

* See American Naturalist for April, 1886.

do not display any material differences from those of the *A. longicriste.* The premolars and molars have a well-marked external cingulum, and there is an internal cingulum round the base of the second premolar. The only other cingula are weak ones round the bases of the anterior lobes of the second and third true molars. The anterior intermediate tubercle forms an angulation in the outline of the anterior cross-crest of the premolars, and a rounded enlargement in that of the true molars. The posterior intermediate tubercle has a triangular section. The anterior teeth are curiously unsymmetrical. There are six incisors, the third having a more posterior position on one side than on the other, and having a cupped crown. The crowns of the others are lost. On the right side, behind a diastema rather longer than the transverse width of the crown of the third incisor, is a robust canine tooth. On the opposite side there is no canine tooth, nor a trace of one ever having been there. The diastema separating the canine from the first premolar is long. The latter has but one root and has a rather small crown.

It is in the cranial characters that this species displays the greatest differences from the John Day species. In the first place there is a profound and large preorbital fossa, separated from the orbit by a vertical bow. The preorbital fossa in the John Day species is shallow, and not abruptly defined. In the next place the anterior border of the orbit is above the anterior border of the last molar tooth. In this it agrees only with the large *A. præstans;* in the *A. equiceps* and *A. longicriste,* the anterior border of the orbit is above the anterior part of the second superior molar. Thirdly, the infraorbital foramen is above the middle of the fourth premolar; it is over the posterior part of the third in the three John Day species. Finally, the nareal notch marks the anterior two-fifths of the diastema; it extends much further back in the John Day species, marking either the front or middle of the first premolar. The palate extends about as far anteriorly as in *A. præstans,* viz., to opposite the posterior border of the first true premolar.

Measurements.		M.
Length of diastema from I. 3		.047
" " " " C		.035
" " superior molar series		.079
" " " true molars		.034
" " crown of p. m. 1 (greatest)		.007
Diameters of crown of p. m. ii	anteroposterior	.0145
	transverse	.0145
" " " " m. i	anteroposterior	.011
	transverse	.015
" " " " m. iii	anteroposterior	.011
	transverse	.014
Long diameter of crown of I, 3		.007
Depth of muzzle at middle of diastema		.039

For comparison with this specimen I have used five crania of *A. equiceps*, and one of *A. præstans* and *A. longicriste* each, besides numerous fragmentary jaws.

It was found by Mr. J. L. Wortman in the Ticholeptus beds of Cottonwood creek, Oregon.

I give here a list of the species obtained with this one at the locality in question :

Protohippus, ? sp.
Hippotherium seversum Cope.
" *sinclairi* Wortman.
" *occidentale* Leidy.
Anchitherium ultimum, Cope.
Dicotyles condoni Marsh.
Protolabis transmontanus Cope.
Merycochœrus obliquidens Cope.
Blastomeryx borealis Cope.

The species of the Ticholeptus beds of Montana are the following :

Mastodon proavus Cope.
Protohippus sejunctus Cope.
Merycochœrus montanus Cope.
Merychyus zygomaticus Cope.
" *pariogonus* Cope.
Cyclopidius simus Cope.
Cyclopidius emydinus Cope.
*Pithecistes brevifacies** Cope.
" *decedens* Cope.
" *heterodon* Cope.
Procamelus vel Protolabis, sp.
Blastomeryx borealis Cope.

This horizon is interesting as that in which the genus Mastodon makes its first appearance in America. It is now shown to be the last which contains the genus Anchitherium. See Final Report United States Geological Survey Territories, Vol. iii, p. 18, where some of the characters of this fauna are pointed out. In the list of the Deep River fauna above given occurs the name

MERYCOCHŒRUS OBLIQUIDENS Cope.

This is a species hitherto undescribed, which approaches those of Merychyus in some respects. As it is established on a mandibular ramus only, although this is nearly entire, it cannot be positively decided to which genus it should be referred, as the generic character is only seen in the presence or absence of lachrymal vacuities. However, in all the species of Merychyus, where the parts are preserved, *M. elegans*, *M. arenarum*, and *M. zygomaticus*, the first inferior premolar is one-rooted, while in the species of Merycochœrus it has two roots. In the present animal there are two roots. The symphyseal region is very much contracted, so that if there were three inferior incisors they were small.

This species is smaller than any known species of Merycochœrus, about

*The absence of caries in the teeth of extinct Mammalia is well known. The type specimen of the *Pithecistes brevifacies*, however, displays a carious excavation on the external side of one of its inferior molars. This feature adds to those which indicate the degeneracy and approaching extinction of this type, as I have remarked in my synopsis of the Oreodontidæ, Proceedings American Philosophical Society, 1884, 557.

equaling the larger individuals of *Oreodon culbertsoni.* The molar teeth are, however, relatively larger than in that animal and in the species of Eucrotaphus, and the anterior premolars and incisors smaller and more crowded. The last two premolars are in line, but the second premolar is set obliquely in the jaw so as to overlap the first premolar by the whole of its anterior root, and the third premolar by half of its posterior root. The anterior root is interior, the posterior exterior. The first premolar has a robust root with round section. The crown is but little expanded at the posterior base ; anterior part and apex lost. The alveolus of the canine diverges somewhat outward. The symphyseal suture is short and rather deep. Its posterior edge is below the posterior quarter of the third premolar.

The outline of the jaw is nearly vertical behind, with rounded angle, and abrupt excavation below the condyle. Its edge is beveled outwards except opposite the grinding edge of the last molar where there is a thickening on the external side. The masseteric fossa is well impressed, but rather small, descending only to the line mentioned. On the contrary the fossa of the internal pterygoid muscle occupies the entire jaw behind the line of the third molar, and is bounded posteriorly and at the angle, by an incurved edge. Dental foramen opposite middle of last molar. Mental foramen below posterior edge of second premolar.

Measurements.	M.
Length of ramus at line of mental foramen	.150
" " molar series	.096
" " premolar series	.042
" " third premolar	.0125
" " fourth "	.013
Diameters m. ii { anteroposterior	.0165
Diameters m. ii { transverse	.012
Length of m. iii	.025
Depth ramus at p-m. iii	.030
" " " m. iii, front	.035

In the *Merychyus pariogonus* Cope of the Deep River Ticholeptus bed, the posterior part of the ramus is more expanded, and is perfectly rounded, while the other dimensions are considerably smaller.

From Cottonwood creek, Oregon ; J. L. Wortman.

HIPPOTHERIUM RECTIDENS, sp. nov.

The probable Loup Fork Upper Miocene formation of Tehuichila, State of Vera Cruz, Mexico, has yielded a third species of three-toed horse, which differs from any of those known to me * I owe the superior molar tooth on which the evidence depends, to my friend, Dr. Santiago Bernad, to whom I am already indebted for the other species known to me, and

*See Proceedings American Philosoph. Society, 1885, p. 150 (1886), for descriptions of two species, *Hippotherium peninsulatum* and *Protohippus castilli.*

described in the Proceedings of the American Philosophical Society, 1885, p. 150. The present animal presents very nearly the same enamel folds as the *H. peninsulatum* Cope, of the same locality, including the subquadrate central loop which is nearly cut off from the anterior lake. But the tooth differs in two essential points, and in some minor ones from that species. It is considerably larger, presenting .6 more area of the grinding surface. The shaft of the tooth, instead of being strongly curved, is straight. Less reliable characters are, first, that the crown is nearly square, while it is oblong in the *H. peninsulatum;* and second, that there are two large loops extending inwards towards the column instead of one. This character may or may not depend on the position of the tooth. Diameters of crown, transverse, 21.5 mm.; anteroposterior, 21.5 mm.; longitudinal, 450 mm. I propose that the species be called *Hippotherium rectidens.*

Vocabulary of the Selish Language. By W. *J. Hoffman, M.D., Washington, D. C.*

(*Read before the American Philosophical Society, March 19, 1886.*)

The Selish, or Flathead tribe of Indians, is one of a group of tribes constituting what may be termed the eastern division of the Selishan linguistic stock. The tribe is at present located in Jocko valley, Northwestern Montana, near the eastern spurs of the Rocky mountains. The surrounding country is extremely fertile, and abounds in game. The tribe numbers less than one hundred and fifty souls, and the primitive customs are fast giving way to the modern innovations of civilization.

In the accompanying vocabulary, which was obtained in 1884, a peculiarity will be observed in the terms of relationship which is of more than ordinary interest, especially terms which indicate a relative as living, or dead, changes being made after the demise of an individual because the name of the dead is not spoken aloud or in the presence of other relatives.

The words are spelled phonetically, with the addition of a letter or two to simplify orthography, and a few characters as explained below:

a, has the sound of *a* in father.

â, " " " " " " law.

q. " " " " ch, in the German *nicht.*

x, " " " " gh, " " Arabic *gh*, or German *nacht.*

˘, ¯, placed over vowels indicate respectively, short and long sounds.

', indicates an interruption in sound.

′, the accent indicates accented letters, or syllables.

ⁿ, the superior ⁿ, as in eⁿ, indicates nasalized sounds of letters to which it may be attached.

Italicized letters are whispered.

Man,	Skal′tamĭuq.
Woman,	S'um′ĕm′.
Old man,	Paq′pohot skal′tamĭuq.
Old woman,	Paq′pohot s'um′ĕm′.
Old man, another form,	Sli′optshĭ′.
Young man,	Sku′kwimĕlt′ skal′tamĭuq.
Young woman,	Sku′kwimĕlt′ s'um′ĕm′.
Boy,	*Ku'ku'* sē′.
Girl,	She′shu*wĭt′*ŭm.
Infant,	Oqtĕl'.
Widow,	Sluwe′lŭmpt.
Grass widow,	*S*′tseĕm′.
A widow looking for a husband,	Tsĕl′ĭshkuĕ′.
Indian prostitute,	Uĭ′uqunĕ′, lit., one who runs at large.
City prostitute,	Sin′kalĕ′, lit., fresh meat.
Wife, said by husband,	Nâ′qŭuq.
Husband, said by wife,	Sqē′lŭĭ.
Son, said by father,	S'kŭssĕ′.
Father, said by son,	Liĕ′uq.
Mother, " " "	Skōl.
Daughter, said by father,	Stĕmtshiĕlt.
Father, said by daughter,	Inmĕstĕm.
Mother, " " "	Ĭntum′.
Elder brother,	Inkĕtsht.
Younger brother,	Ĭsīm′tsĕ.
Elder sister, said by younger brother,	*Ĭ′s'ms*ŭmsĕm′.
Elder son's wife, said by father,	Sĕ′pĕn.
Elder daughter's husband, said by father,	Ĭsne′tshĕnuq′.
Wife's father, said by father,	Sâxē′.
Wife'a father, said by father, after wife's death,	Stshĕel′.
Wife's mother,	N'ilse′tsht.
" " after wife's death,	Stshĕel′.
Wife's elder brother, said by husband,	Ĭs′stests.
Wife's elder brother, after death of wife,	Inkuit′sĭua.
Wife's elder sister, said by husband,	Sestĕm.
Wife's elder sister, after death of wife,	Inkuit'itĕm.
Brother's son,	Ĭsmelq′.
" " after brother's death,	Ĭs′luqūĕlt.
Sister's son,	Ĭntunsh′.
" " after sister's death,	Ĭs′luqūĕlt.
Brother's daughter,	Smĕlq.

Brother's daughter, after brother's death,	Ĭs'luqūelt.
Sister's daughter,	Tūntsh.
" " after sister's death,	Ĭs'luqūĕlt.
Eldest child,	S'shiī'ti.
Youngest child,	Stēē'uti.
Intermediate, *i. e.*, the second of three, or the third of five children,	Kēē'usi.
Chief,	I'lĭmi'qu.
Friend,	S'lăqt.
Slave,	Sh'mĕn.
Indian,	S'kĕluq.
Whiteman,	Suī'ăpi.
Frenchman,	Se'ămĕ.
Indian policeman,	Squ'nĕum.
People,	Kuīts'kĕ'luq, lit., many, Indian.
Great Spirit,	Xōlĭntso'tă.
Shaman,	Tlekuilsh.
Doctor,	Squ'malĭĕl'.
Moccasins,	Kĕshil'.
Blanket,	Sitsŭm'.
Earth lodge,	Mĕlta'qulq.
Tule lodge,	Sĭste'qulq.
Skin lodge,	Spie'qulq.
Fire,	Sâl*qlts* hi'.
Ashes,	Kōlmĭn'.
Smoke,	S'mot.
Bow, of wood,	*Sts*kuī'ltsh ; ski'ŭĭlst.
Bow string,	Tsha'tsinsht.
Sinew, on back of bow,	Tīnsh.
Arrow,	Tapŏmīn'.
Notch in end of arrow, for string,	S'kuadlamī'.
Arrow feathers, on shaft,	Tshkŏ'.
Quiver,	Sĭnkolxtĕ'.
War-club,	Tshu'lulĕ'.
Quiver strap,	Tshatsĕ'.
War-spear,	S'mo'lomĕn'.
Fish spear,	Xlomintĕn'.
Shield,	*S'sh*tlĕ'.
Drum,	Pomēn'.
Fish-line,	Tshatsĕ'.
Fish-net,	*Kă* kă mĕ'.
Pipe (general term),	S'she'nsh.
Pipe, of stone,	S'she'ush nĭmĕ'.
Pipe-stem, of wood,	*T*'pĕ'.

Spoon,	S'xlu'mĕn.
Knife,	Nin'tshĕmĭn'.
Scraper, iron,	*P*'tsha'mĭn.
Head,	*S'ptl*xe'.
Hair,	Kom'k'n.
Face,	*Sk'tl*ŏ'.
Forehead,	*St'shtl*tshŭmĕ'stĕ.
Eye,	*S'tshtl*hŭkŭ'.
Eyelash,	*St'sho*'pŭs.
Ear,	*T*'e'nĕ.
Nose,	*S*'pasa'.
Cheek,	*S*'kultshamūs'.
Mouth,	*S'plt*'mu^{n}tsĕn'.
Tongue,	*Stixus*tshĕ'.
Saliva,	*Spt*'auq.
Throat,	*S*kame'lt'n.
Shoulder,	Sintshumsh'xĕlt.
Nipple,	*Sk*'ŭme'ĭl.
Hip,	Sâkamĕ'ĭ.
Belly,	Olin'.
Navel,	Te'muĕq.
Arm,	Stshouaqĕu'.
Elbow,	Stsh'axosaqĕn.
Wrist,	Skul'tshomĕt'*sn*.
Hand,	Tshēlsh.
Thumb,	Stum'*sht*.
First finger,	Tso'komĭ'.
Second finger,	Sin'lsht.
Little finger,	Stauptke'ĭ.
Leg,	St'shamak'tshĭn.
Foot,	St'sūtsu'shĕ.
Blood,	*S'n*'qulq.
Heart,	*S*'puŭs'.
Lung,	Snĭsqtĕl'stĕ.
Liver,	Pĕnīnsh'.
Stomach,	S'stema'usts.
Antelope,	Sta'ăn.
Buffalo,	Kuĕikua stema'.
Cattle,	Stema'.
Beaver,	Skalĕu'.
Bear, grizzly,	Sămxĕ' ; sŭmxĕ'.
" cinnamon,	Tl'tshikuĕ n'sămxĕ'.
" black,	Kua'ĭ n'sămxĕ'.
Deer, white-tailed, male,	Soxle'.
" " female,	*T*sulqu'.
" black-tailed, male,	Puĕ'.

Deer, black-tailed, female,	Stŏltsĕ.
Elk, male,	Tshĕts.
" female.	*S'n*nĕ'.
Fox, generic term,	Xăxă'.
Goat,—mountain,	S'uxlĕ'.
Lynx [*L. rufus*],	Sĭn'xutso.
Moose,	Sxa'sĕlŭks.
Muskrat,	*Tshĭtshĭ*lĕ'uq.
Otter,	*L*'ĭlĕku'.
Panther,	*S'kŭ*tisamĭĕ'.
Rat,—common,	Xĕ'ut.
Rabbit, sage,	*L*'skua'.
" jackass,	Skŭa'ŭktsĭ.
Sheep, mountain [*O. montana*], male,	Xu'l'nĕ'.
Sheep, mountain [*O. montana*], female,	*Xŭt*hŭā''tl.
Wolf [*C. occidentalis*],	*N*tsi'tsă.
Bittern,	Li'lĕ.
Bluebird [*Sialia arctica*],	*N'l'q*kui'kuaĭă.
Blue jay, generic,	Kuăs'kuī.
Blackbird [*Agelæus phœniceus*],	*K'itsh*klă'.
Blackbird, yellow-headed [*Xanthocephalus icterocephalus*],	*Skĕk*'itshklă'.
Crossbill [*Loxia curvirostra americana*],	Ai'qusa'.
Crow [sp. ?],	Tsaă'.
Curlew,	Hauĭt'hauĭt'.
Crane,	Skuăltshĭn'.
Coot,	Stĕlak'sha.
Dove [*Z. carolinensis*],	Ua'uia'ŭk.
Duck,	Nŏsŏshinĕ'.
Eagle, bald head,	P'kălqkĕ, lit., white head.
Eagle, bald head, young, with black-tipped tail,	Mĕlkenŏ'.
Grouse [*Bonasa umbella*],	Ka'xit'lsĕ.
Humming bird [*T. colubris*],	Qo'nĭmqo'nĭm.
Hawk,	Tsĕltsĕltshĭmŭ'.
" duck,	Hâ'iât.
" fish,	Tsi'ŭqtsuq'.
Heron [*Ardea herodias*],	Sâmâkŭĕ'i.
Night heron,	Smatskĕ'uq'.
Kingfisher,	Tsa'dlīs.
Loon,	Osu'luq.
Lark,	Ŭeuĭt'sulĕ'.
Magpie,	A'*d'n*.

Owl, great-horned,	Sni'neĕ'.
" screech,	*N*'tshitqĕ'.
" American long-eared,	*N*'spuĭsh'*n*'imĕ'.
Prairie hen,	*S*'kâ.
Raven,	Mĕla'.
Swift, white-throated,	Mab'*n*kuĭtsĕn.
Swan,	*S'pk*'ămi'.
Turkey buzzard [this probably refers to the black vulture],	Tsa'kŏwi'*ă*.
Whip-poor-will (*Phalænoptilus nuttali*),	Spăs.
Woodpecker,	Stĕlqū'.
"	Sp'ŭăl'xă.
Woodpecker, red-shafted (*Colaptes mexicanus*),	Kul'kuletsh'.
Eel,	Ku'tun.
Oyster,	Sku'skula'nĭ.
Sturgeon,	Tsŭmtū'.
Salmon,	Sŭmqli'.
Trout,	Pīlq.
White fish (*sp.* ?),	Xoĭu'.
Mullet,	Tshilĕ'nē.
Salmon trout,	Xla'ĭ.
Bladder,	Sintshe'itĕ'.
" common term,	Sinl'uaqstĕn.
Scales,	Sĭlktshīm'.
Frog, green (*sp.* ?),	Xĭlm'xlăxa'.
Lizard, newt (*sp.* ?),	Shĭ'shĭltshe.
Rattlesnake,	Xau'lĕuq'.
Toad, black (*sp.* ?),	S'nakŭkuă''m.
Spotted snake,	Tshĕ'uīlĭ.
Gopher snake,	Hŏupo'.
Ant, black,	Sŭqŏiĕ'.
Bee,	Ma'tsŭp.
Flea,	*Sk'ŭtŭ*kŭ'ĭ.
Grasshopper,	Tĭta'tsŭp.
Louse,	Kuta'que.
Mosquito,	Si'lăks.
Spider,	Tshē'ĭt.
Yellow jacket,	Skol'qt.
Cricket,	Sī'luĕnĕ.
Bed bug,	*Ks*'ku'lă.
Tree,	Tsĕl'tsīl.
Stump,	Noqto'sĕ.
Limb,	Tsŏltsīltshĭme'.
Leaf, cottonwood,	Pitstshĕlq.

Leaf, pine leaves,	Tshĕ′me.
Bark, outer,	Tshīlĕ′uq.
" inner,	Tsequ′ĭe.
Trunk,	*S*′tshĕmĕp′.
Root,	Sa′xuĕp.
Clouds,	*S′te*tshĭtēmit′.
Sky,	*Tsh′tsh′*ma′skăt.
Sun = Day moon,	S′xalxali′ spŭkani′.
Moon	Spŭkani′.
" = Night moon,	Kwŭkwŭet′ spŭkani′.
Stars,	K′ku′sŭm.
Rainbow,	Skumĭ′utsshĕn.
Fog,	S′hamīp′.
Frost,	Su′lĕuq′.
Snow,	S′mel′kut.
Hail,	Sātlu′sĕ.
Ice,	Shū′emptku.
Water,	Sēul′kqu.
Rain,	Stĭpe′ĭs.
Thunder,	Stel′tĕlăm.
Lightning,	Suŭĕt′shu.
Wind,	Sne′uwŭt.
Dust,	S′ku′ŭlsk.
Mud,	S′slatsha′l′uq.
Sand,	*Skap*xĕ′pe′.
Stone,	S′shĕnsh.
Day,	Sălxalt′.
Night,	Skŭkū′ŭĕ.
Sunrise,	*St*′kleĕtsht′.
Noon,	*N′to′* qken′.
Sunset,	S′tsha′ă.
Yesterday,	Spistsĕ′.
To day,	Tĕt′l′qâ.
To-morrow,	Nĕ′qali′.
Black,	K′ŭai.
Blue,—cobalt,	K′ŭali′*k′n*.
Brown,	*Tsh′l′*tshĕ′.
Gray, dark,	*Tsh*′xĕ′.
" light,	Tsh′l′pĕ′ik′l′ŭ.
Green, chrome,	Kuĕ′ĭn.
Red, scarlet,	Kuī′l.
Roan [as of a horse],	Xŭa′mukăn.
Sorrel [applied to color of horse],	
" light,	*Pĕ′*′uq.
" dark,	*Tsh*′l′kŭi′.
White,	Piŭk ; Pīk ; Pĭk.

Yellow,	Kŭă′lĭ.
Horse,	Sĕn′tshilxtsa′ska ; from s’nne—*female elk*, and xtsa′ska—*to ride*.
Ax,	Shĕ′lmīn ; shĭlmīn′.
Log house,	Slu′kut′xŭ.
Dog,	*N*′kŏkŏ′sămi.
Large,	*Kuĭt*tū′ŭnt.
Small,	Kukuĭnmeĕ′.
Much,	Xuit.
Little,	Xlu′ŭĕt.
No,	T’ă.
Yes,	Unĕ′.
This,	I’ĕ′.
That,	Shi’ĕ′.
When,	Pĭstĕm′.
Where,	Tshĕ’l ; s’tshil.
Who,	Suwaĭt′.
What,	Stĕ′’m ; stĕ′ŭm′.
I,	Kŏi′ĭĕ.
Thou,	’N’ŭi′ ; nūk′ŭĕ.
He,	*Tsn*’iqts′.
We (plural),	T’kēĕ′.
We (dual),	P’le Xĕ′.
You,	*N*’p’lĕ′.
They,	Isĕtsĭnī′qts.
Mine ; me ; I,	Kŏi′ĭĕ′.
Yours,	A′n’uĭ′.
His,	Tsĕnĭqts.
Theirs,	Tsĕni′ĭqts.
Good,	Xĕts.
Bad,	Tel′ĭe.
Few,	Xlu′uĭt.
All,	Esĭĭa′.
To shoot (with gun),	Tăpskĕ′.
“ “ (with arrow),	Tăpskĕ′tăpănĭn′.
Arrow,	Tăpănĭn′.
Mounted (on horseback),	Tshĕmte′.
To ride,	Tshĭl′kalshĕ′.
On foot,	S’xuĭs′tu′.
To kill,	Pūls′tă ; pūlst′ŭm′.
To eat,	I’xl’n.
To drink,	Sūst.
To sleep,	I′tshĭ.
I go to sleep,	Tshĕkeksi′tshĭ.
To smoke,	K’smē′luqui.
To weep,	S’kuă′kuil.

To laugh,	O′iĕmtsu′.
I run,	Tsin′kĕxĕtsĕlsht.
You run,	K'uke′tsĕlsht.
He runs,	Ke′tsĕlsht.
You and I run (dual),	Xĕkĕ′tselsht.
We run,	Kēĕ′tsĕlsht.
They run,	Xūkĕtselsht.

When the runners referred to are visible and at a distance from the speaker, the first syllable of the word is uttered in a high note (prolonged to intensify distance), and the last is expressed in a more subdued and lower key. The word, under such circumstances, is Kēĕ′tselsht.

Did you run?	Xa′kukĕ′tsĕlsht.
Knife,	Nin′tshĕmĕn.
" to cut with,	Ni′tshĕnt.
Young dog,	Sti′tĭtshĭ.
I have a dog,	Tshĭnĕp′′*xl*′*n*′kŏkŏ′sămi.
How many dogs have you?	Kŭĭnsh′n′kŏkŏ′sămi.
I am hungry,	Tshĭn′ĕstskamĕ′.
We are hungry (plural)	Kĕsi′axee′stskamĕ′.
We are hungry (dual),	Xĕ′ĕstskamĕ′.
You are hungry,	Kuĕsts′kamĕ′.
They are hungry,	Eseshts′ĭltinĕ′kamĕ′.
I strike myself,	Tshĕn′ĭs pĕntsōt′.
I struck myself,	Klĕn′ĭs pĕntsōt′.
I will strike myself,	Nĕm′ĭs pĕntsōt′.
You strike yourself,	Nĕm′kst pĕntōt′.
You struck yourself,	Klĕk′k'sut′pĕntōt′.
I was struck,	Klĕk'kŭ′pĕntsĕm.
You and I were struck,	Kĕ′spĕlxlūlt.
What is it?	Stēm.
Who is it?	Sūĕt′.
What do you want?	Stĕm′aspūs′.

NUMERALS.

1,	N'xō ; N'gō′.	8,	Xēĕd′nŭm.
2,	Sisĕ′.	9,	Xanōt′.
3,	Tshĕxlĕs′.	10,	Opĕn′.
4,	Mōs.	11,	Opĕne′xs n'gō′.
5,	Tsil ; Tsīl.	12,	Opĕne′xs s'sĕ′.
6,	T'a′k'n.	20,	*S*'sĕl o′pĕn.
7,	*Sĭsp*xĕtl.	21,	*S*'sĕlo′pĕnexs n′gō′.

22,	*S*'sĕlo'pĕnexs s'sĕl'.	80,	Xenĕ'*l'no*'pĕn.
30,	Tshĕ'xl'n'o'pĕn.	90,	Xex'*tlo*'pĕn.
40,	*M's'ln'* o'pĕn.	100,	N'kakēn.
50,	Tsil*xl'no*'pĕn.	101,	N'kēnexsn'gō.
60,	*T'k'n*tshilo'pĕn.	200,	*S'l'n* qo'qĭ.
70,	S'pĕltsh'lo'pĕn.	1000,	O'pĕns'tshit'nkĕ'.

Game played with pieces of bone,	Mi'tshumtshĕ'.
A game, similar to the chunkey game, played with a ring and poles, is called,	S'xâl'ku'.
The Coyote's youngest child (myth),	Satsi'uĭnsht'.

There is no word for strike, in the abstract, but the idea is expressed in connection with the manner in which the action is done. This is also the case with some other verbs.

To strike with the hand,	Tsu'ĕntēm'.
" " " a club,	Spŭntēm'telŭk'.
" " " a gun,	Spŭntēmtsu'lŭlminsh'.
" " " a bow,	Spŭntēm*tĭ*'skinsht'.
" " " an ax,	Shilĭntēm' shilmĭn'.
" " " a knife,	Shilĭntēm'tinin'tshumĕn'.
To stab with a knife,	Xlŭntēm'tinin'tshumĕn'.
" " " a bayonet,	Xlŭntēm'tsmu'lumĕn'.
" " " a sword,	Xlŭntēm'tshu'lulĕ'.

Where you going? =

S'tshil	nūk'ŭĕ	s'qŭi?
Where	*you*	*go?*

I am going to the Crows. =

S'tetshem'tshĭ	ō'tshiĕs	s'qŭi'.
Crows [*Indians*]	*I*	*go.*

Don't you wish to trade with me? =
Ō'tsĕmkes tomis'to min'onĕ'?

Give me some sugar. =
Koqui'tsĭsht t'tish.

The following myth is presented to illustrate the syntactic structure of the language.

Sen'-tshĕ-lē'	Ko-tump't.	Sĕ-huist'-tsĕn'tshĕ lēp,
[*of the*] *Coyote*	*Story.*	*He was walking, the Coyote,* [*and*]

ō-wĕ'-tshĕs,	skō-lē'-pĭ*	tō-ō'-sĕ,	hui'-huē-iu';
he saw	*they were cooking*	*eggs,*	*many animals and birds;*
s'ā-a-tsu'-qts	wē-titsht'	es-tsĭ-ă'	o-qōl'-lŭ,
he looked	*while they went to sleep*	*all of them*	*he went,*

* Cooking in a depression in the ground, by paving the floor with stones and covering the food with grass, leaves, etc.

sĕn′-tshĕ′-lē′, t’l′-kĕn-tēs′ t’lŭs-kăl-ēp′. U-il′-qīs
the Coyote, [*and*] *removed the dirt* [*from the eggs*] *from the cooking place. Then he ate*

tsūs-pĕn-ōs; o-ko-ēs′ l’hui′-hue-u-ql’s * ē-huĕ′-u-ql’sts
everything; [*then*] *he took the little bird* [*and*] *he pulled* [*crosswise*]

x’lus′-pē-lēm′-tsĭs; o’k-tsō′-tsĭs xlŭs′-ĕn’k-tsū′; †
the bill; he pressed [*the head*] [*of*] *the lynx;*

sō′-tumst sō′-pŏt xlŏs-qtī-sŭ′-mĭ-ē; ‡ o-wĕ’-wĭ′
he pulled (*stretched*) *the tail* [*of*] *the Panther; the Lark*

kwa′-wĭ-lixlts′ xlŏs′-tshi-tshi-ma′ uqts; ō-huĭst′-xlu′ sĕn′-tshĕ-le′
yellow breast the breast he made; he walked away the Coyote

tshil-kūt′ xlak′-tshilsht wĕ-x’l-stla′-xlsht. Kă-liqts′
a short distance he sat down [*and*] *he looked at them. They awoke*

xlu-hui′-huē-xults. Sē′-tsĭsh-tshēl′, ha′-xlĕ klĕ′-kĕ-o′-wĭ-tsĕ
all the birds and animals. What is the matter, already we ate all

ŭ′-kĕ-tītsh′? Wē′-kŏl-kwĕ′-tshi-nă′ ta′-sĭn-sō-huĭ′-nĕ-
before we went to sleep? Talked one they could not under-

mĭn-tēm′.§ Kwēmt′-po-mĭn-tsŭqt.
stand him. Then they all scattered.

The following is a list of Indian tribes best known to the Selish, and the names which they apply to them:

Pend d’Oreille,	Kalĭspĕl′.
Banak,	Aquĭt′sĕ, “*Gopher-skin-blanket.*”
Shoshoni,	S’nu′uĕ.
Blackfeet,	S’tshu′kuĕ, “*Black-feet.*”
Nez Percès,	Saăp′tĭn.
Arikare,	S’qŭĭes′tshĭ.
Dakota,	Nŭqtu′.
Absaroka = Mountain Crows,	Ste′ămtshĭ.
= River Crows,	S’kuĭstshi.
Arapaho,	N’tshĭ’ltshĭ’lu′sŭ, “*Hair-parted-in-the-mid-dle.*”
Cheyenne,	*Sh’k*’kai′usĕ, “*Spotted-arrows.*”
Kutenai,	Skălsē′, “*Water-people.*”
Cœur d’Alene,	Tshi′tsauĭ.

*The Crossbill. It is said the bird lost his speech at this time.

†This act of the Coyote accounts for the flat face of the wild cat—*Lynx rufus.*

‡The Panther received his long tail; was a Lynx previously and had a short one.

§The Crossbill, previously mentioned.

Vocabulary of the Waitshum'ni Dialect, of the Kawi'a Language. Tule Agency, Cal. By W. J. Hoffman, M.D., Washington, D. C.

(Read before the American Philosophical Society, March 19, 1886.)

The material relating to the accompanying vocabulary of the Wait-shum'ni, or Waiktshum'ni, dialect of the Kawi'a language of California, was collected chiefly in 1882, but some verifications were made at a subsequent visit to Tule Indian Agency in 1884. The agency headquarters are located eighteen miles east of Porterville, on the south fork of Tule river. The Indians occupy log dwellings, and most of them raise cereals and some fruit. The habitable portion of the agency, or reservation, is nearly two miles in length, and varies from one hundred yards to half a mile in width, either side being flanked by towering ridges of the Sierra Nevada. Game is exceedingly abundant, and game birds, especially the valley quail, are found in almost every copse and grassy lawn.

These Indians manufacture exceedingly fine and durable basket-ware, the coils consisting of three or more strands of long grass, the stitching together being accomplished by using thin strands of split roots of natural, or artificial colors—usually black, red and white. The design which may be denominated a typical one, consists of a sort of serrated character, running straight, or diagonally from the centre to the periphery. The figure of the Yo'kut—*man*, also figures on drinking-vessels, and on women's conical hats. Their food being chiefly obtained from the agent, requires but little exertion on the part of the natives to subsist satisfactorily; but during the autumn great quantities of acorns are gathered, and pounded into meal at such places where this fruit occurs in greatest abundance. Here too, one finds cavities in the boulders which have been made to serve as mortars. The meal is placed in conical baskets, when water is poured over it to extract the bitter principle, after which it is boiled into a mush and eaten cold, the hand serving as a spoon.

But few good crania can be obtained at this day, the one common Indian burial-ground being carefully and unceasingly watched, not so much for fear of losing the bones of their relatives, but on account of their superstitions regarding the dead. In general appearance, these Indians resemble the Pah-Utes of the Nevada side of the mountains. Their personal cleanliness does not give them much care, but there are times when several may be found taking a wash in the river, after having submitted to a very severe sweat-bath in one of the low and partly underground sweat houses.

These are but three or four feet from floor to ceiling, and measure about six feet in diameter. The entrance is low, and about two feet in diameter. A small opening near the ceiling, at the point opposite the entrance, serves as an exit for the smoke from the fire, which is built immediately inside the door, after the bathers have entered and huddled together. During this scorching and sweating process, singing is kept up, and when the proper stage arrives, all of the occupants rush down and into the water.

Many of their primitive rites are still practiced, in secret, though the influence of the agent has had considerable effect in modifying their most trying ceremonies, and in causing them to imitate their white neighbors in observing modern customs relating to church services, burials, etc.

In the following vobabulary the orthography adopted is that referred to in the remarks preliminary to the Selish :

Man,	Ko′tun ; yo′kŭt yo′kutsh.
Men,	Mâ′ni yo′kutsh.
People,	Tra′ătre.
Chief,	Ti′a ; di′a.
Warrior,	Hiau′tra.
Woman,	Mu′kis.
Child,	Wit′ĕp ; wit′iĕp.
Father,	Na′tet.
Mother,	Na′shush.
Brother,	Nā′ăt.
Sister,	Hŭ′koish.
" younger,	No′ăt nim.
Son,	Pu′tshung.
Daughter,	A′qĭdam ; a′xit.
Wife's brother,	Năpa′tĕm.
Brother's wife,	Idŭwăp.
Wife's father,	Năqa′mĭsh.
" mother,	Untĭp.
Grandfather } paternal and ma-	E′nĭsh ; e′nas.
Grandmother } ternal,	Tu′ta ; du′ta ; tu′da.
Brother's son,	Tshai′aq.
" daughter,	Tshai′aq.
Sister's son,	Pu′tshung nim tshai′aq.
" daughter,	Mu′kis nim tshai′aq.
Mother's sister's husband,	Komo′dĭs.
" brother's wife,	Mo′koi.
Father's sister's husband,	Kui′ha.
" brother's wife,	Mo′koi.
Son's son,	Pu′tshung nim pu′tshu^{n}.
" daughter,	Pu′tsung nim a′xit.
Daughter's son,	A′xidin nim e′nash.
" daughter,	A′xidĭn nim a′xit.
I, me, my,	Na′.
Thou,	Ma′.
He,	Ta.
She,	Mukes′.
We,	Mai.
You,	Kŭmui′man.
They,	Ka′sin.

We, dual,	Na'ăk.
You, dual,	Ma'ăk.
They, dual,	Tashĭk'.
Shaman,	Ang'tru.
God (Great Spirit),	In'tshĭsh tĭe'dĭtsh.
Demon,	Tawa'tsha.
Alive,	Tād ; dād.
Dead,	Tauwa'tsha ; tauwa'tsa.
Sick,	Tshiga'tsin.
Head,	Tod, dod.
Eye,	Sĕsse'.
Eyes,	Pungoi' sĕsse'.
Ear,	Tūk.
Hair,	O'tro.
Cheek,	Tran'gĭ.
Chin,	Wupŏi'si.
Nose,	Tring'ĕk.
Mouth,	Sim'ĕ.
Tooth,	Tē'di ; de'di.
Teeth,	Wu'qunĭm te'di.
Tongue,	Tadxad'.
Lip, upper or lower,	Yĭpie'pŭd.
Neck,	Muk'ĕsh.
Adam's apple (Pomum Adami),	Tsadtsad'itsh.
Hand	Pu'trung.
Thumb,	U'mutru'drung.
Forefinger,	Tru'trukui'.
Second finger,	Tui'nininkui'.
Third finger,	Pin'taluk'.
Little finger,	Pin'taluk'.
Palm,	Tăka'trĭ.
Wrist,	Kĕtrau'shĭd.
Forearm	Putrung'unka'dĭt.
Shoulder,	Pŭids ; pŏits.
Mammæ,	Me'nid ; me'nit.
Back,	Kĕ'wid.
Thigh,	Yo'kotsh.
Leg,	So'ka.
Foot,	Wut'ŭng.
Heel,	Hada'shi ; hata'shi.
Toes, are named the same as the fingers and thumb.	
Sole,	Tăpŭput'wŭtun'gŭn.
Skin,	Tshu'du.
Heart,	Hung'hung.
Liver,	Tĭp.

Intestines,	Tos ; dos.
Bladder,	Tshŭion′.
Lung,	Hung hung′intĭshe′.
Water,	Pai′a ; ĭd′dĭk ; ĭl′lik.
Hail,	Howa′tron′ĭd′dĭk.
Snow,	Pŭn′pŭn.
Cloud,	Kŭd′dĕ.
Rain,	Kō′dŏ.
Vapor,	Mâ′drăk.
Tears,	Mŏ′ugant.
Perspiration,	Dō′mak.
Rock,	Ĭa′kau.
Stone,	Putshi′tĕt ĭa′kau.
Sand,	Wa′gas.
Mountain,	Dū′mĭt.
Hill,	Pu′kăt ; bu′kăt.
Valley,	Tshodo′wĭn.
Dust,	Shro′wŏt.
Mud,	Trĕbĕ′gut.
Tree,	Iăp′kin.
Trunk,	Tra′taan.
Branch,	Da′bĕdŭp.
Leaf,	Dăp′dăp.
Stem,	Dăp′dăp in′trătră.
Flower,	E′dau.
Bud,	Dī′bing.
White,	Tshŏdōt′.
Red—ochreous,	Pa′tshĭgan.
Yellow—chrome,	Ti′qad.
Green—chrome,	Tri′mad ; Tri′māt.
Blue—French,	Pădi′kăn.
Black,	Tshum′kăta^{n} ; trum′kĕtĕn′.
Vermilion,	Mit′dat pa′tshĭgan.*
Lake,	Trum′kĕtĕn′ mit′dat pa′tshĭgan.†
Here,	Xe′u^{n}.
There,	N'ga′ŭ.
This,	Xe′ĭ.
That,	Ta.
These,	Xi′săk'.
Those.	Ka.
Now,	Tshăan′.
No,	Ka′mu.
Yes,	Ho.

* Mit′dat—little; *i. e., little-red.*

† Sig. *Black-little-red.*

When,	Hau′dau.
Where,	Hi′dĕu^{n}.
None,	Ka′mu^{n}.
Across,	Po'ŏi′u.
Bear, black,	Deu′qun ; du′qŭn.
" grizzly,	No^{n}′qo^{n}.
" cinnamon,	Pa′tshigĕdu′qŭn.
Raccoon,	Kuid′tshu ; kuit′shu.
Lynx,	Tung′un.
Panther,	Wu^{n}he′sid.
Coyote,	Kai′ĭu.
Wolf,	Iwait′.
Jack rabbit,	To′pŏl ; do′pŏl.
Badger,	Tăn′nau ; tĭn′nau.
Bird,	Taĕ′nip.
Crow,	A′dawut′'ĕ.
Vulture,	Tau′ka ; tan′ka.
Jay (Steller's),	Tiĕshu′dĕtsh.
Quail, valley,	Hu′mut.
Deer,	Hoi.
Elk,	Shōlk′hoi.
Fish,	Lu'pitsh.
Lodge,	Tri′.
Sweat lodge,	Mōs.
Fire,	O′sĕt.
Smoke,	Mo′drek.
Ashes,	Ha′pas ; ha′pash.
Charcoal,	Sa′pan.
Feathers,	Pada′ ; pata′.
Wing feathers,	Ka'păd.
Animal hide,	Tshudui′.
To eat,	Du′i.
To laugh,	Hai′wis.
To drink,	U′kun,
To weep,	A'hin.
To hear,	Dâng.
To know,	Hōt.
To trade,	Sitĕd′ăwăsh.
To think,	Tem′tem ; dem′dem.
To walk,	Hi′wĕt.
To run,	Da′wĭt.
To fall,	Ui′in.
To ride horseback,	Had′hin.
To talk,	Xa′hĭ.
To sleep,	Man′gĭs.
To die,	Tau′ĭts.

To like, or admire,*	Ho′iutshă ; hu′yutsha.
To kill,	Tau′tra ; tau′trat.
To shoot an arrow,	T′′ui ; Tr′′ui.
To strike with a club,	Witshe′trŭm wat'r.
" " " knife,	Nokŏits′ŭn wat'r.
" " " stick,	Wat'r.
To cut with a knife,	Tshīs.
" " " an ax,	A′t'r.
Much,	Wai′ĭdĭ ; wu′qĭ.
Many,	Wu′qoi ; wu′qĭ.
Many bows,	Wu′qoi tai′up.
Two bows,	Pun′goi tai′up.
Bow,	Taiup.
Bow string of sinew,	Tooiq′tut.
" " loop for securing at end of bow,	Pēt ; pĭt ; pēt.
Front side of bow,	Ke′wĕt.
Cord side of bow,	Ko′tro.
Arrow poison,	Hai′ĕnĭt.

The parts of an arrow, having a wooden point detachable from the shaft, are as follows :

Point of wooden arrow-head shaft,	Sha′padan ; tshi′pidun.
Body of wooden arrow-head,	Sho′toitsh.
Shaft of arrow proper,	Sik′kid.
Feathers,	Tshodon′gĭsh.
Notch, at base of shaft,	Tin′nĕiu.
Sinew fibres at head of shaft to prevent splitting upon introduction of arrow-head,	Pik′kĕd.

NUMERALS.

1,	Yēt ; Yet.	13,	Sho′piŭm.
2,	Pun′goi ; bun′gŏi ; pun′ga.	14,	Hatsh′pŭm.
3,	Shrâ′pĭn ; sho′pĭn ; tro′pĭn.	15,	Yit′sum.
4,	Hâtpun′gĭ.	16,	Tshud′pum.
5,	Yit′singĭt ; yet′singĭt.	17,	Num′tshum.
6,	Tshu′dĭpi ; tsho′dĭpi.	18,	Mun′shum.
7,	Nump′tsin.	19,	Nont′pum.
8,	Mu′nŭs.	20,	Pungat′shium′.
9,	No′nĭp.	21,	Pungat′riayet′.
10,	Tri′o ; dri′o ; tri′a.	30,	Shrâ′pĭntri′a.
11,	Ie′tsum.	40,	Hâtpun′gitri′a.
12,	Tshi′uka^{n}.	50,	Yit′singatri′a.

* Also in the sense of *to love*, although there is no word for love as ordinarily recognized.

60, Tshu′dĭpitri′a.
70, Num′tshetri′a.
80, Mu′natri′a.
90, No′nĭptri′a.
100, Yet′pitsh.
101, Yet′pitshĭo yet′.
1000, Tri′apitsh′a.
2000, Pun′gatri′apitsh′a.
3000, Shrâpintri′apitsh′a.

Ho′iutsha—*To like, to admire.*

PRESENT TENSE.

Sing. 1. Nim ho′iutsha.
2. Min ho′iutsha.
3. Ta ho′iutsha.

Plural. 1. Wai′tung ho′iutshet.
2. Kumuiman ho′iutshet.
3. Kasin′tun ho′iutshet.

Dual. 1. Na′aktang ho′iutshet. (We two.)
2. Ma′aktang ho′iutshet. (Ye two.)
3. Tashīk′tang ho′iutshet. (They two.)

PAST TENSE.

Sing. 1. Ni′amtang yūd ho′iutshush.
2. Ma′tang yūd ho′iutshush.
3. Ta tang yūd ho′iutshush.

Plural. 1. Wai′tung yūd ho′iutshush.
2. Kumuiman yūd ho′iutshush.
3. Kasin′tun yūd ho′iutshush.

Dual. 1. Na′ak tang yūd ho′iutshush.
2. Ma′ak tang yūd ho′iutshush.
3. Ta shīk′tang yūd ho′iutshush.

FUTURE TENSE.

Sing. 1. Na tang′he ho′iutshe.
2. Ma tang′he ho′iutshe.
3. Ta tang′he ho′iutshe.

Plural. 1. Wai′tung tan ho′iutshe.
2. Kumuiman tan ho′iutshe.
3. Kasin′tun tan ho′iutshe.

Dual. 1. Na'ak tang tan ho'iutshe.
2. Ma'ak tang tan ho'iutshe.
3. Ta shīk'tang tan ho'iutshe.

Tau'trat—*To kill.*

PRESENT TENSE.

Sing. 1. Tshan na tang tau'trat.
2. Tshan ma tang tau'trat.
3. Tshan ta tang tau'trat.

Plural. 1. Wai'tung tshan tang tau'trat.
2. Kumuiman tshan tang tau'trat.
3. Kasin'tun tshan tang tau'trat.

Dual. 1. Na'aktang tshan tau'trat.
2. Ma'aktang tshan tau'trat.
3. Ta shīk'tang tshan tau'trat.

PAST TENSE.

Sing. 1. Hiăm'na tang tau'trash.
2. Hĭam'ma tang tau'trash.
3. Hĭam'ta tang tau'trash.

Plural. 1. Hĭam'waitung tau'trash.
2. Hĭam'kumuiman tau'trash.
3. Hĭam'kasin'tun tau'trash.

Dual. 1. Hĭam'na'aktang tau'trash.
2. Hĭam'na'aktang tau'trash.
3. Hĭam'tashīk'tang tau'trash.

FUTURE TENSE.

Sing. 1. Na tang'he hĭam'xash tau'tret.
2. Ma tang'he hĭam'xash tau'tret.
3. Ta tang'he hĭam'xash tau'tret.

Plural. 1. Waitung tang'he hĭam'xash tau'tret.
2. Kumuiman tang'he hĭam'xash tau'tret.
3. Kasintun tang'he hĭam'xash tau'tret.

Dual. 1. Hĭam' xash na'aktang tau'tret.
2. Hĭam'xash ma'aktang tau'trat.
3. Hĭam'xash tashīk'tang tau'trat.

Discovery of the Thoracic Feet in a Carboniferous Phyllocaridan. By A. S. Packard.

(*Read before the American Philosophical Society, February 5th, 1886.*)

It is a matter of some surprise that notwithstanding the large number of fossil Phyllocarida from the Palæozoic strata made known to us by the researches of McCoy, Salter, Barrande, H. Woodward, James Hall, J. M. Clark, R. P. Whitfield, C. E. Beecher and others, no definite, unmistakable traces of the limbs have been discovered. So far as we are aware, no portions of the antennæ of either pair, nor of the thoracic or abdominal limbs (except those next to the telson), have been figured or described, though many specimens of the fossils have been subjected to the scrutiny of our leading palæontologists. While most of the species are represented by the bivalvular carapace alone, which must have been, as in the recent Nebalia, easily detached after death from the body so as to float away by itself, still in some cases, as in that of *Ceratiocaris stygia* Salter, figured by Messrs. Jones and Woodward in the *Geological Magazine* for September, 1885, the abdominal segments, with the last pair of uropoda and the telson, are distinctly preserved, while in other cases the large toothed mandibles are preserved in place between the valves of the carapace; the rostrum has also sometimes been preserved. But we should have expected ere this to have become acquainted with the nature of the antennæ and the anterior abdominal appendages, if, as we have good reason to suppose, they were like those of the modern Nebalia.

In their diagnosis of the genus Ceratiocaris, Messrs. Jones and Woodward in referring to the body, state: "Body many-jointed, with fourteen or more segments, of which 4–7 extend beyond the carapace; ornamented with delicate raised lines. Some or all of these segments bore small, lamelliform, branchial appendages."*

Although Messrs. Jones and Woodward have kindly sent me nearly all their valuable papers on fossil Crustacea, those cited in the foot-note, unfortunately are not among the number, and hence I am unable to refer to them. Mr. Etheridge's note in the Annals and Magazine Natural History is as follows:

"At the Brighton meeting of the British Association, Mr. H. Woodward, F.R.S., noticed the discovery of the 'swimming gills' of *Ceratiocaris,* to which I had previously drawn his attention. On a slab of thin flaggy shale from the Upper Silurian series of Lesmahagow are exposed, the caudal segments, telson, and caudal appendages of a *Ceratiocaris.* From the ventral margin of the terminal segment proceeds a broad paddle-shaped membraneous (?) expansion, presenting a strong marginal outline,

*See the Sixth Report on Fossil Crustacea, Brit. Assoc. Report for 1872, p. 323, and Geological Magazine, ix, p. 561. Also a descriptive note by Mr. R. Etheridge, given in the Mem. Geol. Surv. Scotl. Explan. Sheet 23, 1873, p. 93, and Annals and Mag. Nat. Hist. Ser. 4, Vol. xiv, 1874, p. 9.

with a transversely striated surface. This is followed by another similar appendage, proceeding in the same manner from the penultimate segment. The dorsal edge of the specimen shows that one of the corresponding 'foot-gills' of the opposite side has been bent back upon itself, and thus thrust out of place. The free ends of these paddle-shaped appendages are attenuated to more or less rounded points. They do not show any evidence of a marginal fringe. These gill feet are no doubt analogous to the same supplementary abdominal organs in *Nebalia*."

I do not understand from the foregoing description, the nature of the so-called appendages, especially since they are not figured, but will now proceed to call attention to those noticed in a specimen sent me a year ago by J. C. Carr, Esq., of Morris, Illinois, which occurred in a nodule from the Carboniferous beds of Mazon creek at Morris.

As soon as I examined the fossil, the indications of broad lamellate appendages of several pairs were at once apparent. Owing to the incomplete state of preservation of the dorsal and ventral edges of the valves I was at a loss to what group to refer the fossil. It was apparently a Phyllocaridan, but seemed to differ from most of the genera described. I therefore considered it as the type of a new genus intermediate between Ceratiocaris and Aristozoe, and named it *Cryptozoe;* it may be called *Cryptozoe problematicus.* After, however, comparing the specimen with Dr. Woodward's figure of the Carboniferous *Ceratiocaris oretonensis* Woodw. and *C. truncatus* Woodw. (*Geological Magazine*, viii, March. 1871), and his figure of *C. papilio* Salter and *C. stygia* Salter (*Geological Magazine*, September, 1885), I was inclined to provisionally regard it as belonging to that genus.

But on consulting my friend, Mr. C. E. Beecher, who has worked so faithfully on the fossil Phyllocarida, he kindly sent me the following opinion :

ALBANY, Dec. 30, 1885.

The typical Ceratiocaris (see McCoy's description) differs from your specimen in its semi-elliptical outline, with the abruptly truncated posterior end and evenly convex valves.

Your species has a short hinge-line, very broadly rounded posterior end, and the cephalic and thoracic regions of the carapace are well defined. These are characters which do not belong to Ceratiocaris when strictly defined. The contour of the dorso-anterior extremity would seem to indicate the presence of a well-developed rostrum. The typical Ceratiocaris are from the Silurian system, and I very much doubt their extension into the Carboniferous, although they have been noted in the Devonian. I have not seen the article by Woodward and Jones which you mention.

I should be inclined to consider this as a type of a new genus.

It is very interesting, especially as furnishing some information as to the appendages.

CHAS. E. BEECHER.

The generic characters as drawn from the carapace alone are as follows: Valves one half as long as broad; moderately full and convex, with no definite, straight hinge-margin. It differs from Ceratiocaris in the lack of a long, straight hinge-margin, the dorsal edge being curved, and in the lower edge not being thickened, while the posterior end is well rounded. The anterior end of the valves is about half as wide as the posterior end, and is oblique, the lower part of the edge being directed outwards. From Aristozoe it differs in the lack of a definite hinge-margin, and in its elongated oval valves; from Nothozoe in its well defined narrow anterior end, and well defined dorsal and ventral edges.

As Mr. Scudder's genus Rhachura* from the Carboniferous limestone of Danville, Illinois, is only represented by the end of the abdomen, it is impossible to discuss its relationship to that form.

The specimen is a cast, and shows no tracings of markings on the exterior of the valves. In form it is ovate, obliquely truncated at each end; the dorsal edge is not so much curved as the ventral edge, but it is more curved towards the posterior edge than towards the anterior; the ventral edge is quite regularly curved. The anterior end is obliquely truncated, the lower angle directed outwards. The posterior edge is about a third wider than the anterior end, and is directed obliquely inwards so as to be nearly parallel with the anterior end. While each end of the valves is well preserved, the dorsal and ventral edges have apparently not been preserved, as they are usually thickened in the other species of the genus.

The lamellate limbs are situated in the specimen at the posterior end of the carapace; probably after death the carapace turned around and separated from the body, which with the extremities became much displaced.

Of the lamellate limbs there are traces of four pairs. They are broad and thin, slightly contracted in width near the base, and at the distal extremity quite regularly rounded, with the free ends apparently slightly folded longitudinally, the edges appearing to be slightly crenulated, but

FIG. 3.—Outline of *Cryptozoe problematicus*, showing the shape of the lamellate feet, the valve being upside down.

these folds were perhaps due to changes after death. All the feet are of nearly the same size. They are about two thirds as long as the carapace

* Proc. Bost. Soc. Nat. Hist. xix, 1878, Pl. 8, Fig. 3, 3*a*.

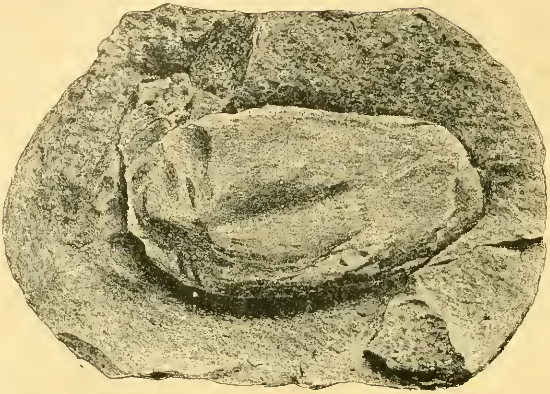


Fig. 1.

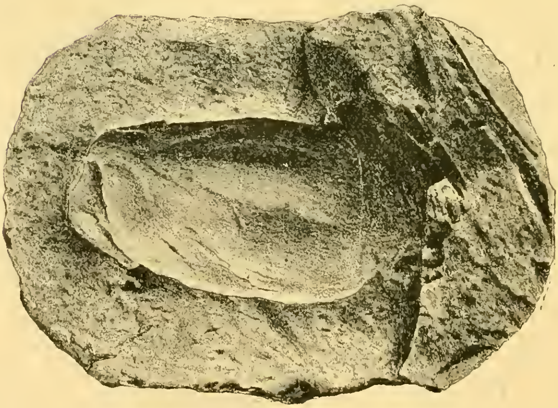


Fig. 2.

Cryptozoë problematicus Pack.

is high; the length of the best preserved one 18^{mm}, the breadth $3–4^{mm}$. There are no traces of a division into endopodites and exopodites; but we should regard the parts preserved as the homologues of the exopodites of Nebalia; there are no traces of setæ on the edges. The general appearance of the appendage is much as in Pl. xxxvii, Fig. 6, of our monograph of North American Phyllopod Crustacea. Length of the carapace 46^{mm}; height at the highest part, 26; at the anterior end $12–13^{mm}$.

From the foregoing description it seems reasonable to suppose that in the fossil forms, Ceratiocaris and allied forms at least, the thoracic feet were, in shape and structure, homologous with those of the modern Nebalia.

Beyond the feet, at the larger or posterior end of the carapace is the impression of what may have been the basal joint of one of the basal abdominal feet, which joint in Nebalia is as long as the lamellate thoracic appendages; but this, of course, is quite problematical.

It is not a little strange that no undoubted traces of the antennæ or basal abdominal limbs of any extinct Phyllocaridan have as yet been brought to light; but the discovery of these large, broad, thin, lobular appendages which most probably belonged to the thorax, makes it all the more likely that the extinct Phyllocarida had antennæ, and basal abdominal limbs similar to those of the existing Nebalia.

Explanation of the Plate.

Fig. 1. Cast of carapace of *Cryptozoe problematicus* Pack., natural size.

Fig. 2. Reverse of the same, showing the impressions of the lamellate feet originally attached to the thorax.

The Use of Oil in Storms at Sea. By Lieut. A. B. Wyckoff, U. S. N.

(Read before the American Philosophical Society, April 2, 1886.)

My attention was drawn to this subject in 1884, soon after I took charge of the Branch Hydrographic Office in Philadelphia. Several Masters of vessels described their methods of using it, and the striking results of their practical experiments. I became convinced of its great utility; and in November, 1884, reported the matter in a letter to the Hydrographic Office. Soon afterwards, orders were given the branch offices, to collect all the information they could obtain regarding its use; and in January, 1885, the data, thus collected, was published upon the monthly North Atlantic Pilot Chart. This has been continued ever since, and the Hydrographer, Commander J. R. Bartlett, has done everything in his power to interest mariners in the subject. In consequence, where one vessel formerly used it, there are probably now fifty prepared for such an emergency.

In view of the unvarying successful result, the time must soon come, when no vessel will leave port without some cheap fish or vegetable oil, for this purpose. Insurance companies, owners and masters of vessels, are all too greatly interested, to have this precaution longer neglected.

The use of oil in calming troubled waters, was evidently well known to the ancients, as Aristotle, Plutarch and Pliny refer to it in their writings. The divers in the Mediterranean still use it in the manner described by Pliny—taking oil in their mouths, and ejecting a little at a time, to quiet the surface and permit the rays of light to reach them. Fishermen, who depend upon the spear to capture their prey, pour oil on the water to calm it, and enable them to clearly see the fish. The hardy fishermen of the north of Scotland and along the shores of Norway, have known this use of oil for centuries. When crossing a dangerous bar or tide-rip, or when landing through surf, they press the livers of the fish until the oil exudes, and then throw them in advance of their boats. The Lisbon fishermen carry oil with them, and use it in crossing the bar of the Tagus, in rough weather. Whalers have resorted to oil and blubber, in severe storms, for the last two hundred years. Very recently, an old whaler informed me, that it was their custom to hang large pieces of blubber over each quarter of their vessel, when running before a heavy sea, and it entirely prevented the water coming on board.

The members of this Society should take special interest in this subject, because its founder made many experiments, and left his views on record regarding the great utility of oil for this purpose. On a stormy day, he calmed the surface of a pond covering a half acre, by pouring a single teaspoonful of oil upon its windward side. He afterwards made other laborious tests upon the waves of the sea, and gave a scientific explanation of the manner in which the oil acted. This explanation is still believed to be substantially correct.

Molecules of water move with freedom, and the friction of air in motion upon the surface of a body of water, produces undulations. These increase in size, proportionately to the depth of water, the distance they can proceed to leeward, the strength of the wind and the time it is acting. There is a limit, of course, to this increase in height; none probably ever exceeding forty feet.

The precursor of a cyclone in the North Atlantic, is often, what is known to seamen, as a heavy swell. It may be perfectly calm when this reaches a vessel. It is simply a long, high undulation; started by the storm, and traversing the ocean in advance of it. Off the coast of California, I have experienced the tremendous swells, made by a westerly wind across the immense stretch of the North Pacific. These undulations were as high as any I have ever seen, and yet, on calm days, I have often ridden them in an ordinary whale boat. These swells correspond to oiled waves. The boat or vessel slides up their front slope, and down the rear. Let a sudden gale spring up, like the "Northers" in the Gulf of Mexico, and the harmless swells becomes raging seas. How is this change effected?

The friction of the wind, upon the exposed slope of the swell, produces little irregularities of the surface. These wavelets are driven up the slope to the summit of the undulation. At the same time, the forward slope is more and more protected from the wind, and, because of its inertia, becomes steeper and steeper. Any one who ever saw a sand dune within the limits of the trade winds, has seen the storm wave in permanent form —a long windward slope and abrupt leeward face. The constantly sharpening crest of the storm wave, is finally thrown forward and downward with a force proportionate to its weight and speed. When this storm wave encounters a ship, the vessel cannot rise up the abrupt front. Instead, she checks the progress of the base of the wave, and the crest is thrown forward with tremendous violence, filling her deck and sweeping away men, boats and everything movable. The storm wave is, perhaps, no higher than the heavy swell, and only differs from it in shape. Oil changes the storm wave into the heavy swell. How is this done? The scientific explanations given with great minuteness, that I have seen, would only be confusing to the ordinary mariner. My opinion is : that the oil with its less specific gravity floats on the surface, and spreads rapidly, forming a film, like an extremely thin rubber blanket, over the water. Because of the viscosity of the oil, and its lubricant nature, the friction of the wind is not sufficient to tear this film, and send individual particles rolling up to the summit. At the same time, the molecules of water beneath are protected ; and, although the force of the wind may increase the speed of the undulation as a body, it will be as a heavy swell, and no longer in the shape of a storm wave. This effect can always be obtained at sea, if a suitable oil is used. It has been supposed, that the oil exerts some chemical action in dissolving the foam, as is witnessed, when it stops the frothing of pulp in a paper mill. It is more probable, however, as Dr. Franklin says, that the effect is purely mechanical.

I have examined one hundred and fifteen reports of the use of oil in storms at sea, published by the Hydrographic Office, and find all the trials were very successful, except four. In these, refined petroleum was used. In one instance, sperm oil was said to have thickened so that it did not spread freely ; but in four others, it acted very well. Fish oil was used 9 times, crude petroleum 3, pine oil 3, linseed 22, lard 5, neat's-foot 1, colza 2, and varnish 3 times. In 58 trials, the kind of oil used is not specified. It is apparent, that the heavier oils are the most efficacious. The result in every instance, where used by a novice, is of extreme astonishment at the wonderful effect. One trial seems convincing, and soon it is hoped, the whole profession of merchant officers will be converts, and always go prepared.

In using oil for this purpose, it is evident that it must be spread well to windward, in order to be efficacious. In consequence, a steamer plunging into a head sea, or a sailing vessel on a wind, can derive no benefit. But any vessel driving before a gale, or lying to and making a dead drift to leeward, gets the full protection of its use. As all vessels, except perhaps the rapid passenger steamers of the Atlantic, assume one of these two positions in a storm, the oil is of very general application. Even the fast passenger steamers, in crossing to the eastward before the winter gales, or when, for any reason, their machinery is stopped, will find it invaluable in saving their boats and upper works. Many vessels have found it of great utility, in passing the dreaded trough of the sea, either in heaving to or getting before the wind.

The ordinary methods adopted for distributing the oil are : to pour it down the pipes forward, or place oil alone, or oil and oakum, in canvas bags with holes punched in them, or in bags made of coarse material, as gunny or corn sacks. These are hung over the ship's side wherever required. In my opinion, the bags should always be placed over the bows ; as in running, there is time for the oil to spread, and when lying to, it is needed as far forward as possible. From the reports received, I should judge that one gallon of oil, when properly distributed, should last a vessel at least four hours.

In lowering a boat in a sea-way, oil is of great advantage. If to rescue the crew of a disabled vessel, the rescuer should take a position to windward, and distribute a quantity of oil. After the boats have been started, the rescuing vessel should drop to leeward to pick them up. The boats should carry oil to use in running before the sea.

A bottle of oil, with a quill in the cork, should always be kept attached to every life buoy. When a man falls overboard and reaches the life buoy, the oil will prevent the waves breaking over him, and enable the rescuing boat to find him, by the "slick" on the water. There should be an oil tank in every ship's boat, in the event of it becoming necessary to abandon the vessel. Riding to a drogue, made of the masts or oars, a small expenditure of oil will enable a boat to live through a severe storm.

At the entrance of a harbor, or river with a deep bar, oil can be used to great advantage, as has been proven by the experiments in England. When, however, the waves strike a beach, the problem becomes very different. The base of the wave is then retarded by the shoaling depth and the undertow from its predecessor, and, of necessity, the crest is thrown violently forward. Oil cannot prevent this; but it will certainly have considerable effect upon the outer line of breakers, and enable a boat to approach so much nearer the beach, as to greatly increase the chances of a favorable issue. However, many instances are given of the successful landing of boats, through surf and breakers, that would have overwhelmed them without the use of oil.

I append some illustrations of the practical use of oil, in some of the emergencies to which I have referred.

In 1881, a Mr. Fondacaro arrived at Naples from Montevideo, in a three-ton boat built by himself. When caught in a gale, a bag was thrown over as a drag ; and two oil bags were put over, one forward and the other aft. The oil circled around the boat, and prevented the seas breaking over her.

One gallon of oil lasted about twenty-four hours. Mr. Fondacaro says, "the oil does not diminish the size of the waves, but renders them comparatively harmless by preventing them from breaking."

The chief officer of the S. S. *Diamond*, wrecked off the Island of Anholt, describes their escape from the wreck. He provided each boat with a five-gallon can of oil, and stationed a man to pour it gradually over the stern. Immediately the sea, in the wake of the boats, became perfectly smooth, and they passed right through the boiling surf, and reached the land in safety, without shipping a sea. None of the men in the boats believed, when they left the ship, that all would reach the shore alive ; and the people on land watched their approach in wonder, deeming it impossible for even the life-boat to live in such awful breakers. (The chief officer evidently means, that the sea ceased to break in the wake of the boats ; not that it became perfectly level.)

Capt. E. E. Thomas, of the S. S. *Chillingham*, writes, that during a voyage from Philadelphia to Queenstown in March, 1883, he encountered a heavy gale from S.W. "For forty-eight hours we ran before the gale, and during the whole of the time we shipped very heavy seas, and the decks were continually full of water fore and aft. We then had two oil bags made, filled them, and made one fast to the ring of each anchor over the bows. Within a few moments we saw the effects of it on the seas. In the wake of the ship they did not break, whereas, outside of our wake the waves were breaking in all directions. Up to then, we had run before the gale for forty-eight hours without heaving the log, none of the crew daring to go aft for fear of being washed overboard. After using the oil we did not ship any heavy seas whatever, and ever since we always use oil when running before a heavy sea. I would also recommend it to be used in ships that are lying to in heavy seas. The bags were slung about two feet below the anchors, so that when the vessel pitched they were, at times, just awash. About one quart of colza oil was put in each bag every four hours."

Capt. Jones, of the British S. S. *Chicago*, while rescuing the crew of the brigantine *Fedora*, used oil with the best results. It was blowing a heavy gale with very high seas. The *Chicago* ran to windward of the *Fedora*, and, during a lull, oil having been poured on the water, the port life-boat was successfully launched and started. A can of oil was taken in the boat, and by using this the seas were kept down in the immediate vicinity, though they broke in masses of foam a short distance away. As the boat approached the *Fedora*, the crew of that vessel poured oil on the water, which so calmed the sea that the boat got alongside and rescued the shipwrecked crew without sustaining any injury. About half a gallon of paint oil was used by the boat during her trip.

The S. S. *Menzaleh*, in March, 1885, from Italy to Philadelphia, encountered a severe S. W. gale. While running before the sea, the vessel was pooped and the main hatches were stove in. It was determined to heave to, and men were stationed to drip oil down the forward shutes. The vessel came around without shipping any water, and kept perfectly dry while lying to.

Captain J. E. Lewis, master of schooner *Lawrence Haines*, reports that he used oil when hove to in a terrible N. N. E. gale off Hatteras, on December 26th and 27th; force of wind from fifty to sixty miles per hour. He put over three bags containing oakum and oil; one forward, one aft, and one amidships, and hanging so as to dip as the vessel rolled. Oil used, mixture of linseed, tar and kerosene oil. The bags were used thirty hours, and three gallons of the mixture were expended. He claims that his vessel was saved by the use of oil.

Captain E. L. Arey, of the schooner *Jennie A. Cheney*, writes: "I used oil with very satisfactory results during the late severe hurricane of the 25th of August, in latitude 31° N., longitude 79° W. The wind having carried away the mainsail, I bent a storm trysail, and continued under that sail until it also blew away. During the time, the vessel was shipping large quantities of water, the sea being very irregular, nearly every one breaking. After the sails were blown away, finding it necessary to do something to save the ship and crew, I took a small canvas bag and turned about five gallons of linseed oil into it, and hung it over the starboard quarter. The wash of the sea caused a little of the oil to leak out, and smoothed the surface, so that for ten hours no water broke aboard. I consider that the oil used, during the last and heaviest part of the hurricane, saved vessel and crew."

An Obituary Notice of the Late George Whitney. By William Sellers.

(Read before the American Philosophical Society, February 19, 1886.)

The subject of this memoir was born in Brownville, New York State, October 17th, 1819. He was educated at the Albany Academy, Albany, N. Y., where he distinguished himself by his quickness of perception and aptitude for learning, which enabled him to carry off the honors of his class in successive competitive examinations and to obtain a large share of the prizes given each term.

At an early age George Whitney developed a decided preference for studies in natural philosophy, drawing and mechanics. In 1832 his father, Mr. Asa Whitney, was appointed Superintendent of the Mohawk and Hudson River Railroad, one of the earliest steam roads in this country, and his son George availed himself, on all holiday occasions, of the opportunity thus presented of acquiring familiarity with the mechanism of the engines and the practical operation of the road.

As a draughtsman, George Whitney was equaled by few, and his beautiful drawings of some of the first English locomotives sent to America (made when he was quite a youth), are still preserved in his family, and are tangible evidences of his skill in this direction.

Mr. Whitney's taste naturally led him to choose the profession of civil engineering, and on completing his studies he immediately secured a situation on the surveying corps of the proposed railroad between Hartford and Springfield, Connecticut, the lines for which were run in the middle of a rigorous winter, the engineers being exposed to the hardships of extreme cold and deep snows. On the completion of this survey he was retained by the engineer in charge, the late William H. Talcott, and transferred, in 1840, to the little town of Cuba, Allegany Co., N. Y., where he was placed in charge of a section of the work of enlarging the Genessee Valley canal, being engaged both in preparing estimates of cost and in supervising the practical construction. Mr. Whitney remained at this post more than two years, and was then transferred to Albany as private secretary to the same engineer.

In 1842, Mr. Asa Whitney removed to Philadelphia, having formed a partnership with Matthias W. Baldwin, under the name of Baldwin & Whitney, for the manufacture of locomotives. Mr. George Whitney was soon called to Philadelphia and was employed by this firm until its dissolution in 1846.

We next find him assisting his father, who had been appointed president of the Morris Canal Co., in the work of preparing drawings for the remodeling and enlargement of the canal, a work of considerable magnitude in those days, involving some bold schemes in the substitution of improved inclined planes for the old-fashioned locks, and which, by their successful operation, rescued the company from its financial embarrassments and placed it upon a paying basis.

The President's "Report to the Stockholders of the Morris Canal and Banking Company, March 17th, 1848," contains an interesting account of the experimental tests made January 27th, 1848, of the first inclined plane constructed under his supervision, in which he says that a boat containing seventy tons of cargo (exclusive of the weight of boat and car) was passed repeatedly up and down the plane, with great apparent ease and without employing more than half the power that had been provided. The boats were carried up the inclined planes at a greater velocity than they were towed on the levels, and the system then introduced is still in successful operation on the canal. The height of the first plane was fifty-one feet, its inclination one in ten ; the whole distance that the boat was moved by machinery was 900 feet and the time employed was three and a half minutes.

Mr. Asa Whitney, realizing, prior to dissolving partnership with Mr. Baldwin, the great necessity for improvement in wheels for locomotives, tenders and cars, had devised a process for annealing wheels made of chilled cast-iron, for which he obtained a patent in 1848. The experiments, which were made chiefly by Mr. George Whitney, under his father's direction, proved so successful that Mr. Asa Whitney, foreseeing the opportunity here presented of developing a large and profitable business, resolved to confine himself to this specialty; accordingly, in 1847, the firm of A. Whitney & Son was established for the purpose of manufacturing chilled cast-iron car-wheels under this patent. The extensive works covering the ground between Callowhill street, Pennsylvania avenue, and Sixteenth and Seventeenth streets, were erected a few years later, and were by far the finest and most substantial, as well as largest, devoted to this specialty in the country. As an evidence of the extent of the business it may be stated that about one and a half million car-wheels have since that time been made at this establishment and sent to all parts of the world where the iron horse has penetrated.

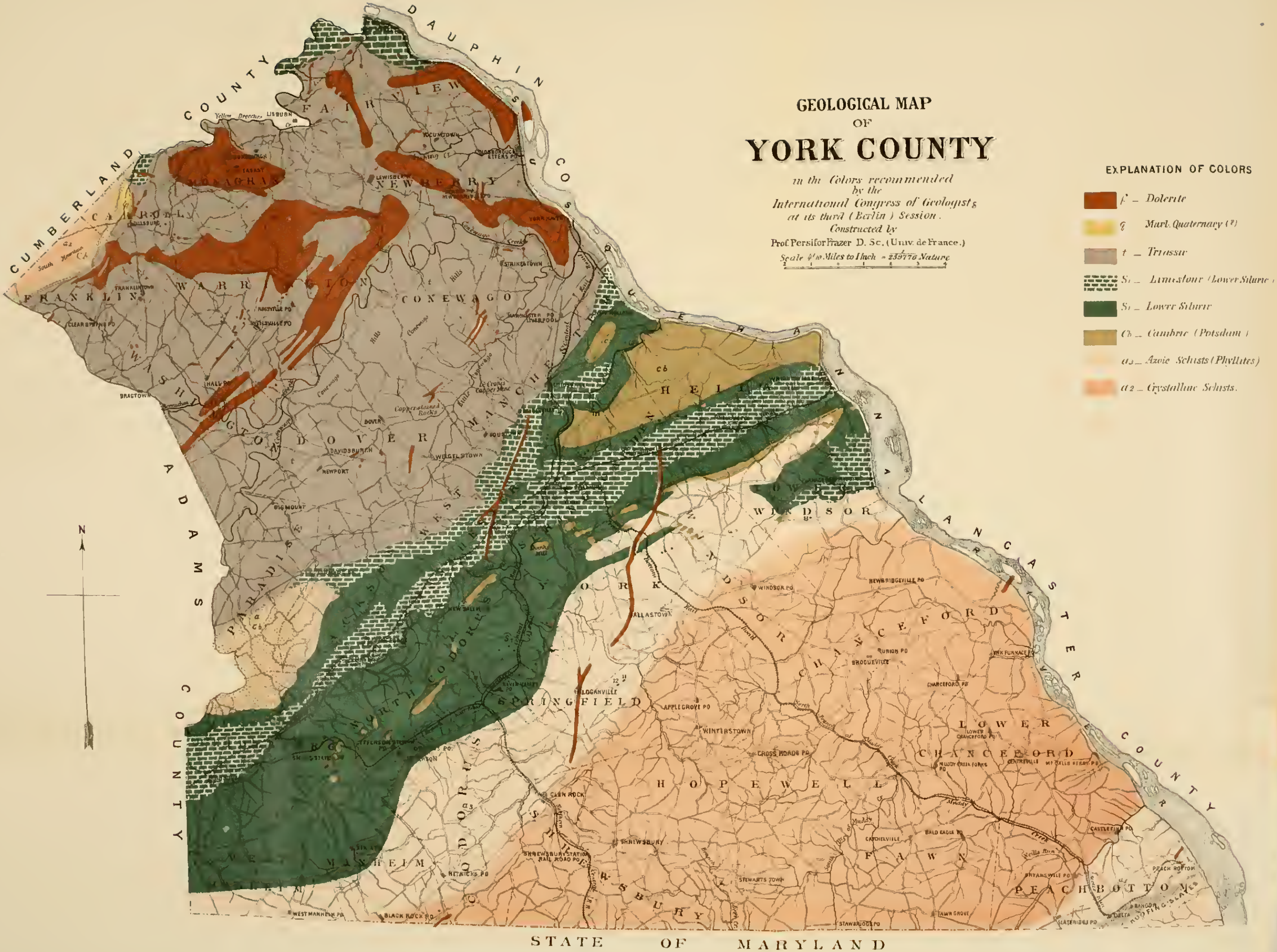
Mr. George Whitney devised many improvements facilitating this manufacture, and for several years prior to the death of his father, which occurred in 1874, he was the practical head of the firm.

Outside of this special occupation, Mr. Whitney was well known as a public-spirited citizen, giving aid both by his wise counsels and his generous contributions to all laudable objects. At the outbreak of the late rebellion he was one of the foremost business men in this city to recognize and accept the responsibilities thrust upon him and he never wavered for a moment, or lost courage in the darkest hours of the nation's peril; he was one of the original members of the Union Club, a liberal subscriber to and treasurer of the Bounty Fund, and he testified, in various other substantial ways, his loyalty to his country.

As a business man, Mr. Whitney's reputation was such that his counsels were eagerly sought by many of our largest moneyed institutions, and though failing health compelled him of late years to relinquish some of these labors he was still active in not a few such corporations. At the time of his death he was a Director of the Insurance Company of North America, The Philadelphia National Bank, The Philadelphia Saving Fund, and The Lehigh Coal and Navigation Company.

As an art patron, Mr. Whitney has done much to stimulate the higher education in art in this country, both by his judicious selection of foreign paintings of the highest order and by his generous encouragement of native talent; his collection of pictures is one of the choicest in the United States and is even better known in Europe than in this country. Mr. Whitney was, for many years, a Manager of the Philadelphia School of Design, a member of the Board of Trustees of the Academy of Fine Arts and of the Pennsylvania Museum of Industrial Art; he was also an honorary fellow of the Metropolitan Museum, and at the time of his death was one of the Board of Trustees of the University of Pennsylvania.

In private life Mr. Whitney was an exceedingly modest and unassuming Christian gentleman, generous to a fault, ever ready to assist the unfortunate, while carefully concealing his name and his good works from the public eye. He died on the sixth day of March, 1885, after an illness of several weeks.


GEOLOGICAL MAP
OF
YORK COUNTY
in the Colors recommended by the International Congress of Geologists at its third (Berlin) Session.
Constructed by
Prof. Persifor Frazer D. Sc. (Univ. de France.)
Scale 4/10 Miles to 1 Inch = 1/25 Nature
EXPLANATION OF COLORS
Dolerite
Marl. Quaternary (?)
t _ Triassic
Limestone (Lower Siluric)
Lower Siluric
Cambric (Potsdam)
Azoic Schists (Phyllites)
Crystalline Schists.
CUMBERLAND COUNTY
DAUPHIN COUNTY
LANCASTER COUNTY
ADAMS COUNTY
STATE OF MARYLAND
SUSQUEHANNA
N
FAIRVIEW
NEWBERRY
MONAGHAN
CARROLL
WARRINGTON
FRANKLIN
CONEWAGO
WASHINGTON
DOVER
MANCHESTER
WEST MANCHESTER
PARADISE
HELLAM
YORK
WINDSOR
LOWER WINDSOR
CHANCEFORD
LOWER CHANCEFORD
SPRINGFIELD
HOPEWELL
FAWN
PEACH BOTTOM
SHREWSBURY
NORTH CODORUS
CODORUS
MANHEIM
WEST MANHEIM
HEIDELBERG
JACKSON
GOLDSBORO
LEWISBERRY
DAVIDSBURGH
NEWPORT
WEIGELSTOWN
DALLASTOWN
WINDSOR PO
NEW BRIDGEVILLE PO
BROGUEVILLE
CHANCEFORD PO
LOGANVILLE
APPLE GROVE PO
WINTERSTOWN
CROSS ROADS PO
GLEN ROCK
SHREWSBURY STATION RAIL ROAD PO
STEWARTS TOWN
BALD EAGLE PO
CASTLEFIN PO
FAWN GROVE
WEST MANHEIM PO
BLACK ROCK PO
STRINESTOWN
CLEAR SPRING PO
BRAGTOWN
DELTA
PEACH BOTTOM
SLATERIDGE PO
ROOFING SLATES

GENERAL NOTES.—SKETCH ON THE GEOLOGY OF YORK COUNTY, PENNSYLVANIA.

By Persifor Frazer.

(*Read before the American Philosophical Society, December 4, 1885.*)

The conditions which make York county soil productive, the study of its geology interesting, and that geology itself varied, are due to effects of movement in early geological time, which, compared with those which have shaped our continent, are so small that they can hardly be represented upon a geological map of the United States of ordinary size. Yet, in a rough and general way, York county is a partial imitation, on a very small scale, of the United States, inasmuch as, like that part of the American continent, it consists of a belt of Archæan rocks in the north-west; of another in the south-east; and that its intermediate portions are made up of newer formations containing fossils. Cavities in the limestone containing lignite and fossil plants, the latter resembling that of the present day, are not rare. These and possibly a marl in Carroll township near Dillsburg, which, however, has yielded no fossils, represent the latest geological period; and thus it may be said that of the five great divisions of the rocks of our planet: viz, the "original" (?) or Archæan; the "old life" or Palæozoic; the "middle life" or Mesozoic; the "new life" or *Cainozoic (including under this head the Quaternary and Recent), and the Eruptive or igneous, each has a representative (or several of them) within the confines of the county. If it were of interest or profit, the analogy might be pushed a little farther to include the occurrence of the igneous rocks in the north-west; the broad belt of Mesozoic strata which abuts upon the Archæan (but, in the case of the continent, also upon numerous masses of new rocks which are scattered over a great part of their junction); the contact of the Palæozoic (Siluric in both cases) on the south-east border of the Mesozoic and the contact on the south-east of the latter formation with the Archæan. The last feature of the United States' geology, which fails in the case of York county, is the border line of New Life or Cainozoic rocks to the south-east of all the above formations; and even this might be supplied if the limits of the county were pushed a comparatively short distance across Mason and Dixon's line, and into the State of Maryland. But enough has been made of this fancy, which is only introduced in order to fix more securely upon the memory the fact that, geologically speaking, York county may be considered to be a part of a great accidented plain of which the general trend is east of north and west of south. Its valleys, or portions of them, have successively formed the ocean bottoms of four or five different geological periods, probably extending from first to last over many millions of years.

To Rogers' names of "Primal" (or the beginning); "Auroral" (or

* Written frequently Cenozoic.

the *dawn* of life); "Matinal" (or the morning. Same metaphor): "Surgent" (or rising), &c., to the lower divisions of the Palæozoic; and "Cadent" (or falling); "Umbral" (or darkening); "Vespertine" (or evening), &c., to the later divisions of the Palæozoic, the insurmountable objection is made that they do not describe any general state of facts. Thus it might be asked: Of what are these rocks the beginning, dawn, evening? Evidently of the second only of the four arbitrary and artificial divisions by age which geologists have constructed for their temporary convenience. The plan adopted by the New York geologists of giving a name to each formation, which should either recall the locality where it was characteristically displayed, such as the "Potsdam sandstone;" or describe it lithologically, as the "Calciferous sandrock," the "Marcellus shales," the "Oneida conglomerate," &c., would be a good one for provisional use, were it not that in addition to the geographical designation, a lithological definition is added, which, because restricted in the area to which it is applicable, is as often inaccurate as the *time* description of Rogers. Thus the "Potsdam sandstone" is a "Hellam Township quartzite," in York county, and Prof. Fontaine, of Virginia, thinks it represented by a peculiar schist containing quartz fragments in Virginia; and some persons are sure that it occurs in other places as a gneiss. The "Calciferous sandrock" of New York is the same formation which makes up the major part of the broad and fertile limestone valleys of Lancaster, York, Cumberland and Franklin counties, &c., where it is not a sandrock at all.

As there are various objections to every system yet proposed, I have adopted here that recommended by the International Congress of Geologists at its Berlin session.

The Archæan (or beginning) in this classification comprises those rocks, usually crystalline in structure, but of very varied and divergent character, in or below which the very earliest known forms of life occur—and those very sparingly—in York county. This series comprises all the rocks which are geologically inferior to the Hellam Township quartzite.

The Palæozoic (or "old life") includes all the rocks from and including the Hellam quartzite to the New Red sandstone, and is made up of the quartzite, hydro-mica schists, and their included iron ores, the great blue and buff limestone on which the city of York is built, together with that of Lower Windsor township; that near New Holland, in Manchester township; around Newmarket in northern Fairfax township; and north of Dillsburg in northern Carroll township.

The Mesozoic (or "middle life") rocks are the reddish-brown sandstones and shales (and perhaps the igneous rocks penetrating them) which cover almost the entire north-western part of the county. If the fancy might be indulged of likening the outline of the county to that of the lower part of a horse's leg, this formation would constitute the fetlock joint and all that portion immediately above the hoof proper.

The Cainozoic (or "new life") includes all those rocks of which the origin is of later date than the last mentioned, but it is generally used for those before the date of any historical evidences of the appearance of man on the planet. It is not known to me that there is a representative of this age present: that marked "marl" in the geological map being introduced without the evidence of fossils so far as I know and with considerable doubt.

The Quaternary and *Recent* deposits comprise those deposits which have been made from the earliest appearance of man on the planet down to the present time, including of course those of origin so late that they might have been historical. Such are the marks of the denudation which has shaped the meadows and hills as they are at present; the moulding of the ravines and deepening of the stream-beds; the distribution along the latter of gravels, &c; and finally (for the sake of saving one more division of time, which would otherwise lie wholly within this one, and at best remain very uncertain as to exact date) the works of man's hand, which are discoverable in the arrow-heads and sculptures not infrequently observed along the lower course of the noble river which forms York's north-eastern boundary.

One word more is necessary as to the subdivision of the rocks of these different geological ages before their occurrence in York county becomes our theme.

It has been said that if the average thickness of all the strata which have been yet recognized as distinct in the State of Pennsylvania were laid one upon the other, the height of the pile would reach something like forty thousand feet. But this is made up almost without taking into account other than the Palæozoic rocks. If the ordinary methods of calculation were pursued in estimating the thickness of the Mesozoic or New Red sandstone and shale alone which crosses York county, three miles and a half would be added to this column.* No very great thickness of Tertiary or Cainozoic rocks is to be found in Pennsylvania, but if, instead of counting upwards, or from the most recent of the Eozoic series, we were able to count downwards to its lowest member; or to the earliest existing rocks of the globe, it is probable that a thickness of this series alone greater than all of those that we now know put together would be established. That the exposures of rock in York county will not justify the belief that any considerable fraction of this Archæan series can be reached by boring, the following list of its divisions, accepted by many geologists, will sufficiently show. They are given in descending order, the lowest being the earliest known, and the first named the most recent:

VI. Keweenian.†	III. Huronian.
V. Taconian.	II. Norian.
IV. Mont Alban.	I. Laurentian.

*There are, however, good reasons for rejecting such an estimate.

†See volume E. p. 211, Publications of the 2d Geological Survey of Pennsylvania, by Dr. T. Sterry Hunt.

The Archæan Rocks of York County.*

Crystalline Schists (a_2).

I have not seen in York county any rocks which I considered to be of Laurentian age. If there be any, they are to be sought in the portion of the South mountain, which is included in parts of Carroll and Franklin townships, but it is very improbable that any will be found there. The same may be said of the Norian, which is simply another name for what was once called "Upper Laurentian." There remain then only the Huronian, the Mont Alban and the Taconian, for the Keweenian is not known in this part of the United States. The lowest member of the Archæan series, which has been recognized in York county is the Huronian, and if I be not in error, the rocks of this age form the greater part, if not all, of its lower strata. On the accompanying geological map it is colored a pink of medium tint, and lettered "a_2," as well as all that previously referred to in Carroll and Franklin townships forming the South mountain.

Crossing the Susquehanna somewhat obliquely a broad flat arch of these rocks becomes evident in plotting the observations on section lines along either the right or left bank of the river.†

The perpendicular thickness of the Huronian rocks which constitute the visible parts of this arch has been calculated by me to amount to fourteen thousand four hundred feet, or 2.7 miles (or 4.3 kilometers), measuring from the lowest rocks exposed a short distance above McCall's Ferry to the base of the Peach-Bottom slates. This arch (or anticlinal) is a very important feature in the geology of this part of the State ; for it is not improbable that it is the leading element in the structure of a broad belt of rocks extending from a point at least north of the Schuylkill river (and not improbably even within the New England States) to and into the State of Alabama.

But whether this carefully considered hypothesis be true or not, there is not the slightest reason for doubting that the rocks of this part of the county form the floor on which all the others in the county were laid down. Another fact in relation to this flat arch or anticlinal remains to be considered, viz : the line along its crown (or along the top of the arch) appears not to have been an horizontal line after the last great earth-crust movements, of which we can find evidence in this part of the continent, had been completed ; the *axis* of this arch appears to have sloped upwards, from the west of south to the east of north ; and to say that this axis rises towards the north-east, is to say that, judged from our present surface, the lower (and consequently older) beds of this arch rise nearer to that surface, the farther one follows this direction of north-east ; and of course these same rocks sink lower beneath the surface

*See Note 7 at the end.

†See these sections by the author in atlas accompanying volume CCC, 2d Geological Survey of Pennsylvania.

the farther one follows the direction of the arch to the south-west. I have elsewhere given reasons for the hypothesis that this anticlinal joins and continues the anticlinal of the Buck Ridge * near Conshohocken, a few miles north-west of Philadelphia, on the Schuylkill river, traversing Lancaster and Chester counties, a little south of the Chester valley. But at Conshohocken, the anticlinal is represented by Laurentian gneiss, while in Lancaster and York counties, the Huronian schists, which have been torn off by atmospheric denudation at the former locality, still remain ; and still farther to the south-west it is not unlikely that even more recent sheathings may be found, unless the axis be broken or bent, and rise also in this direction. The main fact, which it is my purpose to emphasize here, is that the same structure of arch evidently affects an enormous thickness of beds ; in all probability is traced in the flexed rock masses of at least two entirely different geological periods, and may possibly be discovered in those of yet others outside of the limits of the field which it is my purpose to describe.

A somewhat arbitrary division has been made by the writer between the rocks of the Huronian and those of the next following age. The line which constitutes this division may be seen passing through the southern part of Lower Windsor, the middle of Windsor, the eastern part of Springfield, including Codorus, and reaching the Maryland line a short distance east of the boundary dividing Manheim from West Manheim township. This line does not profess to be, and in all probability is not an accurate line of demarcation between the two formations. It was adopted as an approximate dividing line between two regions which exhibit lithological characteristics diverging from each other in a degree proportional to the distance on either side of it. The same is true of the line which separates these lower rocks from the triangular area in the extreme south-eastern corner of the county, in which are found the famous Peach-Bottom roofing slates. These two lines, which are in the average parallel to each other, are approximate boundaries only between the two regions, and that filled by the rocks of the McCall's Ferry or Tocquan Creek anticlinal. The rocks of the latter belt are strongly marked crystallized rocks,† *i. e.*, their structure is coarse, and the minerals which compose them are large and well crystallized, especially along the central parts of the belt. The rocks of the two bordering regions just mentioned are more crystalline, *i. e.*, crystallized imperfectly or in much smaller masses, besides having other differences in kind. For example, the arch-belt (if I may be permitted to express it so), contains larger amounts and larger specimens of Muscovite, and more potash micas generally. The rocks are lighter, and not infrequently enough feldspar is found to give them a decidedly gneissic character ; and the more so in general terms, the farther one gets away

*See "Thèses presentées a la Faculté des Sciences de Lille. Université de France," &c., 1882, and "History of Lancaster County," &c., Phila., Everst & Peck Publ., 1883, p. 3.

†See note at the end.

from the bordering regions. The rocks in these latter regions, on the other hand, are more and more magnesian, darker in color (usually greenish or yellowish-green) and softer. They contain large quantities of chloritic minerals, and are remarkable for the great number of white quartz dykes which intersect them.

These "arch-rocks" are very generally destitute of valuable minerals, so far as they have been explored in York county, except on the fringe of the South mountain, where they are in close proximity to a series of iron ore deposits similar to and in fact continuous with those known as the ores of the "Great," or "Cumberland Valley." But though this juxtaposition would tempt one to connect these ores with the rocks just spoken of, and though it is conceded that rocks of this age do often carry iron ores, the strong probability is that the proximity is "accidental," that is to say, that the ores occur at the foot of the mountain, because having been originally imbedded (as constituents of minerals) in the rocks which covered these slopes during the degradation and destruction of these latter they have been disintegrated, carried away from their original place (sometimes not far off), and segregated in the soft and unctuous clays to which these loose beds have been reduced. But it is not improbable that some of these ores may have owed their origin to the same kind of alteration taking place within the mass of the Huronian rocks themselves. So that wherever the loose débris of higher formations (and notably of the Hellam quartzite (Potsdam sandstone), which everywhere abounds on the slope in boulders and blocks) will permit the undoubted Huronian to appear near one of these great iron mines, it is likely to be found that a part of the wealth of the latter consists in a somewhat peculiar ore unlike the rest, which can be traced to its first resting place within the bosom of the Huronian rocks.

The belt of rocks which represents the Archæan in York county, lies, as it may be said approximately, between two lines, one following Muddy creek from its mouth in the Susquehanna to its right-angled bend, and thence through Bryantsville to Constitution ; and the other commencing opposite Turkey hill (in Lancaster county), and passing north-west of Windsor post-office, south-east of Dallastown, and nearly through Glen Rock post-office. The portion of the South mountain above referred to as belonging to the same age is small in area within the county limits, and occurring at one end of the chain of crystallophyllites where they appear to sink beneath the newer limestones and shales ; its slopes are gentler ; it has been subjected to greater erosion, and is covered for the most part with the débris of more recent formations. This belt, thus defined, contains no minerals which are yet mined (if we except the iron ores from the category), but the soil formed by the chemical and mechanical action of the atmosphere on its rocks is next in fertility to that of the limestone belt itself. The rocks of the Archæan belt, thus defined, are intersected by but few igneous dykes or trap, and this fact, taken in connection with the remarkable prevalence of such dykes in the north-western part of the county, and their frequency throughout the middle belt of limestone and schists, would lead one to conclude either that the seats of the igneous action resided within the beds of the newer rocks, or that the superposition of the latter in some way favored the development of the Plutonic forces which have forced molten rock for miles through narrow crevices and cracks in the envelope of the globe. Perhaps the explanation may be found in the supposition that the number of such dykes would depend upon the number of fractures in the earth's crust, and that this number would increase with the growing weight due to thickening sediments deposited by water. However this may be (and it does not explain all of the facts connected with the new red sandstone), the only points where have observed trap penetrating and terminating in the rocks of this belt are : First, in a small exposure north of York Furnace on the Susquehanna, and second, a short distance east of Black Rock post-office.

The Belt of Azoic Schists or Phyllites (a_3).

I have preferred to describe this belt under a separate heading, because there are difficulties connected with its assignment, either to that part of the Archæan rocks just considered, or to the Palæozoic which will next be described. These difficulties arise in great part from the lack of outcrops of "rock in place." The decomposition which has attacked this intermediate belt has destroyed the identity of the individual beds and strewn the surface with its products, which are mingled with the remains of rocks of much later date. This is not surprising if we may assume that this belt formed the upper and later portions of the great Archæan series, for we have abundant proof that in contrast to the stability and repose of the broad flat arch to the south-east, this new region was the hinge on which the first of a number of severe plications of the strata were operated. This bending and twisting unquestionably crumbled the rocks and left loose material which was easily moulded by the waters of the ocean, which then or subsequently covered it, to forms which more or less resembled those which had originally characterized it. But after its consolidation with the next succeeding formation, and after an unknown amount of erosion had laid bare their contact line, both were together similarly treated, so that in the contorted state in which it was left it exhibits some features which recall the Middle Archæan, and others which remind one of the Lower Palæozoic of the county. Its precise boundaries being difficult to ascertain on the ground, cannot be given with precision in the text. It will suffice to say that, beginning on the Susquehanna river, a short distance south of the southern outcrop of the Prospect limestone, one part of it occupies all the region lying between the north-western boundary of the Archæan already given and the southern and eastern limits of the Hellam quartzite shortly to be described. It is traversed through part of its extent by two large trap dykes, and contains numerous deposits of iron ore which I am disposed to ascribe to segregation from iron minerals in other formations. Some limestone occurs interbedded with these rocks (as at Glen Rock), which may be safely assumed to be of earlier date than the important York limestone, whether or not it be (as seems not improbable) a part of the regular Huronian series.

The most extensive iron ore banks noted in or on the border of this intermediate belt are the Brillhart and Feigley banks marked Nos. 11 and 12 on the map.

The Peach-Bottom district, including the roofing slates lying to the south of the flat arch, was described by me in volume CCC, Second Geological Survey of Pennsylvania, in 1877, where I showed that its position in the series was doubtful, and that these rocks might be interpreted to represent the Upper Archæan (a_3) (below the Potsdam); or the schists immediately above the Potsdam (s_1); or (by supposing a fault), a formation still higher—the "Matinal" of Rogers. Since then fossil algæ were furnished to Prof. James Hall from the quarries, but he was unable to determine the age of the rocks from them with greater precision, than to refer them to the second or third of these horizons, with a preference to the second.* Photographs of the quarries and of the manner of working them will be found in volume CCC, Second Geological Survey of Pennsylvania.†

The Palæozoic Rocks.

Cambric (Hellam Quartzite, Potsdam Sandstone). (cb)

Prof. H. D. Rogers, in the First Geological Survey of Pennsylvania, marked out and described the members of the different formations represented in the State. This formation, which we may consider the base of the Palæozoic, was considered by him to consist of three parts: a lower series of "talcose" slates, a middle white sandstone, and an upper series of talcose slates. It will be easily understood, by what has just been said, to what extent the view here offered differs from that of our great pioneer geologist. These "lower talcose slates," in all probability, are identical with the Azoic schists (or phyllites) just described, and, therefore, their position relatively to the beds beneath them and above them is the same, whether they be considered Upper Archæan or Lower Palæozoic. There are no good exposures of the Hellam quartzite with the slate below it at any place in York county which I recall. On the flank of the South mountain, the quartzite is very much rent and crushed into fragments, while of the small patch on the map about two miles west of Case's ore bank (No. 8 on the map) no accurate dip was recorded. The Hellam quartzite, of which a part composes the "Chikis mountain," exhibits, indeed, in its numerous foldings the rock, called by Rogers, "talcose slate," between its two principal beds of quartzite, but not appreciably lower than the latter. We are forced to look to other parts of the country for a clearer knowledge of the relation to each other of this quartzite, and the schists on which it rests. We find abundant instances

*See Peach-Bottom slates of S. E. York and S. Lancaster counties, Proc. Am. Inst. of Min. Engrs. Troy meeting, 1883.

†See note No. 2 at the end.

of this contact in Chester county north of the valley of that name, and in all of them the quartzite lies "uncomformably" (*i. e.*, with changed dip) upon the schists. The latter, it is true, are somewhat different in minor characteristics from those of which it is here the question, but so also is the quartzite. Yet we have the best reasons for believing that each is of contemporary origin with its analogue in York county; and indeed, the differences, which would not be considered at all important by any but a critical geologist, are what we might expect when we remember that these rocks are sediments laid down at the bottom of successive seas, and that their characters depended upon the kind of material which different streams draining different parts of the country brought down to be strewn out at different localities during different epochs.*

It will be explained before long that the physical break between the Archæan schists and the limestone series is rendered highly probable by the observations in York county, but that between the flat arch belt and the Hellam township quartzite must rest upon the direct evidence obtained in other counties, unless here also we may apply the indirect method mentioned above, and conclude that inasmuch as the Hellam quartzite contains one important fossil (*Scolithus linearis*) and the Archæan schists contain none that have yet been discovered in York county, this fact alone entitles them to be considered different formations.

The Hellam or Chikis quartzite is a hard quartzose rock, of which the general color is white or gray, tinted by some other color, usually pink, brown or blue, depending upon the minerals with which it has been associated. It is almost always crystalline, and in disturbed regions like this is most frequently found in broken fragments rather than in continuous beds. This is probably owing to its brittleness, which prevented it from yielding gradually to the strain which has folded and tilted the other rocks of the county. These strains have twisted, broken and crumbled it, but on account of its great hardness and its resistance to the chemical action of the atmosphere, it is the least altered or decomposed of all the rocks to be considered here, and almost always indicates its presence by a hill, whatever be the position of its strata.†

It is not necessary to specify the localities within the county where this quartzite occurs, because they are indicated by brown on the accompanying geological map; still less is it desirable to discuss here all the possibilities of structure which these scattered outcrops suggest. It is important, however, before leaving the floor of the Palæozoic column, to say that eleven years of experience in the field have caused me to doubt the cor-

* Let any one observe the great differences between the characters of the sand beach of our own Atlantic coast within short distances. See on this subject Delesse's important contribution entitled "Géologie du fond des mers," and the writer's notice of the same in the Proc. Am. Philos. Soc.

† Of course the reason of this is that the erosion, which has torn off hundreds and perhaps thousands of feet of the other measures, has not been able to reduce it to the same extent, and it remains, consequently, as an elevation, or chain of hills.

rectness of ascribing to this formation the iron ores which are found in the schists immediately above the quartzite.*

The Grubb ore bank (No. 111 of the map) is the only one which lies wholly within the area of the Hellam quartzite as given on the map, but a reference to the description of this bank (Vol. C, p. 64, 2d G. S. of P.) leads to the belief that the larger part of the ore lies in a small remnant of the bottom schists of the next higher formation, which has escaped the erosion that cut off the higher layers of that formation. Part of it, however, answers to the description of an iron ore which may really belong to the quartzite and which has been noticed in the rocks forming the outer casing of the South mountain.†

Siluric. (s)

The York Limestone and Schists (*Auroral* of Rogers, in part the *Calciferous Sand rock* of the New York Survey). This important member of the Palæozoic series in York county consists of at least two, and perhaps three, distinct kinds of rocks, and inasmuch as the kind that occurs at the bottom (which resembles strongly that which occurs among the limestone beds themselves, and also above them) has already been mentioned several times by anticipation, it will be advisable to consider it first.

Hydro-mica Schists. (s_1)

It was previously stated that Rogers, and following him, almost all other writers on geology up to the commencement of the Second Geological Survey of Pennsylvania, had given the name of "talcose slates" to a group of rocks which he connected in epoch with the quartzite. The word talcose was applied to them because from their softness and greasy feel it was assumed that they were largely composed of "talc;" but subsequent investigations of these rocks in the chemical laboratory have shown that they contain little or no magnesia, and that they derive their peculiar characters from large amounts of a group of micas containing potash or soda and water. Prof. James D. Dana conceived the happy thought of naming the group the "Hydro-micas" (or water-containing micas), and naturally the rock which is mainly composed of them is called Hydro-mica schist.

These hydro-mica, or nacreous schists, are not of uniform appearance. Sometimes, and especially in the beds that underlie the limestone, they are firmly compacted together, making hard rock masses and high hills, as at many places along the Susquehanna, from Wrightsville to Cabin Branch run, and elsewhere in the county. Sometimes they are so much disintegrated as to form dust, which on close view is seen to be mainly

*Of course, if the Potsdam have an upper member consisting of schists, the above assignment is correct; but I know of no instance in which the opposite supposition is not equally supported by the facts. It is also to be noted that the limestone and iron-ore bearing schists are more frequently found together without the quartzite, than the quartzite and schists without the limestone.

†Cottrell, Benson's and Smyser's mines (Nos. 11 and 112) are on the border line between the quartzite and limestone.

made up of little glinting particles. In the former case the beds are very often strewn with pyrite. Again, in place of these crystals of iron—and occasionally copper—sulphide, are beautiful casts or moulds of the shape of a cube, more or less filled with a dark brown iron rust obtained from the decomposition of the original crystals. These little crystals have been of no small importance to the prosperity of York county, for there is good reason for believing that by far the largest part of its iron ores have been derived from their oxidation, transportation by water and final deposition in the clays formed from the grinding up of the rocks which originally contained them.*

These argillites, or limestone schists, as I have sometimes called them, in all probability hold all the important iron ore† mines of the county, outside of the formation of red sandstone and shales. It is true that sometimes the iron ore banks appear to be far from the area colored as limestone, and sometimes directly within the boundaries of that area, but in neither case is it under conditions that forbid the belief that they are in the veritable hydro-mica schists, even if the latter may have been reduced by the weather to soft unctuous and variegated clays. It is not assuming too much, therefore, to call this portion of York county rocks the real iron-bearing region. The edges of the rock appear in the right bank of the Susquehanna river, where that river has cut through them, and one would select the part just above Wrightsville to ascertain whether these schists were unconformable upon the quartzite; but the following records of the dip, or inclination of the two rock series taken from section 1 of my report on the county,‡ will show that both formations are so flexed or twisted, that no certainty can be obtained there. First, there are two dips in the Quartzite of South—50°, and almost at the contact with the schists S. 20°, E.—45°. Next there are three dips in the schists which are respectively S.—45°, S. 10°, E.—50°, S.—10°, E.—10°. Still, there is every probability that in fact the dips of the two differ, both in direction and amount, while there are no such indications for the dips of the schists and of the limestone proper at this place.§ These schists are colored dark-green in the accompanying map.

The York Limestone with Argillites.—One of the best opportunities of measuring the thickness of this limestone is afforded by the section referred to along the Susquehanna from a little run half a mile above the Columbia bridge to Creitz's creek. This is evidently a trough with the axis close to the bridge, and measures 2800 feet of limestone and included schists. If the schists between the quartzite and the limestone be included, it would add some 1600 feet to this, making the limestone

*See Volume C, p. 137, 2d G. S. of Pa., by the author.

†See Note 3, at the end.

‡Vol. C, p. 78.

§In the section above referred to it is probable that a further study would enable me to abandon the hypothesis of non-conformability at *g*, *i*, *k* and *o*, which I considered necessary eleven years ago.

and the schists below it to the quartzite 4400 feet thick. The same beds measured by me in Lancaster county only amounted to 3400 feet. These beds, therefore, thicken 1000 feet in the twelve miles which intervene between this section and the city of Lancaster, and of this thickening 400 feet belong to the schists below the limestone and 600 feet to the limestone itself and its included schists.* The limestone, of which numerous analyses will be found in Reports C, CC, CCC, M and MM, is dolomitic, that is to say, it is a carbonate of lime, containing varying amounts of carbonate of magnesia. There is also some ground for believing that two kinds of limestone are represented, each having its own peculiarities of physical structure. It was noticed in many cases that two kinds of limestone were often exposed in the same quarry, and that they usually showed slight variations of dip. One, which was apparently the elder, was of a buff or grayish color, and less marked stratification; the other blue, with white streaks and spots of lighter colored limestone (often calcite). One case was recorded where, in a contact between the two, pebbles of the buff were found in the blue. There seems no doubt that the great mass of limestone now under consideration was formed subsequently to the quartzite, and at about the epoch of the Calciferous Sand-rock of New York and before the Trenton, or in other words in the Canadian epoch of Dana. But no fossils were found in the county to settle the question. The portions of the beds connecting the limestone near New Market with that of York (a connection which doubtless exists), is covered up by the beds of the Mesozoic. Those which once connected that of Wrightsville with that near Prospect has been washed away in the general planing down of the surface by erosion. The limestone is indicated in the map by white line blocks through the dark green.

The Mesozoic Rocks in York County.

None of the numerous members of Mesozoic rocks is known to be represented but the groups of sandstones and shales known as the "New Red Sandstone," and sometimes the "Triassic Sandstone."

There are many puzzling questions which arise from the study of these rocks, not the least of which is their thickness. If one assumes them to lie naturally without distortion, layer upon layer, in York and Adams counties, their perpendicular thickness in this region will be not less than sixteen thousand four hundred feet.† The lower bed of this formation,

*See Note 4, at the end.

†See Volume CC, 2d G. S. of Pennsylvania, p. 303, by the author. See also by the same "The American New Red Sandstone." Trans. A. I. M. E.; "The Mesozoic formation in Virginia," by C. J. Heinrich; Trans. A. I. M. E., Feb., 1878; Notes on the Mesozoic of Virginia, by Prof. William M. Fontaine, Am. J. of Sc., January, 1879; and "Some Mesozoic ores," Proceedings American Philosophical Society, April 20, 1877, by the writer. In the article cited second, and in a review of the others in the *American Naturalist* for May, 1879, I have shown that by calculating the thickness of Prof. H. D. Rogers' Yardleyville section of this formation (First Geological Survey of Pennsylvania) by the ordinary method, the thickness of beds would appear to be 51,500 feet, or nine and three-quarter miles.

which forms its eastern boundary, is very generally a conglomerate of the older limestone pebbles, forming Mesozoic rocks. This can be observed about two miles west of York, at Beeler's Cross roads (Vol. C., p. 92, Sec. 2a).

The upper bed seems to be also a conglomerate which forms its western boundary on the slope of the South mountain. Rogers was in doubt, whether the so-called "Potomac marble" was represented by the upper or lower of these (see Report CC., p. 265). Borings with the diamond drill by Mr. Heinrich, recorded in the paper above mentioned, show that no such thickness exists in point of fact as one might conclude from the appearance of the beds, and the probability is that the actual thickness there is not above fifteen hundred feet. No such borings have been made in York county, but the probability is that this thickness is not very greatly exceeded. But these measures in York county are chiefly interesting on account, 1st of their fossils; 2d of their iron ores; and 3d of their coal. From the former Prof. E. D. Cope was able to assign the beds containing them to the middle and upper divisions of the Triassic. The coal which is found about three-quarters of a mile north of Liverpool on I. Spahn's farm, and elsewhere, represents the extensive deposits known as the Richmond Coal fields, which have been wrought for a century in Virginia to advantage, and are so still. Although its analysis indicates it to be a good bituminous coal (see CCC, p. 259*), yet it has never been found in Pennsylvania in paying quantities.

Copper, and other valuable metals have been similarly observed in this formation, though in disappointing quantity, in this county, though they have supplied furnaces in other parts of this State and in other States. The richest deposits of these metals are usually found near the borders of the formation. For the following summary of the Triassic fossils as yet determined in Pennsylvania I am indebted to the kindness of Prof. Cope.

The vertebrate fossils from the Triassic beds of Pennsylvania have been obtained principally from two localities by Mr. C. M. Wheatley. The longest known is the tunnel of the Reading railroad at Phœnixville; the other is in York county.† The species represented belong to the Fishes, Batrachia and Reptilia, as follows:

Fishes.

Turseodus acutus Leidy........................Phœnixville.

Batrachia.

Eupelor durus Cope..........................Phœnixville.

Reptilia.

Belodon priscus Leidy...............York Co., Phœnixville.

" *carolinensis* Emmons........York Co., Phœnixville.

" *lepturus* Cope........................Phœnixville.

*See Note 5 at the end.

† About two miles north of west of Emilysville and one and a half miles from the south-eastern border of the Mesozoic.—P. F.

Palæosaurus fraserianus Cope.................... York Co.
Suchoprion cyphodon Cope........................ York Co.
" *aulacodus* Cope........................ York Co.
Clepsysaurus pennsylvanicus Lea................ Phœnixville.
" *veatleianus* Cope..................... York Co.
Palæoctonus appalachianus Cope................ York Co.
Thecodontosaurus gibbidens Cope................ York Co.

Total, twelve species, most of which are described in the Proceedings of the American Philosophical Society for 1877.

Of the above, the genera Belodon, Palæosaurus and Thecodontosaurus are typical Triassic forms. The first and last named are the most clearly determined. Belodon is characteristic of the Keuper in Europe. As the species found in North Carolina and in New Mexico (*B. scolopax* and *B. buceros* Cope) are characteristic members of the genus, I have identified their horizons with the Keuper. The specimens from Pennsylvania are not so perfect as from the other localities, but are not separable from them. Thecodontosaurus belongs to the base of the Keuper (Etheridge).

No vertebrate remains indicating the existence of the Muschelkalk have yet been found in North America.—*E. D. Cope.*

Iron Ores. What has been said of the copper and other metals, may here be said of the iron ores. Although an immense amount of iron must have been consumed in providing these beds with their characteristic red color, and in fact large quantities of thin oxide scales are to be observed almost everywhere between the strata; the only localities where iron ores appear to have been found in any abundance or permanence are: 1st, those near the margins of the New Red Sandstone, when it overlies another formation containing iron ore; and 2d, in the neighborhood of the trap dykes, which contain over 11 per cent of oxide of iron.* In the former case, it is extremely probable that the deposits of the older beds (as on the flank of South mountain) have been torn up by the agitated waters which laid down the Triassic rocks, and redistributed as part of the latter. In the other case it is very probable that after the decay of the exposed portions of the Trap, part of their iron oxide contents was concentrated by natural water-flow, and carried into the cavities and seams of the porous Mesozoic rocks. The Traps, probably, not only supplied the original material for these ore beds, but in addition protected them from being washed away, and new outbursts of molten rock very likely gave them their altered appearance and magnetic character.

The Trap. Though the trap cannot be said to be of the same age as the Triassic (since it cuts through the highest beds and therefore appeared clearly after the latest sedimentary bed of the Mesozoic), still there is no sense. The most interesting features of the York county trap are its appearance sometimes as dykes cutting through narrow clefts of the rocks, and sometimes as mesas, or "tables" covering large areas after having

*See Note 6 at the end.

been poured out from a comparatively small vent. One of these may be seen in Warrington and one in Monaghan townships. The chief constituents of this rock are pyroxene (or augite) and labradorite. Magnetic oxide of iron is always, and apatite is very generally present. The trap in Warrington is directly connected with the mass in and to the east of Gettysburg, and is identical in composition with the so-called "Gettysburg Granite."* The Triassic is represented by a medium tint of violet on the map.

Cainozoic. Of these, including the Quaternary and Recent, the only representatives are the marl bed north of Dillsburg, (?) and the gravels, fluviatile deposits, and Indian sculptures on the banks and islands of the great river. Full descriptions and phototypes of these latter will be found in Vol. CCC, 2d Geol. Surv. of Pa.'s publications. Though in strict accordance with the determination of Prof. Cope, just given, it should be represented perhaps as t3, which is a violet of very light tint. No rocks answering to the description of the shell limestone or "Muschelkalk," which constitutes the middle Trias of Germany and France, have been found in Pennsylvania at least. Pending the establishment of a parallelism, I have adopted the plan suggested by the International Geological Congress, of coloring the entire area as if it were the middle member of the formation.†

Analyses of Ores, Rocks, Minerals, &c.

Note 1. An analysis of a mica schist with imbedded crystals from half a mile N. W. of Cully's station, Columbia and Port Deposit R. R., is added here for comparison with that of the Beach-Bottom slate which follows: (No. 1705 in Survey's catalogue of specimens, CCC, p. 271.)

	P. C.
Silica (SiO_2)	59.01
Titanic oxide (TiO_2)	1.34
Phosphoric oxide (P_2O_3)	(traces)
Alumina (Al_2O_3)	17.02
Iron sesqui-oxide (Fe_2O_3)	7.76
Ferrous oxide (FeO)	2.64
Manganous oxide (MnO)	0.96
Lime (CaO)	2.08
Magnesia (MgO)	0.07
Potash (K_2O)	2.63
Soda (Na_2O)	2.44
Ignition	4.42
Total	100.37

The rocks of which the above is an analysis correspond with those be-

*See Note 6 at the end.

†The above paper was rewritten from one intended for a history of York county. Some matters not entirely adapted to a paper in the Proceedings, but which were difficult to eliminate, still remain.—P. F.

tween Centreville and Castle Fin in York county, not far to the north-westward of the Peach-Bottom district.

Note 2. Peach-Bottom slates. Mr. Andrew S. McCreath gave the following report of a specimen of the Peach-Bottom slate taken from J. Humphrey & Co.'s quarry half a mile east of Delta, York county (p. 270, CCC).

	P. C.
Silicic oxide (SiO_2)	55.880
Titanic oxide (TiO_3)	1.270
Sulphuric oxide (SiO_3)	0.022
Alumina (Al_2O_3)	21.849
Ferrous oxide (FeO)	9.033
Manganous oxide (MnO)	0.586
Cobaltous oxide (CoO)	(trace)
Lime (CaO)	0.155
Magnesia (MgO)	1.495
Soda (Na_2O)	0.460
Potash (K_2O)	3.640
*Carbon (CO)	1.794
Water (H_2O)	3.385
Iron bisulphide (FeS_2)	0.051
Total	99.800

Note 3. The following analysis of two different kinds of ore from York county are given. The first is from the "Lower Auroral," or limestone schists. It is from Earley & Killinger's Mine two miles and one-half east by north of Littlestown. It was analyzed by Mr. McCreath (See C, p. 44).

	P. C.
Insoluble residue	12.320
Iron sesqui-oxide (Fe_2O_3)	67.000
Alumina (Al_2O_3)	0.950
Manganese sesqui-oxide (Mn_2O_3)	2.341
Phosphoric oxide (P_2O_5)	2.804
Sulphuric oxide (SO_3)	0.277
Lime (CaO)	1.680
Magnesia (MgO)	0.591
Water (H_2O)	11.890
Sum	99.853

In the above there were

Metallic Iron	46.900
" Manganese	0.815
Sulphur	0.110
Phosphorus	1.224

* Average of three determinations.

The following is the result of an analysis of the Mumper mine in the Mesozoic sandstone, one mile north-east of Dillsburg (C, p. 71.)

	P. C.
Ferrous oxide (FeO)	18.643
Ferric oxide (Fe_2O_3)	42.100
Pyrites (FeS_2)	4.093
Copper sulphide (CuS)	0.098
Cobalt sulphide (CoS)	0.766
Alumina (Al_2O_3)	2.417
Manganese sesqui-oxide (Mn_2O_3)	0.186
Lime (CaO)	6.132
Magnesia (MgO)	6.738
Potash and Soda	0.350
Phosphoric oxide (P_2O_5)	0.052
Sulphuric oxide (SO_3)	0.119
Carbonic acid (CO_2)	1.760
Water (H_2O)	1.080
Silica (SiO_2)	15.120
Sum	99.654
Metallic Iron	45.880
" Manganese	0.129
Magnetic Oxide of Iron	59.040
Ferric oxide	1.703
Sulphur	2.680
Phosphorus	0.023

Note 4. In MM, p. 344, Prof. Lesley gives some analyses which derive their interest from the fact that they are very numerous, and all from a comparatively small thickness in the Walton limestone quarry opposite Harrisburg. His paper in the Am. Phil. Soc. was presented Dec. 20, 1877, but the article just referred to is dated June 23, 1879. From analysis of 115 layers of the limestone exposed in the quarry, it appears

	P. C.
That the Carbonate of Lime constituted	80.662
" " " " Magnesia constituted	14.215
The insoluble residue constituted	4.715

Those proportions will give a better idea of the average constitution of the good merchantable York and Cumberland limestone than any number of scattered analyses. Prof. Lesley's attempt to ascertain a connection between a given horizon and a constant proportion of the carbonates of lime and magnesia to each other may have been suggested by some analyses which I had published previously with the same end in view (See CC, p. 307), in 1875.

The analyses made by myself are as follows :

No. 1. From the west branch of Creitz's creek, near Wrightsville.

No. 2. Upper bench of Pine Grove quarry.

No. 3. Lower " " "

No. 4. White limestone 100 yards east of Beeler's Cross roads, 2 miles W. by N. of York.

No. 5. Was from Detweiler's quarry, N. W. of Wrightsville.

No. 6. " " " " S. of Wrightsville.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Av.
Specific Gravity.	2.832	2.735	2.731	2.750	2.737	2.770	2.759
Insoluble Siliceous residue.	4.400	12.270	12.000	3.570	0.490	41.710	6.546
Alumina and Ferric oxide.	1.170	1.540	0.450	0.210	1.440	6.350	0.962
Carbonate of Lime ..	49.920	75.320	81.617	91.580	91.400	43.728	72.260
" of Magnesia................	42.980	10.750	6.400	4.110	7.290	6.450	12.996
Sulphur.............	0.220	0.120	0.422	0.113	0.003	1.480	0.175
Sum............	98.690	100.000	100.489	99.583	100.623	99.718	99.850

Note 5. Mr. A. S. McCreath's analysis of the coal referred to is as follows :

	P. C.
Volatile Organic Matter...........................	18.482
Water..	4.310
Fixed Carbon (by loss)	74.358
Sulphur	0.528
Ash	2.322
Sum...	100.000

Rating this coal according to the system proposed by me in a paper in the Trans. Am. Inst. of Min. Eng. and subsequently published as part of report MM, the p. c. Carbon is to the p. c. Volatile Hydro-Carbon : : 80.1 : 19.9 and the "Fuel Ratio" would be 4 or within the range proposed for the bituminous coals : (5 to 0).

* No. 6 not counted in the average.

Note 6. The following is an analysis by Dr. Genth of the Trap (Dolerite) dyke, which crosses Beeler's farm two miles S. W. of York.

	P. C.
Silicic oxide	52.53
Phosphoric oxide	0.15
Titanic oxide	0.32
Alumina	14.35
Ferric oxide	5.93
Ferrous oxide	5.45
Manganous oxide	(trace)
Magnesia	7.99
Lime	10.27
Lithia	(faintest trace)
Soda	1.87
Potash	0.92
Copper	(trace)
Sulphur	0.08
Ignition	1.23
	101.04

By a mineralogical analysis of the results (C, p. 123 &) it appears that there are two molecules of labradorite and one of pyroxene which together essentially make up this rock.

Note 7. In a volume entitled "The Azoic system and its proposed subdivisons," by J. D. Whitney and M. E. Wadsworth, printed as a Bulletin of the Museum of Comparative Zoology at Harvard College in August, 1884, but which might well serve as a type of all that a scientific memoir ought not to be, the authors are pleased to dispose of the work on the Archæan rocks of this State as if it were entirely due to four persons representing all grades of experience, and various dates of activity from 1858 to 1880. The two elder and better known of the four are waved aside ostensibly because they are unreliable, in that they have modified their views, or did not feel justified in drawing sharp divisions on the map which were supported only by a high degree of probability. The younger and less generally known of these, though nowhere claiming to have solved the problem of sequence, are given a prominence which contrasts strangely with their own modest words. The mystery is, however, explained when we observe that the views of Prof. Rogers and Dr. Hunt do not accord with those of the authors of the volume, whereas Mr. Charles E. Hall leans towards the view that the mica schists of the Philadelphia group, the South Valley Hill rocks, &c., are well within, if not high up in the Palæozoic column; and Prof. Prime's merit in the eyes of these authors appears to be that he has differed with Dr. Hunt as to the age of the rocks in a certain mine in Berks county. The many sections across the crystalline rocks of the South mountain and the hills and plains of Adams, York, Lancaster and Chester counties, with the evidence they contain of the pre-Palæozoic age of these rocks, which were published in Vols. C, CC and CCC, and the part of C_4 which Prof. Lesley has permitted to appear as it was written, are easier to ignore than to invalidate. It is not necessary to characterize the conduct of authors who, professing to discuss a subject in the interest of truth, and filling pages of their books, as well as parts of their index, with unjust imputations on the truthfulness and reliability of a geologist whose services to his science are recognized throughout the world, give an example of their own possession of this virtue by suppressing all that does not happen to coincide with their own peculiar views, but which (to compensate for this) forms by far the larger part of the literature on the subject. Profs. Whitney and Wadsworth quote Mr. C. E. Hall's paper in the Am. Phil. Soc.'s Proc. of 1880, but do not allude to the criticism of those views in the A. P. S.'s Proc. for Dec., 1882, nor even quote their author's summary of his maturer views printed in part of C_4. In the criticism of the views expressed in C_6 (which are virtually the same as those read before the A. P. S. and quoted at length) the author was supported at the time by Prof. Lesley (see "The Horizon of the South Valley Hill rocks in Pennsylvania"), and the structure on which he based his argument had received the endorsement of Profs. Gosselet and Barrois on the assumption of the facts of dip, &c., about which there was no dispute. The section at "Gulf Mills," on which Mr. Hall relied (C_6, p. 32) for his structure, is shown in the above paper, where it is independently given, to have been so drawn by Mr. Hall that every synclinal is in reality an anticlinal and vice versa, and this is confirmed by a later section published in the transactions of the A. A. A. S. of the Philadelphia meeting in 1884. Further information on this subject may be found in the "Théses presentées à la Faculté des Sciences de Lille," "Reply to a paper entitled Notes on the Geology of Chester county and vicinity" (Journal of the Franklin Institute, April, 1884) and "Review of C_4" (American Naturalist, October, 1883), by the writer.

Those who would discuss the Archæan of Southeastern Pennsylvania without reference to the lessons to be learned from the South mountain in Franklin, Cumberland, Adams and York counties, or the great flat Tocquan anticlinal of Southwestern Lancaster are incompetent to do so either from ignorance of the facts or from a disingenuous desire to suppress them.

THE BEOTHUK INDIANS.

By Albert S. Gatschet.

Second Article.

(Read before the American Philosophical Society, May 7, 1886.)

ROBINSON'S VOCABULARIES.

Since the publication of the first article on the Beothuk Indians (Proc. Amer. Philos. Soc'y, 1885, pp. 408–424), I was so fortunate as to obtain two further vocabularies of their language, which yielded a number of terms not contained in the collections previously used. Both were written down by Capt. Hercules Robinson, of the vessel "The Favorite."

One of these is contained in *R. M. Martin's* History of Nova Scotia, Cape Breton, etc., London, Whittaker & Co., 1837. 16mo (364 pages); a book which forms volume sixth of the same author's: "The British Colonial Library, etc.," published by Bohn in 16mo. Mr. Martin extracted this vocabulary of ninety words, which stands on pp. 299-301, from the journal of Captain Robinson, and to Mr. Martin the original, from which he copied, had been loaned by the "late Secretary to the Royal Geographical Society;" cf. pp. 238,269. In Martin's text, Robinson states "that he gathered a vocabulary of Beothuk from Mary March after her capture in 1818," and that in his "paper" he inserted only "the most prominent words collected from her." In this statement are contained at least two falsehoods. Mary March was not captured in 1818, but in 1819, and Leigh's and Robinson's printed vocabularies are either copied from a common source, or Robinson, who never saw Mary March, copied from Leigh, which is more probable. The ending *-ue* (in one numeral and elsewhere) is incorrect, Leigh showing the correct form in *-uc, -uk;* cf. *nine, wind, rain, body.* An incorrect form is also contained in Robinson's terms for *eye, watch, teeth* (there is no *f* in Beothuk) and perhaps in *arrow.* But he may be more correct than Leigh in terms like *chin, iron, tickle, shoulders,* although both are rivalizing in their lack of philologic accuracy. Many terms of this list agree with those in my alphabetic list previously published, and in that case have been omitted. Whenever they agree with the first, but not with the second or third in order of the terms in the previous list, they were omitted also. Enumerated in the alphabetic order of the Beothuk terms in my previous list, the excluded words are as follows: *cat, feathers, leg, singing, to bite, to lie down, duck, man, egg, oil, knee, to sleep, mouth, eyebrow, tongue, arms, wolf, elbow, ear, ice, nails, I thank you, to swim, salmon, to kiss, husband.* At present, no trace can be found of Captain Robinson's manuscript in the library of the Royal Geographical Society, as I have been informed by its courteous secretary, Mr. Clements R. Markham. Concerning the list of terms Mr. Markham writes substantially as follows: "From 1830 to 1836 the Secretary of the R. G. S. was Capt. A. Maconochie of the Navy, when he emigrated to Tasmania (died there, 1861). He took an interest in philology and I think the vocabulary of Beothuk must have belonged to him personally, and not to the Society."

The other vocabulary of Capt. Robinson I have obtained through the kindness of Mr. James P. Howley. Having ascertained that there was in the library of the British Museum a pamphlet entitled, "A History of Mary March (Waunathoake), together with a vocabulary of the Boethuck Language," Mr. Howley had it carefully copied by one of his brothers, then stopping in the British metropolis. The description of Mary March etc., contained in it is from memory, for the paper winds up as follows: "I have written these notes from the recollection of conversations with Mr. Leigh, at Harbor Grace, several weeks ago, and I regret that I neglected to note them before many interesting particulars had escaped my memory. Hercules Robinson, H. M. Ship "Favorite;" at sea, November 7th, 1820." The Captain remarks, that the woman showed a remarkable aptitude to obtain a knowledge of English, and her powers of mimicry were so acute she either understood or conveyed her meaning by signs when language failed her, with great calmness. To conclude from this that Robinson saw Mary March himself, would be entirely wrong, for the date of November 7, 1820, does not agree with that of her presence at St. John's; nor is the vocabulary in the pamphlet anything else but a hasty copy of Leigh's collection, with a few additional words obtained from that clergyman. Its 133 terms are reproduced in full below; wherever there are two terms, the one copied from the Robinson pamphlet in London stands second in order.

Whether Capt. Robinson has copied the same vocabulary which Whiteway, the pilot of St. John's, Newfoundland, afterwards loaned to Rev. Lloyd (see Lloyd's first article, p. 23) or another, the chief merit of his two printed collections is that of confirming the fact, that Leigh's vocabulary was really obtained from Mary March, for Robinson's paper is dated three years before Nancy was brought to St. John's.

ROBINSON'S VOCABULARIES COMBINED.

abidemasheck *bake-apple;* the Newfoundland name of a wild fruit.
abidish *martin-cat, marten.*
abodoesic *four.*
abodonec *bonnet.*
abusthibit *to kneel.*
adadiminte *spoon.*
adasic *two.*
adiab *wood.*
adothe *boat, vessel.*
agamot *buttons; money.*
amamoose *woman.*
aparita bedesook *sunken seal* (probably: aparit abedesook).
awoodet *singing.*
abkashamesh *boy.*
barodiisick *thunder.*
bathue; bathuc *rain.*
beatathunt *gunpowder.*
bedesook *seal.*
bedisoni; bedesoni *sword.*
begodor *heart.*
begomot; begomat *breast.*
besdic *smoke.*

bethic *necklace.*
bethiote *good night.*
bigadosic *six.*
bobbodish *pigeon.*
bobidigimidic *berries.*
bocbodza *teeth* K.
Boeothik ; Beuthook *Red Indian.*
bofomet outhermayet ; bogomet outhermayet *teeth.*
boodowit *duck.*
borod and wieith *lightning* (one of these words perhaps *lighting*).
budiseet *dancing.*
bukashaman *man.*
bukashamesh *boy.*
bushudite *to bite.*
coish ; ooish *lip.*
corrasoob ; conasoob *sorrow.*
debine *egg.*
dedoneet *saw,* subst.
dogemat ; digemat *arrow.*
dronna *hair.*
ebautho ; ebauthe or ebanthe *water.*
edrathu *comb.*
edree *otter.*
emamooset *girl.*
ejibiduish *silk handkerchief.*
emet *oil.*
emoethuk *dogwood ;* the Newfoundland name for the mountain ash, which in Canada is called *Rowan tree* (Howley).
enano *go out.*
ethewwit *fork.*
gadgemish *rat.*
gasset *stockings.*
gathet *one* (numeral).
gawzadun *raspberries.*
geen *nose.*
gewzewook or gewzenook *mainland.*
gidgeathue *wind.*
giggarimanet *net.*
givinya *eye.*
guashavet *bear.*
gwoshuawit *puffin.*
haddabothie *body.*
hedyyan *to stoop.*
hodamishit *knee.*
hosket *fall* (verb ?).
hothamashet *to run.*
howmeshet *ducks and drakes.*
iedesheet ; idesheet *neck* and *throat.*
ibeath, ibemite *to yawn.*
ihingyam *clothes.*
isedoweet *sleep.*
itweena *thigh;* not thumb, q. v.
izzobauth *blood.*
japathook *canoe.*
yeothodue ; yeothoduc *nine.*
kaduishnite *tickle;* Howley's copy has *sickle.*
keauthut gonothin *head.*
kius *moon.*
kooret ! kooset ! *come hither!*
kuis *sun.*
madyna *leaves.*
mammasmeet *dog.*
mammateek *house.*
mammausheek *islands.*
mammasameet *puppies.*
mameshuadet *drawing knife.*
mamoose *whortleberries.*
mangarewius *sun.*
manovorit *blankets.*
matheothuc *to cry.*
matheuis *hammer.*
memasuck *tongue.*
memayet *arms.*
memet *hand.*
methic *dirt.*
moidewsee *cold* (for *comb?* cf. moidensu).
moisamadrook *wolf.*
momezemethon *shoulders.*
moocus *elbow.*
moosin *shoes.*
mooshaman *ear.*
mooweed *trousers.*
mowazeenite ; mouarzeenite *iron.*
mudyrat *hiccough.*
mushabauth *oakum.*
nethabeat *cattle.*

nijik ; nijick *five.*
odeiisook *goose.*
odisuit *to cut.*
odosook *seven.*
odoit *eat.*
odoosook *eight.*
oothook *tinker.*
osuk ; osuck *wife.*
osweet *deer.*
ozeru *ice.*
peatha *fur.*
pigathu *scab.*
poodybeat *oar.*
pooeth *thumb.*
possont *back.*
quish ; guish *nails.*
ruis ; kius *watch.*
shamye *currants.*
shebathoont *trap.*
shebohoweet *woodpecker.*
shedsic *three.*
shegamet *to blow the nose.*
toun *chin.*
theant *ten.*
thingaya *hatchet.*
thoowidgee *swimming.*
traunasoo *spruce.*
uine *knife.*
uvin *hop.*
wasemook *salmon.*
washewiush *moon.*
woodrat *fire.*
woothyat ; woothyot *to walk.*
zosueet *ptarmigan* (Lagopus albus); in Newfoundland called *partridge.*

ADDITIONAL HISTORIC REMARKS.

Before entering upon the discussion concerning the Beothuk language, I add a few historic remarks which have suggested themselves since completing the first article.

The tradition is generally credited, that Conception Bay received its name from *Cortereal,* and that therefore that navigator must have visited the Newfoundland coast. Whitbourne annually visited the island from about 1580 and wrote a book: "The Discovery of the Newfoundlande" in 1622.

The Baron *de la Hontan*, who in his younger years had been Lord Lieutenant of the French colony at Placentia in Newfoundland, does not mention the name of the Beothuks in his "Voyages." About 1690 he wrote: "The Eskimaux cross over to the Island of Newfound Land every day, at the Streight of Belle Isle; but they never come so far as Placentia, for fear of meeting with other savages there" (I, 210; Engl. translat. of 1735). "There are no settled savages in the Island of Newfound Land" (I, 226). He had seen Eskimos previously on Lower St. Lawrence River, northern shore. The Jesuit author *Charlevoix* states (1721) that no other Indians but Eskimos have ever been seen upon Newfoundland (Journal, Letter xi). From this it follows, that the Beothuks must have confined themselves at that time to tracts distant from white settlements, unless the French would have heard of them.

The archæologic research after Beothuk dwellings, implements, skeletons and other remains has been diligently prosecuted ever since Cormack's expeditions. Relics have been found even on Funk's Island, about thirty miles north-east of the nearest point upon the mainland, and their usual wintering place seems to have been the Exploits River. The most comprehensive sketch of all the explorations is contained in Lloyd's articles. Newfoundland has a population of about 120,000, which is exclusively settled upon the sea-shore. The Hudson's Bay Company uses all its influence to prevent the settling of the fertile lands in the interior of the vast island, for this would reduce the abundance of game and fur-animals in those parts, which are the stock in trade of that monopoly. The same exclusive policy* is pursued by that Company in the wide territories west and northwest of Lake Superior, and with such success, that the Riel rebellion, or so-called "half-breed war" of 1885 was the immediate outcome of it. The existence of agricultural settlements in the interior of Newfoundland would greatly facilitate and promote all researches concerning the relics of the mysterious aborigines who are now occupying our attention.

For several reasons it is surmised that Mr. W. E. Cormack took from Shananditbit a much more extensive list of vocables than the one I have obtained through Mr. Howley, which contains only the Beothuk numerals, month-names and terms corresponding to English words with initial *A* and *B*. Researches made in England and on Newfoundland failed to reveal any trace of an ampler collection. From Rennie, a half-brother of Cormack still living at St. John's, Mr. Howley gathered the following information: Cormack was educated in Edinburgh under the auspices of the late Prof. Jamieson, resided in Newfoundland till 1829, afterwards carried on a mercantile business in Victoria, Vancouver's Island as the partner of Mr. Nuttall, and died there single, about 1875 or 1877. Mrs. Scott, his sister, died in England in 1884 at a very advanced age. The late Judge Des Barres of St. John's was vice-president of the *Boeothik Institute* previously referred to, and in Cormack's time took great interest in all his efforts to acquire information on the Red Indians. That Cormack sent his vocabulary, relics and some drawings to a Dr. Yates in England, is stated by himself in his "*Notes;*" nothing else is known concerning his papers and effects.

The original of Mary March's vocabulary, taken down by Rev. Leigh, printed with many copyist's errors and since recopied by Mr. Howley, is now in possession of Rev. William Pilot. The final *k* in the printed copies is a *t* in most of the verbs in the manuscript.

Concerning the localities on Newfoundland which were the principal haunts of the Micmac Indians, Ph. Tocque, Newfoundland (pg. 506), has the following: The Micmacs have wigwams similar to those of the Red Indians. Several families were in Clode Sound, at the head of Bonavista Bay (48° 30′, eastern coast); the last family there was lost in 1841. North of that, others were at Notre Dame Bay; 60 persons belonging to the Micmacs resided at Bay Despair and in the various parts of Fortune

*The mercantile principles followed by the Hudson's Bay Company have remained the same throughout its historic existence and may be studied from the pages of Arthur Dobbs' "Account of the countries adjoining to Hudson's Bay," London, 1744.

Bay, in the south of the island. On his expedition, Mr. Cormack saw Micmac Indians in the south-west between King George the Fourth's Pond and St. George's Bay. Although the Micmacs resided chiefly on the west side, there were many points on which they came in hostile (or friendly?) contact with the Red Indians, whose most frequented haunts seem to have been in the east and north of the island.

ADDITIONAL NOTES BY MR. HOWLEY.

In various books about Newfoundland many misstatements were published about Shananditbit and her family. The facts are as follows: Shananditbit in 1823 took refuge with the white people, with her mother and sister, and at that time was about twenty-three years old. She learnt what she knew of English from Peyton's family, in whose house she staid at St. John's. Her sister died shortly after coming to St. John's, and her mother, who is described as *a morose old hag*, died a year or two after, about fifty years old, having never returned to her tribe. Only during the last winter of her life (1828–29), Shananditbit lived in Mr. Cormack's house. The emblems or figures drawn by her (represented in Article First) were called mythological emblems by Cormack, perhaps without sufficient reasons; Dr. Dawson regards them all as the totems of gentes.

The blue jay, whose feathers served for striking sparks, was not the *Corvus canadensis*, but *Cyanocitta cristata*, quite common on the west side of the island.

The puffin or sea parrot is the *Fratercula arctica* of Linné.

The sea pigeon is the black guillemot, *Urea grylle* [The Amer. Ornith. Union Check List of 1886, has *Cepphus grylle*, or Black Guillemot].

Blackbird. The robin, *Turdus migratorius*, is there called blackbird.

Capelan, a fish, is *Mallotus villosus*.

Ticklas is the kittiwake gull: *Rissa tridactyla*.

(*Cibo*, local name near Cape Breton, is the Micmac term: shibu *river*.)

REMARKS ON THE VOCABULARIES.

The precarious condition in which the words of the Beothuk language have come down to us, is due to several causes which have to be fully recognized before inquiries upon the language itself can be undertaken and variant readings reduced to their original forms. This confusion has had the following causes:

Indistinct handwriting has caused the uncertainty which in many words exists between *n* and *h*, *r* (cf. *fork*), *v* and *r*, *g* and *y*, *b* and *t* (cf. *trap*), *ck* and *ek*, *t* and *f* (in: botomet), between the capitals *B* and *R* (cf. *six*) and the final *-k* and *-t* in Leigh's vocabulary. Even among us, people of a low degree of education always write *n* like *u*, and the same thing was done by some copyists of the Beothuk vocabularies. Faulty copying was the immediate consequence of indistinct chirography.

The use of the Roman letters with the value they have in the English alphabet. This alphabet is wholly preposterous, even for English itself, and much more so for any foreign, especially illiterate languages. If the authors had been more accurate in their transcription of the words received, they would not have used *ch* sometimes for χ, at other times for *tch* ; cf. the numerals 2, 12.

Instances where the authors failed *to hear* sounds with sufficient accuracy ; cf. *cattle* (p. 421).

Insufficiency of the knowledge of English on the side of the two female informants ; cf. the mistaking of *wet* for *white*. It appears that several terms were obtained not by putting questions, but by making gestures ; in many vocabularies of other languages this has become a fruitful source of errors. Compare the term obtained for *islands* with that for *ship, vessel* (mamashee), and *mouth* with *tongue*.

The want of distinction between the noun and verb in English often causes grammatic confusion, as in the case of *lead, sleep, scratch*, etc. Moreover, the verb is sometimes placed in the participle, sometimes in the infinitive, especially in Rev. Leigh's vocabulary.

A few other remarks referring to the present condition of the vocabularies are as follows :

In several terms the initial sound has been dropped, either through inaccurate hearing or incompetency of the copyists : osweet for kosweet *deer*, ewis for kewis *watch*. cf. also obosheen with boobasha, oosuck with woas-sut, eesheet with mamesheet.

Instances of contraction by synizesis, ellipsis, etc., are not unfrequent : a'shoging from ashwoging *arrow ;* bedoret from bogodoret *heart ;* shucodimit from shucododimet "Indian cup."

The month-names were obtained by Cormack and are partly misspelt and faulty. It is very doubtful to me that April, June and September were all called by the same term, the two final syllables of which contain the word yaseek *one*, perhaps signifying *one* and *first*. But in American languages two *successive* Indian moons are often observed to possess the same name, as we see it done here in the case of October and November, whose names coincide pretty closely.

GRAMMATIC ELEMENTS.

Phonetics.

The points deducible with some degree of certainty from the very imperfect material on hand may be summed up as follows, the sounds being represented in my own scientific alphabet, in which all vowels have the European continental value :

Vowels : a ā
e ä o
i ī u ū

Diphthongs : ai, ei in by-yesh *birch*, madyrut *hiccough ;* oi in moisamadrook *wolf ;* ou, au in ge-oun *chin ;* oe may indicate ö : emoethook (?), etc.

Consonants:

	Explosives:		*Sounds of duration:*			
	surd	*sonant*	*Aspirates*	*Spirants*	*Nasals*	*Trills*
Gutturals:	k	g	χ	h	ng	
Palatals:	tch	dsh		y		ᶜl
Linguals:				sh		r, l
Dentals:	t	d	th	s, z	n	
Labials:	p	b		w, (v?)	m	

The sound expressed by lth in adolthtek, adolthe *boat* I have rendered by ᶜl, the palatalized l, which is produced by holding the tip of the tongue against the alveolar or foremost part of the palate. It appears in many American, but not in Algonkin languages.

The sound dr, tr in adamadret, adamatret *gun*, drona *hair*, edrú *otter* and other terms is probably a peculiar sound, and not a mere combination of d(t) with r.

The articulation dth seems distinct from the aspirate th of the English language; it occurs in dthoonanyen *hatchet*, dthō-ōnut *ten*, used in forming the decade in the terms for twenty, thirty, etc. (cf. theant and shansee *ten*). Perhaps it is *th* pronounced with an explosive effort of the vocal organ.

χ is rendered in our lists by *gh* and sometimes by *ch*, as in yaseech *one*, drone-ooch *hairs*, máduch *to-morrow*.

ts, *ds* are unfrequent or do not occur at all.

sch in deschudodoick *to blow* and other terms is probably our sk.

f does not occur in Beothuk, but is found in Micmac vocabularies; perhaps it would be better to have rendered there that sound by v'h, w'h and not by *f*, for other Algonkin dialects show no trace of it.

l is unfrequent and found, as an initial sound, only in the term lathun *trap*. Whether *r* is our rolling *r* or not is difficult to determine.

th often figures as a terminal, but more frequently as an initial and medial sound.

Consonants are frequently found geminated in our lists, but this is chiefly due to the graphic method of English writers, who habitually geminate them to show that the preceding vowel is short in quantity: cf. dattomeish, haddabothic, immamooset, massooch.

The language exhibits the peculiarity not unfrequently observed throughout America, that final syllables generally end in consonants and the preceding syllables in vowels. Accumulations of consonants occur, but are not frequent; e. g. carmtack *to speak*, Mamjaesdoo, nom. pr. The majority of all syllables not final consists of a consonant followed by a vowel, or diphthong.

Too little information is on hand to establish any general rules for the *accentuation*. None of the accented words are oxytonized, but several have the antepenult emphasized: báshedtheek, áshwoging, dósomite; the term éjabathook has the accent still further removed from the final syllable. Very likely the accent could in that language shift, as in other languages of America, from syllable to syllable, whenever *rhetorical* reasons required it. By some of the collectors the signs for length and brevity were used to designate the emphasized syllable, placed above or underneath the vowels.

Alternation of sounds, or spontaneous permutation of the guttural, labial, etc., sounds without any apparent cause, is traceable here as well as in all other illiterate languages. Thus the consonantic sounds produced in the same position of the vocal organs are observed to alternate between :

g and k : buggishaman, bukashaman *man*, etc.
g and χ : bogomot, boghmoot *breast*.
g and h : buggishamesh, buhashamesh *boy;* bogathoowytch *to kill*, buhashauwite *to beat*.
tch and sh : mootchiman, mooshaman *ear*.
dsh and s, sh : wadshoodet, washoodiet *to shoot*.
r and d : merobeesh, madabeesh *thread, twine*.
t and d : tapathook, dapathook *canoe*.
t and th : meotick, mae-adthike *house;* mattic, mathick *stinking*.
d and th : ebanthoo, ebadoe *water*.
th and z : nunyetheek, ninezeek *five*.
th and s, sh : mamud-thuk, memasook *tongue;* thámook, shamook *capelan*.
s and z : osenyet, ozegeen *scissors*.
s and sh : māmset, mamishet *alive;* bobboosoret, baubooshrat *codfish*.
p and b : shapoth, shaboth *candle*.

In regard to vowels, the inaccurate transmission of the words does not give us any firm hold ; still we find alternation between :
a and o : bogomat, bogomot *breast;* dattomeish, dottomeish *trout*.
a and e : baasick, bethec *beads*.
oi and ei : boyish, by-yeech *birch*.

Morphology.

The points to be gained for the morphology of Beothuk are more scanty still than what can be obtained for reconstructing its phonology, and for the inflection of its verb we are entirely in the dark.

Substantive. The most frequent endings of substantives are *-k* and *-t*, and a few only, like drona *hair*, end in a vowel. Whether the substantive had any inflection for case or not, is not easy to determine ; we find however, that maemed *hand* is given for the subjective, meeman (in m. monasthus *to shake hands*) for the objective case ; in the same manner nechwa and neechon *tobacco*, mameshook and mamudthun *mouth*. Other terms in *-n* are probably worded in the objective or some other of the oblique cases : ewinon *feather*, magorun *deer's horns*, mooshaman *ear*, ozegeen *scissors*, shedothun *sugar*. Cf. the two forms for *head*.

A plural is traceable in the substantives deyn-yad *bird*, deyn-yadrook *birds;* odizeet, pl. odensook *goose*, drona, pl. drone-ooch *hair;* and to judge from analogy, the following terms may possibly be worded in the plural form: marmeuk *eyebrow(s)*, messiliget-hook *bab(ies?)*, moisamadrook *wol(ves?)*, berroich *clouds*, ejabathook *sails*. Compare also edot *fishing line*, adothook *fish hook;* the latter perhaps a plural of the former. The numerals 7, 8, 9 also show a suffix -uk, -ook.

Adjectives are exhibiting formative suffixes of very different kinds gosset and gausep *dead*, gasook *dry*, boos-seek *blunt*, homedich *good*, ass-soyt *angry*, eeshang-eyghth *blue*, ashei *lean*.

The phrase shedbasing wâthik *upper arm* would seem to show, that the adjective, when used attributively, precedes the noun which it qualifies.

The numerals of our list are all provided with the suffix -eek or -ook; what remains in the numerals from *one* to *ten*, is a monosyllable, except in the instance of *six* and *nine*. Yaseek is given as *one* and as *first* (in the term for *April*),* but whether there was a series of real ordinals we do not know.

Compound nouns. A few terms are recognizable as compound nouns, and in them the determinative precedes the noun qualified:

wash-geuis *moon*, lit.: "night-sun."
bobbiduish-emet *lamp;* probably: "fire-oil."
kaesin-guinyeet *blind;* probably for "dry on eyes."
moosin-dgej-jebursūt *ankle;* contains mōosin *moccasin*.
adasweet-eeshamut *December;* contains odusweet *hare, rabbit*.
aguathoonet *grinding stone;* probably contains ahune *stone* in the initial agu-, agua-.

No *pronouns* whatever could be made out with any degree of probability.

Concerning the *verbal inflection* we are almost entirely without reliable dates, nor do we know anything concerning the subjective and objective pronouns necessarily connected with conjugational forms.

(1.) Verbs mentioned in the participle *-ing* or in the infinitive generally end in -t and -k.

-t: âmshut *to get up*, awoodet *singing*, bituwait *to lie down*, cheashit *to groan*, mārot *to smell*, kingiabit *to stand*, washoodiet *to shoot*.

-k: carmtack *to speak*, deschudodoick *to blow*, ebathook *to drink*, odishuik *to cut*.

(2.) Imperative forms, to judge from the English translation, are the following:

deiood! *come with us!* dyoom! *come hither!*
dyoot thouret! *come hither!* (Rob. kooret! kooset!)
nadyed *you come back* (?)
cockabóset! *no fear! do not be afraid!*
bobáthoowytch! *beat him!*
deh-hemin! *give me!*

(3.) Participial forms are probably represented by: amet *awake*, gosset and gausep *dead*, apparet *sunken* (Rob. aparit.)

* Perhaps also in *June*, *July*, *September*.

(4.) The first person of the singular is, according to the interpretation, contained in the vocables :
ajeedick or vieedisk *I like.*
boochauwit *I am hungry,* cf. dauosett.
a-oseedwit *I am sleepy,* cf. bootzhawet *sleep,* isedoweet *to sleep.*
thine *I thank you.* Cf. what was said of betheoate.*

(5.) Other personal forms of singular or plural are probably embodied in the terms :
pokoodoont, from odoit *to eat.*
ieroothack, jeroothack *speak,* from carmtack *to speak.*
becket? *where do you go?*
boobasha, cf. obosheen *warming yourself.*

(6.) Forms in -p and -ss, if not misspelt, occur in : áthep, athess *to sit down,* gamyess *get up,* gausep *dead.*

(7.) No conclusive instance of reduplication as a means of inflection or derivation occurs in any of the terms transmitted, though we may compare wawashemet, p. 423, Nonosabasut, nom. pr. Is mammateek a reduplication of meotick?

Derivation.

Derivatives and the mode of derivation are easier to trace in this insular language than other grammatic processes. Although the existence of prefixes is not certain as yet, derivation through suffixes can be proved by many instances, and there was probably a large number of suffixes, simple and compound, in existence. Some of the suffixes were mentioned above, and what may be considered as "prefixes (?)" will be treated of separately.

Suffix *-eesh ; -eech, -ish* forms diminutive nouns :
mammusemītch *puppy,* from mamasameet *dog.*
mossessdeesh *Indian boy.*
buhashamesh *boy,* from bukashaman *man.*
woaseesh *Indian girl,* from woas-sut *Indian woman.*
shuwänyish *small vessel,* from shuwän *bucket, cup.*
mandeweech *bushes* (?) ; hanyees *finger.*

Probably the term yeech *short* is only deduced from the above instances of diminutives, and had no separate existence for itself.

-eet, a frequently occurring nominal suffix :
a-eshemeet *lumpfish,* deddoweet *saw,* gaboweete *breath,* kosweet *deer,* kusebeet *louse,* methabeet *cattle,* shebohoweet *woodpecker,* sheedeneesheet *cocklebur,* sosheet *bat,* tedesheet *neck,* wobesheet *sleeve,* probably from wobee *white.* Also occurring as a verbal ending, cf. above ; hence, it is possible that the nouns in -eet are simply *nomina verbalia* of verbs in -eet, -īt.

*The Algonkin na-, nu-, n- of the first person occurs in none of these examples.

-*k*, a suffix found in verbs and nouns:

ebanthook *to drink*, from ebanthoo *water*.

obesedeek *gloves*, perhaps (if not *plural* form) from obosheen, q. v.

Verbs in -k were mentioned *supra*; -ook forms plurals of substantives, also numerals; in Micmac the suffix for the plural of animates is -ûk, -k, for inanimates -ûl, -l; in Abnáki-ak,-al.

-*m* occurs in nouns like dingyam *clothes*, lathum (?) *trap*, woodum *pond*; also in ibadinnam, jewmetchem, etc.

-*n*, suffix of objective case and of many substantives.

-*oret*, nominal suffix in bobboosoret *codfish*, bogodoret *heart*, manaboret *blanket*, oodrat *fire*, shawatharott *man*.

-*uit*, -*wit* occurs in kadimishuite *tickle*, ethenwit *fork*, mondicuet *lamp*, Demasduit, nom. pr., guashuwit *bear*; also in sundry verbs.

-*ut* occurs in nouns:

woas-sut *Indian woman*, mokothut *fish-species*, madyrut *hiccough*.

Prefixed Parts of Speech.

Follows a series of terms or parts of speech, found only *at the beginning* of certain words. Whether they are particles of an adverbial or prepositional nature (prefixes), or fragments of nouns, was not possible for me to decide. The dissyllabic nature of some of them seems to favor a nominal origin.

bogo-, *buka-*: bogodoret, abbr. bĕdoret *heart*.

bogomat *breast*.

bogathoowytch *to kill, beat*.

bukashaman *man*.

buggishamesh *boy*.

shema bogosthuc *moskito*.

ee- is the prefix of numerals in the decad from 11 to 19.

hada-, *ada-*, *hoda-*, *odo-*, *od-* is found in terms for tools, implements, parts of the animal body; *a* is easily confounded with *o* by English-speaking people.

haddabothic *body*, hadabatheek *belly*

hodamishit *knee*, cf. hothamashet *to run*.

hadalahet *glass* and *glass-vase*.

hadowadet *shovel*, cf. od-ishuik *to cut*, and godawik.

adamadret *gun, rifle*.

adadimite *spoon*.

ardobeesh *twine*; is also spelt adobeesh (Howley).

adothook *fishhook*.

adoltkhtek, odo-ōthyke *boat, vessel*.

mama-, *mema-*. The terms commencing with this group are all arrayed in alphabetic order on pp. 420, 421, and point to living organisms or parts of such or dwellings.

Remarks on Single Terms.

For several English terms the English-Beothuk vocabulary gives more than one equivalent, even when only one is expected. With some of their number the inference is, that one of these is Beothuk, while the other is borrowed from an alien language. Thus we have :

devil ashmudyim, haoot.

comb edrathu, moidensu.

hammer iwish, mattuis.

money agamet, beodet. The fact that agamet also means *button* finds a parallel in the Creek language, where the term for *bead*, χo'nawa, χo'nap, forms also the one for *coined money :* tchâtu χo'nawa, "*stone bead*" or "*metal bead.*"

bread annawhadya, manjebathook.

lamp bobbiduish-emet, mondicuet.

star adenishit, shawwayet.

grinding stone aguathoonet, shewthake.

shovel godawik, hadowadet.

trap lathun, shabathoobet.

See also the different terms for *cup* (vessel), *spear*, *wife*, *feather*, *boy*, *rain*, *to hear*, etc. Concerning the term *trap*, one of the terms may be the noun, the other the verb (*to trap*). Terms traceable to alien languages will be considered below.

The term for *cat* is evidently the same with that for *seal* and *marten*, the similarity of their heads being suggestive for name-giving. In the term for *cat*, abideshook, a prefix *a-* appears, for which I find no second instance in the lists; abidish is, I think, the full form of the singular for all the three animals.

Of the two terms for *fire*, boobeshawt means *what is warming*, cf. boobasha *warm*, and oodrat is the proper term for fire.

Smoke and *gunpowder* are expressed by the same word in many Indian languages; here, the one for *gunpowder*, baasothnut, is a derivative of basdic *smoke*.

The *muskito*, shema bogosthuc, is described as a black fly.

Whadicheme in King's vocabulary means *to kill*.

Beothik as name for *man*, *Indian* and *Red Indian* is probably more correct than the commonly used Beothuk.

botomet onthermayet probably contains a whole sentence.

The term for *hill*, keoosock, kaasook is probably identical with keathut *head*.

Eeshamut appears in the names for *December* and *January ;* signification unknown.

ETHNIC POSITION OF THE BEOTHUK.

The most important result to be derived from researches on the Beothuk people and language must be the solution of the problem, whether they formed a race for themselves and spoke a language independent of any other, or are racially and linguistically linked to other nations or tribes.

Our means for studying their racial characteristics are very scanty. No accurate measurements of their bodies are on hand, a few skulls only are left as tangible remnants of their bodily existence (described by George Rusk ; cf. p. 413). Their appearance, customs and manners, lodges and canoes seem to testify in favor of a race separate from the Algonkins and Eskimos around them, but are too powerless *to prove* anything. Thus we have to rely upon language alone to get a glimpse at their origin or earliest condition.

A comparison with the Labrador and Greenland *Inuit* language, commonly called Eskimo, has yielded to me no term resting on real affinity. The Greenlandish attausek *one* and B. yaseek *one* agree in the suffix only.

R. G. Latham has adduced some parallels of Beothuk with Tinné dialects, especially with Taculli, spoken in the Rocky Mountains. But he does not admit such rare parallels as proof of affinity, and in historic times at least, the Beothuks dwelt too far from the countries held by Tinné Indians to render any connection probable.

Not the least affinity is traceable between Beothuk and *Iroquois* vocables, nor does the phonology of the two yield any substantial points of equality. Tribes of the Iroquois stock once held the shores of the St. Lawrence river down to the environs of Quebec, perhaps further to the northeast and thus lived at no great distance from Newfoundland.

All that is left for us to do is to compare the sundry *Algonkin* dialects with the remnants of the Beothuk speech. Among these, the Micmac of Nova Scotia and parts of the adjoining mainland, the Abnáki of New Brunswick and Maine, the Naskápi of Labrador will more than others engross our attention, as being spoken in the nearest vicinity of Newfoundland. The first of these, Micmac, was spoken also upon the isle itself. Here as everywhere else, words growing out of the roots of the language and therefore inherent to it, have to be carefully distinguished from *terms borrowed* of other languages. It will be best to make here a distinction between Beothuk terms *undoubtedly* Algonkin in phonetics and signification and other Beothuk terms, which *resemble* some words found in Algonkin dialects. Words of these two categories form part of the list of duplex Beothuk terms for one English word, as given on a previous page.

(1) *Beothuk words also occurring* in Algonkin dialects :

-eesh, -īsh, suffix forming diminutive nouns ; occurs in various forms in all the Eastern Algonkin dialects.

mamishet ; mamseet *alive, living;* Micmac meemajeet, perhaps transposed from almajeet.

mattuis *hammer;* Abnáki mattoo.

mandee *devil;* Micmac maneetoo, Naskápi (matchi) mantuic.

odemen, odemet *ochre;* Micmac odemen.

shebon, sheebin *river ;* Micmac seiboo ; sibi, sipi in all Eastern Algonkin dialects for *long* river.

wobee *white;* Micm. wabaee, Naskápi waahpou, wahpoau *white;* also in all Eastern Alg. dialects. cf. B. wobesheet *sleeve,* probably for "white sleeve," and Micmac wobun *daylight.*

(2.) *Beothuk words resembling* terms of Algonkin dialects comparable to them in phonetics and signification. Some of them were extracted from R. G. Latham's comparative list, in his *Comp. Philology,* pp. 453–455.

bathuk *rain;* Micmac ikfashak, -paesuk in kiekpaesuk *rain;* but the other forms given in Beothuk, badoese and watshoosooch, do not agree. Cf. ebanthoo *water.*

boobeshawt *fire.* The radix is boob- and hence no analogy exists with Ottawa ashkote, Abnáki skoutai and other Alg. terms for *fire* mentioned by Latham.

bukashaman *white man, man.* Affinity with Micmac wabe akecheenom *white man* (jaaenan *man*) through aphaeresis of wa- is exceedingly doubtful. Compare the Beothuk prefixed syllable *bogo-.*

emet *oil;* Abnáki pemmee, Ojibwē bimide *oil;* Micmac memā′ *oil, fat, grease.*

kannabuch *long;* cf. the Algonkin names Kennebec, Quinnipĭac *long* (*inlet*), and the Virginian cunnaivwh *long* (Strachey, p. 190).

kewis, kuis *sun, watch;* watcha-gewis *moon* (the form kius is misspelt); Micm. nakoushet *sun,* topa-nakoushet *moon* (in Naskápi beshung, beeshoon *sun* and *moon*). The ordinary term in the Eastern Alg. languages is gísis, kísûs, kíshis for both celestial bodies; goos is the Micmac *month* appended to each of their month-names.

magaraguis, magaragueis, mangaroouish *son.* Latham, supposing guis to be the portion of the word signifying *son,* has quoted numerous analogies, as Cree equssis, Ottawa kwis, Shawano koisso, etc., but Robinson has mangarewius *sun,* King has kewis, kuis *sun, moon,* which makes the above term very doubtful. Probably it was the result of a misunderstanding; cf. magorun *deer*(?), kewis *sun.*

mamudthun *mouth.* Latham refers us to Abnáki madoon, Micmac toon, but Leigh has mameshook for *mouth* and memasook for *tongue,* which proves that mam-, mem- is the radix of the Beothuk word and not dthun.

mamoodthuk *dog,* mamoosemĭtch *puppy;* Micmac alamonch, elmooche *dog,* elmoojeek *puppies,* Abnaki almoosesauk *puppies* (alma- in Abn. corresponds to mama- in Beothuk).

manjebathook *bread* contains in its final part beothuk *man, people;* and in its first perhaps Micmac megisee, maegeechimk *to eat,* mijesé *I eat,* or the French *manger,* obtained through Micmac Indians. So the signification would be "people's food."

manus *berries;* Micmac minigechal *berries* may be compared, provided mini- is the basis of the term.

mŏosin *moccasin,* meoson *shoe;* probably originated from Abnáki (and other Algonkin): mkison *moccasin* through ellipse.

mootchiman *ear;* in Algonkin dialects táwa is *ear* and therefore Latham is mistaken in comparing Micmac mootooween, Abnaki nootawee (*my* ear).

muddy, mud'ti *bad, dirty;* could possibly be the transformed Ottawa and Massach. word matche, Mohican matchit, Odjibwē mudji *bad,* quoted by Latham. Ashmudyim *devil* is a derivative of muddy.

noduera *to hear* is probably the Micmac noodâk *I hear* (*him*).

woas-seesh *girl* is a derivative of woas-sut *woman,* and therefore affinity with the Naskâpi squashish *girl* through aphaeresis is not probable, sehquow (s'kwâ) being *woman* in that language. In the Micmac, epit is *woman,* epita-ish *girl.*

The lists which yielded the above Algonkin terms are contained in: A. Gallatin's *Synopsis,* Archæologia Americana, Vol. ii, (1836); in Collections of Massachusetts Histor. Society, I. series, for 1799, where long vocabularies of *Micmac, Mountaineer* and *Naskâpi* were published; in Rev. Silas T. Rand's *First Reading Book* in the Micmac language, Halifax, 1875, 16mo; also in *Abnáki* (Benekee) and *Micmac lists* sent to me by R. G. Latham and evidently taken with respect to existing Beothuk lists, for in both are mentioned the same special terms, as *drawing knife, capelan, Indian cup, deer's horns, ticklas,* etc. W. E. Cormack or his attendants probably took all these three vocabularies during the same year.

In order to obtain a correct and unprejudiced idea of our comparative Beothuk-Algonkin lists, we have to remember that the Red Indians always kept up friendly intercourse and trade with the Naskapi or Mountaineer Indians of Labrador, and that during the *first half* of the eighteenth century, when Micmacs had settled upon Newfoundland, they were, according to a passage of Jukes' "Excursions," the friends of the Beothuk also. During that period the Beothuk could therefore adopt Algonkin terms into their language to some extent and such terms we would expect to be chiefly the words for tools, implements and merchandize, since these were the most likely to become articles of intertribal exchange. Thus we find in list No. 1 terms like *hammer* and *ochre,* in list No. 2 *bread, moccasin* and *dog.* We are informed that the Beothuk kept no dogs, and when they became acquinted with these animals, they borrowed their name from the tribe in whose possession they saw them first. The term mamoodthuk *dog* is, however, of the same root as mamishet, mamset *alive,* which we find again in Micmac,* and it is puzzling that the Beothuk should have had no word of their own for *alive.* Exactly the same remark may be applied to wobee *white* and the suffixes -eesh and -ook, all of which recur in Algonkin languages. Concerning shebon *river,* we recall the fact that the Dutch originally had a Germanic word for *river,* but exchanged it for the French *rivière;* also, that the French adopted *la crique* from the English *creek,* just as they have formed *bébé* from English *baby.* The term for *devil* could easily be borrowed from an alien people, for deity names travel from land to land as easily as do the religious ideas themselves. The majority of

* Micmac:-memaje *I live,* memajoo-ŏkun *life.*

these disputed terms came from Nancy, who had more opportunity to see Micmacs in St. John's than Mary March.

In our comparative list No. 2, most of the terms do not rest upon radical affinity, but merely on apparent or imaginary resemblance. In publishing his comparative list, Mr. Latham did not at all pretend to prove by it the affinity of Beothuk to Algonkin dialects; for he distinctly states (p. 453): "that it was akin to the (languages of the) ordinary American Indians rather than to the Eskimo; further investigation showing that, of the ordinary American languages, it was Algonkin rather than aught else." In fact, no real affinity is traceable except in *dog, bad* and *moccasin*, and even here the unreliable orthography of the words preserved leaves the matter enveloped in uncertainty.

The suffix -eesh and the plurals in -ook are perhaps the strongest arguments that can be brought forward for Algonkin affinity of Beothuk, but compared to the overwhelming bulk of words entirely differing this cannot prove anything. In going over the Beothuk list in 1882 with a clergyman thoroughly conversant with Ojibwē, Rev. Ignatius Tomazin, then of Red Lake, Minnesota, he was unable to find any term in Ojibwē corresponding, except wobee *white*, and if gigarimanet, *net*, stood for *fishnet*, gigo was the Ojibwē term for *fish*.

The facts which most strongly militate against an assumed kinship of Beothuk with Algonkin dialects are as follows:

(1.) The phonetic system of both differs largely; Beothuk lacks f and probably v, while l is scarce; in Micmac and the majority of Algonkin dialects th, r, dr and-cl are wanting, but occur in Beothuk.

(2.) The objective case exists in Beothuk, but none of the Algonkin dialects has another oblique case except the locative.

(3.) The numerals differ *entirely* in both, which would not be the case if there was the *least* affinity between the two.

(4.) The terms for the parts of the human and animal body, for colors (except *white*), for animals and plants, for natural phenomena, for the celestial bodies and other objects of nature, as well as the radicals of adjectives and verbs differ completely.

When we add all this to the great discrepancy in ethnologic particulars, as canoes, dress, implements, manners and customs, we come to the conclusion that the Red Indians of Newfoundland must have been a race distinct from the races on the mainland shores surrounding them on the North and West. Their language I do not hesitate, after a long study of its precarious and unreliable remnants, to regard as belonging to a *separate linguistic family*, clearly distinct from Inuit, Tinné, Iroquois and Algonkin. Once a refugee from some part of the mainland of North America, the Beothuk tribe may have lived for centuries isolated upon Newfoundland, sustaining itself by fishing and the chase.* When we look

* Linguistic stocks reduced like Beothuk to a small compass are of the highest importance for anthropologic science. Not only do they disclose by themselves a new side of ethnic life, but they also afford a glimpse at the former distribution of tribes, nations, races and their languages and ethnographic peculiarities.

around upon the surface of the globe for parallels of linguistic families relegated to *insular homes*, we find the Elu upon the island of Ceylon in the Indian ocean, and the extinct Tasmanian upon Tasmania island, widely distant from Australia. The Harafuru or Alfuru languages of New Guinea and vicinity, are spoken upon islands only. Almost wholly confined to islands are the nationalities speaking Malayan, Aino, Celtic, Haida and Ale-ut dialects; only a narrow strip of territory now shows from which portion of the mainland they may have crossed over the main to their present abodes.

ENGLISH-BEOTHUK VOCABULARY.

afraid, to be see geswat.
alive mamishet.
angry a'ss-soyt.
ankle moosindgei-jebursūt.
April wasumaweeseek.
arm wa'thik; memayet; see also maemed, memayet Rob.
arm, upper shedbasing wathik.
arm, the whole wātheēkee.
arrow âshwoging; dogernat; dogemat Rob.
ash see *mountain ash*.
August wadawhegh.
awake amet.
baby messiliget-hook.
back (subst.?) possont Rob.
bad muddy.
bake-apple abidemasheek Rob.
bat sosheet.
bead baasi'ck.
bear guashuwit; Rob.
beat, to see bogathōowytch.
beaver mamshet.
belly see haddabothic.
berries bibidegemidic; manus; bobidigimidic Rob.
birch boyish.
bird deyn-yad.
bird, little obseet.
bite, to bashoodite; bushudite Rob.
black mandzey.
blackbird woodch.
blanket manaboret; Rob.
blind kaesinguinyeet.
blood ashaboo-uth; izzobauth Rob.
blow, to deschudodoick.
blow the nose, to shegamite Rob.
blue eeshang-eyghth.
blunt boos-seek.
boat adoltkhtek; adothe Rob.
boat, large dho-ōrado.
body haddabothic; Rob.
boil, to oadjameet.
bone a-enamin.
bonnet abodooneek; abodonee Rob.
bosom see bogomet.
bow anyemen.
boy būhāshămēsh; bakashamesh and bukashamesh Rob.
bread annawhadya; manjebathook.
breast bogomot.
breath gaboweete.
brook shebon.
bucket shoe-wana.
bushes mandeweech.
buttons agamet; agamot Rob.
candle sha'poth.
canoe tapathook; japathook Rob.; see also *boat*.
cap eeseeboon.
capelan shamoth.
cat, domestic abideshook.
cat; see *marten*.
cattle methabeet; nethabeat Rob.
cheek weenoun.
child emamooset.
chin ge-oun; toun Rob.
clothes dingyam; ihingyam Rob.
clouds berrooick.
cocklebur sheedeneesheet.

codfish bobboosoret.
cold eenoaja ; moidewsee Rob.
comb moidensu ; edrathu Rob.
come, to see deiood, thooret.
come back; see deiood.
come hither! kooret Rob.
comet anin.
consort anwoyding.
cream jug motheryet ; nádalahet.
cry, to matheoduc ; Rob.
cup manune.
cup, drinking shoe-wana.
currant shamye Rob.
cut, to odishuik ; Rob.
dancing badisut ; budiseet Rob.
darkness washewtch.
dead gausep.
death see gausep.
December odasweeteeshamut.
deer kōsweet ; osweet Rob.
deer's horns magorun.
deer-spear amina.
devil ashmudyim ; haoot.
dirt methic Rob.
dirty muddy.
dog mămmăsăveet ; Rob.
dogwood emoethook ; emoethuk Rob.
drake see mameshet.
drawing knife moeshwadit ; mameshuadet Rob.
drink, to ebathook.
dry gasook.
duck boodowit ; eesheet ; mameshet ; cf. boodowit and howmeshet Rob.
eagle gobidin.
ear mooshaman ; Rob.
eat, to odoit ; Rob. ; pokoodont.
egg debine ; Rob.
eight adozook ; odoosook Rob.
elbow moocus ; Rob.
eleven see yaseek.
Eskimo Ashwan.
eye gheegnyan ; givinya Rob.
eyebrow marmeuk.
fall, to koshet ; hosket Rob.
fat eeg ; eed Howley.
fear geswat.
feather abobidress ; ewinon.
February kosthabonóng bewajowit.
fifteen see ninezeek.
finger hanyees.
fire boobeeshawt ; oŏdrat ; woodrat Rob.
fish baubooshrat.
fish (a species) mokothut
fishhook adothook.
fishing line edat.
five ninezeek ; nijik Rob.
flesh áshautch.
fly, to miaoth.
foot adyouth.
forehead doothun.
forest see *tree.*
fork ethenwit ; Rob.
four dábseek ; abodoesic Rob
fourteen; see dábseek.
fox dogajavick.
fur peatha Rob. ; see also geonet.
gaping abemite.
get up gamyess ; see ámshut.
get up, to ámshut.
gimlet quadranuek.
girl emamooset ; Rob.
give me! deh-hemin! *we give you a knife* see wawashemet.
glass hádalahét.
gloves obsedeek.
good homedich.
good night betheoate ; Rob.
goose odensook ; Rob.
go, to; to go out see baetha ; euano; enano Rob.
go home baetha.
go to bed, to poochauwhat.
gooseberry jiggamint.
grindstone aguathoonet ; shewthake.
groan, to cheashit.
guillemot osthuk.

gun adamadret.
gunpowder baasothnut; beatathunt Rob.
hair drona; Rob.
half moon see kewis.
halibut hanawāsutt.
hammer iwish; mattuis; matheuis Rob.
hand maemed; memet Rob.; see *shake hands, to.*
hare odusweet.
harlequin duck mammadronit.
hatchet dthōōnanyen; thingaya Rob.
hatfish hanawāsutt.
head keathut; Rob.
hear, to eenódsha; noduera.
heart bogodoret; begodor Rob.
heaven theehone.
herring weshomesh.
hiccough madyrut; mudyrat Rob.
hill keoosock; see keathut.
hoop woin; uvin Rob.
horn; deer's horns magorun.
house meotick; mammateek Rob.
hungry boochauwhit; cf. dauosett.
husband anwoyding; zathrook.
hut meotick.
ice ozeru; Rob.
Indian Beothuk.
Indian boy see mozazeosh.
Indian cup shucododimet.
iron mowageenite; Rob.
islands mammasheek; Rob.
January kobshuneesamut.
July kowayaseek.
June wasumaweeseek.
kill, to bogathōowytch; datyuns; whadicheme.
kiss, to widumite.
knee hodamishit; Rob.
kneel, to akusthibit; abusthibit Rob.
knife eewā-en; uine Rob.
lamp bobbiduishemet; mondicuet.
lead (subst.?) goosheben.
lean ashei.
leaves madyna Rob.
leg aduse.
lie down, to bituwait.
life see mamishet.
lightning borod *and* wieith Rob.
like, I ajeedick.
lip ooish; coish, ooish Rob.
lobster odjet.
long kannabuch.
lord bird mammadronit.
louse kusebeet.
lumpfish a-eshemeet.
mainland gungewook; gewzewook Rob.
make haste eeshoo.
man bukashaman; Rob.
March manamiss.
marten abidish; Rob.
Mary March Demasduit; Waunathoake.
May bedejamish bewajowite.
meat áshautch.
Micmac Indian Shanung.
milk madabooch.
moccasin mōosin.
money agamet; agamot Rob.; beodet
moon kewis; washa-geuis; kius and washewiush Rob.
moskito shema bogosthuc; see *nipper.*
mountain ash emoethook.
mouth mameshook.
mythologic symbols; see ashwameet, kewis, owasboshno-un.
nails quish, Rob.
Nancy Shananditbit.
Naskapi Indians Shō-udamunk.
neck tedesheet; iedesheet Rob.
necklace zeek; bethic Rob; see baasi'ck.
net gigarimanet; Rob.
night washewtch.
nine yéothoduc; Rob.
nineteen see yéothoduc.
nipper (*moskito*) bebadrook.
no newin.

nose gheen ; geen Rob.
November godabonyeesh.
oakum mushabauth Rob.
oar podibeak ; poodybeat Rob.
ochre odemen.
October godabonyegh.
oil emet ; Rob.
one yaseek ; gathet Rob.
otter edrú ; edree Rob.
outdoors see baetha.
paddle podibeak ; poodybeat Rob. ; see *to row*.
partridge zósoot.
pigeon bobbidist ; Rob.
pin dósōmite.
pitcher manune.
pond woodum.
ptarmigan zosueet Rob. ; see zósoot.
puffin guashawit ; Rob.
puppy see mām̃măsăveet ; mammasameet Rob.
rain bathuc ; watshoosooch ; bathue Rob.
raspberries gawzadun Rob.
rat gadgemish Rob.
red deed-rashow.
Red Indian (*man*) Beothuk ; Shawatharott ; Boeothik Rob.
Red Indian boy mozazeosh.
Red Indian girl woas-eeash.
Red Indian woman woas-sut.
rifle adamadret.
river shebon.
rock ahune
row, to osavate ; see *oar*.
Rowan tree see dogwood.
run, to ibadinnam ; wothamashet ; hothamashet Rob.
sail éjabathook.
salmon wāsemook ; Rob.
salt water mássooch.
saw (subst.) deddoweet ; dedoneet Rob.
scab pigathu Rob.
scissors oseenyet.
scollop gowet.
scratch bashubet.
sea-gull asson.
seal bidesook ; see mathik. bedesook Rob.
seal-spear a-aduth.
seal, sunken apparet o bidesook ; Rob.
see, to ejew.
September wasumaweeseek.
seven o-odosook ; odosook Rob.
seventeen see o-odosook
shake hands kawingjemeesh ; meeman monasthus, see maemed *hand*.
ship mamashee ; adoltkhtek ; see *canoe*.
shoe see mōosin ; Rob.
shoot, to washoodiet.
short yeech.
shoulder manegemethon ; momezemethon Rob.
shovel godawik ; hadowadet.
sick ashei.
sickle see kaduishnite Rob.
silk handkerchief egibididuish ; ejibiduish Rob.
sinew (*of deer*) modthamook.
singing awoodet ; Rob.
sit down, to athess.
six básbedtheek ; bigadosic Rob.
sixteen see báshedtheek.
sleep, to bootzhawet ; isedoweet.
sleepy, I am a-oseedwit.
sleeve wobesheet.
smell, to mārot.
smoke basdic ; besdic Rob.
snail ae-u-eece.
sneeze, to adjith.
snipe aoujet.
snow kaasussabook.
son magaraguis ; see mangaroonish.
soon jewmetchem.
sore throat anadrik.
sorrow corrasoob ; conasoob Rob.
speak, to carmtack.
spear ánun.
spider woadthoowin.

spoon adadimite ; Rob.
spruce traunasoo Rob.
stand, to kingiabit.
star adenishit, shawwayet.
stinking mathik.
stockings see gasook ; gasset Rob.
stone see *rock.*
stoop, to hedyyan Rob.
sugar shedothun.
sun kewis (see mangaroonish); kuis and mangarewius Rob.
sunken seal aparita bedesook Rob.
swim, to thoowidgee ; Rob.
sword bidisoni ; bedisoni Rob.
tea butterweye.
teeth botomet onthermayet ; bofomet outhermayet Rob. ; bocbodza Leigh.
ten shánsee ; theant Rob.
tern geonet.
thank, to ; I thank you thine.
thin ashei.
thigh itweena Rob.
thirteen see shendeek.
thirty see shendeek.
thread meroobish.
three shendeek ; shedsic Rob.
throat tedesheet ; iedesheet Rob.
throw, to pugathoite.
thumb boad ; pooeth Rob.; itweena is *thigh,* Rob.
thunder baroodisick ; Rob.
ticklas gotheyet.
tickle kadimishuite ; kaduishnite Rob.
tilt camp see meotick.
tinker osthuk ; oothook Rob.
tobacco nechwa.
to-morrow máduck.
tongue memasook ; Rob.
trap lathun ; shabathoobet ; shebathoont Rob.
tree annŏŏ-e ; annooce Howley.
trousers mowead ; mooweed Rob.
trout dattomeish.
twelve see adzeech.
twenty see adzeech.
twine ardobeeshe.
two adzeech ; Rob.
upper shedbasing.
vessel (*ship*) adoltkhtek ; mamashee ; adothe Rob.
vessel, see *cup; small stone vessel,* see shoe-wana.
walk, to woothyat Rob.; see wothamashet.
warm bŏŏbasha.
warming yourself obosheen.
watch kewis ; ruis Rob.
water-bucket shoe-wana.
water ebanthoo ; ebáutho Rob. ; *to drink water,* see ebathook.
water, salt, mássooch.
wet see wabee.
whale's tail owasboshno-un.
white wobee, wabee.
white man see bakashaman; and *boy.*
white girl emamooset.
white wife adizabad zea.
white woman emamoose.
whole, see wáthik,
whortleberries mamoose Rob.
wife anwoyding, oosuck ; osuk Rob.
wife, white adizabad zea.
wigwam meotick.
wind gidyeathuc ; Rob.
wolf moisamadrook ; Rob.
woman emamoose ; amamoose Rob. ; see *Red Indian woman, wife.*
wood adiab Rob.
woodpecker shebohoweet ; Rob.
woods see *tree.*
yawn, to ibeath Rob.
yes yeathun.

Composite Photography applied to Handwriting. By Dr. Persifor Frazer.

(*Read before the American Philosophical Society, January 16, 1886.*)

The following preliminary note on this subject appeared in the Journal of the Franklin Institute for February, 1886 :

Francis Galton was the first to point out in fugitive memoirs, and notably in his important work, "The Human Faculty," that one could sift the common from the accidental features of a number of objects by exposing them in succession to a sensitized plate in such a manner that the images of the similar parts of the different objects should occupy as nearly as possible the same parts of the plate ; and that each object should be exposed for only a fraction of the length of time necessary to complete a picture on the film used. This fraction depended generally, if not always, on the number of objects and on the sensitiveness of the film. For example, if there were eighteen objects and the plate took thirty-six seconds to develop, each object would ordinarily be exposed for two seconds. It is easy to see that the result in the finished picture would be that those features which all the objects had in common would be re-enforced by each separate exposure, whereas those features which were accidental or variable, and which would be different for every individual, would be exposed for but two seconds and would be so indistinct as practically to fade away. Where the object was to catch a family likeness by exposing all the members male and female to the same portion of the plate, the result is a curious medley of faint whiskers and moustache ; of hair parted in the middle and at the side ; of female gowns with buttons to the throat and of male shooting jackets thrown open. But out of all this faint halo of confusion and blur, there starts a characteristic face which is the family type. Very often, too, this type-face resembles noticeably two different members of a family between whom no one can find a resemblance. It is this latter fact (which might have been expected) that induced me to look to the process for aid in solving the problem of identity of origin in handwriting. When a number of animals of the same race are thus treated, the method secures the fixing of the race or family characteristics, etc., as the case may be. When a number of pictures or coins bearing different representations of the same individual or scene are the objects, the result is to obtain either the average appearance of the same thing under different conditions (as for instance a man at different times of life), or the average of the impression made by identically the same thing on different artists. In this case, the merit of the process is that it constructs its image out of all that many pairs of trained eyes have seen, without giving undue weight to any one pair. So far, then, these efforts have been directed to re-finding a lost or concealed existence through multiple testimony, very much as the law tries to get at the truth by examining a number of witnesses.

At first sight one would suppose, however, that the case of handwriting was a different one, but I think that the analogy with the above cases will appear strong on due reflection. With a given mental image of what one desires to write before one; and with a given relation of will-power, nerve sensitiveness and muscular force, the same signature could be repeated a thousand times, provided that all these conditions were invariable, and no others were superadded. So far from this being the case, however, every one of the factors just named which produce a signature, depends on physical and mental—in other words, on extraneous influences, to a very large degree. The movement commenced to effect an up stroke is met by an unexpected obstacle in the paper, a slight twinge in the shoulder, or a sudden noise, and the resulting line would show (were we sufficiently cognizant of the detailed working of all the complicated parts of our mental machinery to interpret it) just the order in which our different sentient and executive functions have been affected, and to what extent. But while these ever-recurring accidents result in preventing any signature from being made exactly as intended,* the fact that no two of them effect the same kind or amount of deviation leaves it in the power of the experimenter to extract from this process the "ideal" signature—a signature which probably never was seen as it appears, and yet which so combines all the visible results of a particular will acting on a particular arm to trace on paper a known design with a pen or pencil, that it may justly be called the *type* signature of that writer. What was said of the resemblance of every object of a group of objects which have any claim to be associated together, to the composite made of that group, even though it differ widely from other members of the same group ; is true of handwriting. It has been remarked that the composite signature is an ideal, and never was realized. This is because the lines along which the strongest re enforcements are made are those where locally varying deviations most frequently cross. To put it in another form, suppose the lines a b, c and d to be in agreement as follows : At the point a', b does not cross, but c and d do. At b', c does not cross, but d and a do. At c', d does not cross, but a and b do. The line which would represent to the eye part of the ideal signature, would be that traced the points a', b', c', d', because those points having superposed lines of three out of the four signatures and would be darker, while the variations at each of these points would be indistinct.

In examining with care a composite signature as just described, it at once arrests the attention that the variations are not equally distributed over the entire body of the letter, but that there are regions of each letter where variations of a particular kind are noticeable, and other regions where there are few or none. The more the manuscripts of an individual are compared the more forcibly does this fact appear, until finally one is tempted to conclude that after a handwriting is once formed, it cannot

*The word "intended" is used to imply the effect which would be produced by the action of the will through the hand on the paper if not modified by these accidents, and not solely conscious intention.

naturally exhibit deviations except within a defined variation and in certain limited areas adjacent to the separate letters. It is thus as great an assistance to the observer to study the variations, as to study the ideal signature. Indeed, the variations are all important in the matter of identification, and if there were no variations the method would be inapplicable, because an exact copy might be made by tracing. A comparatively small number ot signatures will give the maximum and minimum of variation in any given region of one of the letters forming it. Moreover, the kind of variation is easily observed where there are a number together, so that the most perfect adept at forgery could hardly hope to simulate the microscopically minute characteristics of variations which are simply the visible expression of a series of indefinitely complex relations of muscle and nerve.

In a case which was recently brought before the Orphans' Court in Philadelphia, this principle of composite photography was for the first time applied by me to the purpose of identifying handwriting, and from the experience thus far gained, it is thought that it will (at least in many cases) more surely lead to the truth than will the mere opinions of the most skillful expert.

Philadelphia, January 19, 1886.

We judge of force and weakness ; of the stability and instability ; of expression and character chiefly by applying the experience that we have gained through the observations of our lives to the images we see before us. In the more complex studies of nature the image is rendered in colors and their shades, and all these increase almost indefinitely the delicate phases and modifications of the thought which is suggested. They are just so many words added to the language in which external nature speaks to us.

But an almost infinite number of facts are impressed on our minds with convincing force without recourse to other than the plainest and simplest combinations of lines. A being, whether civilized or savage, recognizes instantly the impossibility of a tree growing with its roots in the air, or a man standing on the vertical face of a wall. The French caricaturists have demonstrated how much of character and expression may be given by a few lines which when looked at minutely resemble the scrawls of an infant on a sheet of paper, yet when viewed from a certain distance in its general effect tell us a whole story without the use of a word. It is undeniable that the power to do this is based upon the fact that certain accentuated lines appear in the figures of men and things under a given set of circumstances, and by taking these and omitting all else we have a sort of skeleton image divested of unessentials. This skeleton image is in its way a sort of composite, arrived at, it is true, by a different method from that here employed, but nevertheless representing the sum of the artist's experiences in a great many more or less similar cases, and the greatness of the historical painter lies just in his power to represent an important event or crisis by the effects which it makes visible on those who are participators in and spectators of it. Here is no place to admit variation, the attitudes, or, in other words, the lines of the figures in such a composition must be normal and intelligible to the mass of mankind ; must be, in short, a composite or abstraction of the lines that would survive were a hundred thousand such scenes to be instantaneously photographed : all else weakens the effect intended. Composite photography is a method of obtaining the essence of a number of objects and, in so far as those objects are typical of similar phenomena, of recording the relations of things to each other, the effects produced by a certain force or certain forces on matter. The composite will enable the mind, armed with some experience in life, to ascend from the individual cases to the underlying cause or motive.

Is it necessary, then, to prove that a line made by a human arm and hand is liable to the variations which such an arm or hand must produce when influenced, as they always are, by indefinitely numerous physical and mental forces? Is it necessary to devote much time to the proof that a line on paper so produced is as much a resultant of organic processes as the outline of the human figure or the expressions of the human face? It is a kind of fossil like the print of a footstep or of a leaf which, while it consists of nothing having life, or that ever need have had life, and possesses none of the material of the body which made it, is capable like the impressions above referred to of telling a great deal of the characteristics of its creator : it is, in fact, as organic as the forms of living things by which we judge them, for their forms or images do not possess life either.

Such methods as composite photography, or composite drawing or painting of any kind which can be accomplished when the hand has the skill to reproduce what the memory has stored away, are applicable only to the representation of resultants which do not vary within too wide limits, and are especially applicable where such variations depend upon the influences brought to bear on sentient things, and when they do not occur *per saltum*, but gradually and by imperceptible steps.

If the purpose be to represent an average of some object which presents images differing radically from each other at successive views there must be a very large number of such images selected to photograph, and then an ill-defined but darker blur will show vaguely on what part of the field on the whole the images have been most numerous. For phenomena of this kind the method is not adapted to offer its best results, though it still may be used to ascertain some facts in a general way.*

The attempt to apply the composite system of photography to the curves representing the rate of mortality in cities and towns, or to the

*In a pleasant letter received from Mr. Francis Galton, F. R. S., in answer to a copy of the preliminary note given above, which I sent him, he mentions that an attempt was made at the Kew Observatory to apply the principle of composite photography to the meteorological charts, without great success, though with more than Mr. Galton would have anticipated.

changes of the weather, &c., &c., is not likely to be rewarded by striking results, except to the extent which I have stated above, because these curves are composed of data taken at such intervals of time that there is no necessary sequence between them ; they are affected by causes which are in no respect to be likened to the gradual unfolding of human expression by relaxations and constrictions of the muscles, the sum of all the changes not perceptibly altering the field first obtained, but altering the "values," as the artist calls it, or the relative importance of the rôles assumed by each unit of the image to the rest. These changes are as characteristic and delicate in the line made voluntarily by a living being as in the lines which its form involuntarily makes on the retina, and therefore one set is as susceptible of concentration and averaging as the other.

The merely formal and always repeated parts of a letter or other document have an entirely different character value from those parts which are composed of words and letters thrown together to represent a certain state of things, and which may never be repeated in exactly the same order. Obviously no composite of phrases can be expected unless the phrase have a technical significance, but separate words can be selected to form bases of composites, or even the two or three words which enter into an idiom, one of those well-trodden short cuts of language to a given idea. Such partial phrases (rendered frequently in other languages by a single word), as "in order that ;" "as well as ;" "not only ;" "but also," &c., will be found in the handwriting of any one accustomed to write much, and may be taken as elements out of which to construct composites of the words of which they consist ; but the value of such elements in helping one to a knowledge of the character of the person who penned them, or even of the general character of the writers' handwriting is not as great in these cases as it is in the signature and the few formal words which precede it in a letter. There are several reasons for this ; one is that these formulas occur in different connections with the accompanying text, indicating very different attitudes of mind in the several cases. The sense of what is written must have a large influence in the manner of writing it, and therefore the letters composing these words will be larger or lighter ; or more or less quickly and angularly written as the idea of the sentence by reflex action evokes different emotions in the mind of the writer. A circumstance equally noticeable will be the place on the paper which the words occupy ; whether there is an abundance of room to write the words, or whether they are cramped in order to bring them into a smaller space. In cases where the words of such a subphrase are divided between two lines, they will almost surely not appear as they would when they follow each other in their natural order. But more even than these is the fact that the signature and its connected words, "Yours truly," &c., are always indicative of the task completed, the information conveyed. They are words of ceremony and endorsement, no matter what the contents of the letter may be. They are invariably repeated and come to be a purely conventional sign, of which the parts resemble more or less the letters in the body of the writing in different people. This symbol usually occupies very nearly the same part of the page—at least as to its distance from the right or left hand edge of the paper—and this tends to fix it as a distinguishing sign. All these facts lead to a distinction between a signature, and that writing by the same hand which accompanies original composition.

There are, of course, peculiarities in every hand which can be traced both in the signature and in the body of the text. Such are very apparent when the writer labors under a physical disadvantage, such as a maimed or deformed hand or arm, but in lesser degree these peculiarities are present in every handwriting and constitute the general constant of "will-power, nerve sensitiveness and muscular force" employed by a given individual in this perfunctory habit.

I say *general* constant to imply that this relation must be regarded without paying too much attention to detail, for probably on no two occasions of a man's life do these factors exist in him in *absolutely* the same proportions, and even if they did, the least change of environment would alter the results thus accomplished. But the signature of a man being divested as much as possible of the accidents due to his outside influences, it follows that the signature is the production of his hand least likely to yield an insight into his condition when writing it. On the other hand, the fact that he selects one particular way of expressing his identity bestows upon it something of a resultant of the various motives which actuate him, and makes it a sort of digest of the points of his character called into play in the performance of the act. We may look for the same sort of character in a signature that we find in a photograph or a picture, and the same causes may prevent either the one or the other from faithfully representing the peculiarities of the individual, by representing that individual as he appears when conscious that he is being observed ; or, in other words, a character is assumed which corresponds to the taste of the individual and represents more or less how he would like to be seen by the public. When the character is observed to exist throughout the entire mass of his writing, it may be assumed that it represents accarately the man, for no amount of patience and study would enable one to retain such peculiarities under all the varied circumstances attending the act of writing, if it were not inherent in the individual himself. In any case, however, the result is a likeness which all who know the original will recognize, even though one or two features may be made more prominent in pose than in repose, and that constitutes the chief value of the analysis of signatures for identification independently of what we may learn from them of the mental attributes of their signers.

It is not swe ylaantirely obvious how signatures with many light flourishes, or accompanied by intricate lines connecting their several parts, should be superposed, for these appendices are so easily affected by minute causes that it seldom happens that two will cover each other exactly. It is not to be expected that such parts will survive in the resulting type signature, but the breadth of the space covered by the blur and parallelism of the faint lines will give evidence of the extent to which these ornaments have grown from caprice to a habit.

As a general rule there are several places—sometimes as many as eight or nine in a long signature—when the darkening of the lines indicates a general conformity of the pen's path to one direction, and it would seem that these places were not peculiar to any one part of a letter, nor that they were less in a hair line than in a heavy stroke. They appear to be dependent upon the anatomy and muscular structure of the individual in connection with his method of performing the act of writing his signature. For instance, some writers can only form one or two letters without moving the writing hand; only a word or so without shifting the elbow; others describe with the forearm of the writing hand a curve around the elbow which remains stationary; others slide the forearm along into parallel positions while writing. All these habits have different effects upon the handwriting which results, though they are not always to be easily detected, owing to the fact that other habits are cultivated at the same time to counteract the defect which each of these methods, when not so compensated, would have impressed upon the appearance of the chirography.

Thus, he who writes with an elbow pivoted immovably upon the table must learn to move the fingers over a greater space at some part of the line, to avoid the curve which would unconsciously result. This more vigorous movement of the fingers is likely to produce heavier strokes in the part of the signature where the compensation is naturally applied. So that a fixed elbow and heavy letter in the middle of the signature may stand to each other in the relation of cause and effect.

In signatures when the divergence is wide and the agreement correspondingly small, it has been my custom to use the dark portions as centres to adjust the various signatures on, and this plan will sometimes furnish a good composite when other plans fail.

Desiring an illustration to accompany this paper, I sought a signature which would serve as a fair test of the process. Manifestly such a signature must be well known to a large number of persons, and enough examples of it must exist to bring out the type character of their combination. Those individuals whose signatures are known to the largest number of persons are usually bankers or persons authorized to sign firm drafts, checks, &c., and these not unnaturally object to having the minutest characteristics of their writing brought to the knowledge of the public, though for the reasons stated above a study of what the composite teaches would convince the intending forger that his task was a far more difficult one than that of simply reproducing a design. On the other hand signatures of dead bankers and dissolved firms soon pass out of the remembrance of those who were once familiar with them, and therefore have no more significance than the sign manuals of unknown writers, or those which are purely fictitious.

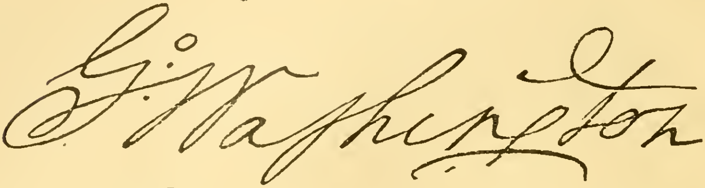
George Washington's signature was one of the first to suggest itself, because many persons were familiar with it, and there are numerous well-authenticated documents in existence which bear it; but it has proved to possess other advantages which were not known when it was selected. As in everything else, Washington was deliberate, painstaking and uniform in his method of writing his signature and the consequence is that it makes an excellent composite for illustration.

In writing his signature Washington put pen to the paper five times. First he wrote the "G W" in one connected line. Secondly, he raised his hand and made the small "o" between the upper parts of the G and W, and the two dots which appear in all but signature No. 7. Thirdly, his hand and arm were placed in position to write "ashing," these six letters occupying a breadth of almost exactly $1\frac{3}{4}$ inches in every signature except the third, when they are extended to $1\frac{13}{16}$ inches. This is about as much of the arc of a circle (of which the centre is the elbow pivoted on the table) as one with a forearm of average length can cause to coincide with the tangent, or the straight line across the paper which the lower parts of the letters follow, unless unusual effort be made and a great deal more movement be given to the fingers. The "g" ends in a curved flourish, of which the convex side is turned upwards below the right centre of the name. [Note. The lower loop of the "g" in all the signatures and in the composite was cut off in preparing the plate.] Fourthly, he wrote the final "ton." Fifthly, he added the very peculiar flourish above the right centre of the name, with the object of dotting the "i" and crossing the "t" at the same stroke.

In examining the composite, the effect of these various separate movements becomes manifest in its strengthened portions. It is hardly possible that any one during the period of sixteen years, which these signatures represent, or from 1776 to 1792, should have so schooled his hand to write a long name that the first inch or so of the writing should always occupy the same relative position to the body of the signature. It would take at least that much action for the hand and arm and pen to be brought into normal signature-writing condition; and especially is this so when this part of the writing is accompanied by flourishes as it is in the case we are considering. The "G W" and the little "o" and the dots at the top were the prelude, after which the arm was moved into position to write the main body of the signature or the "ashing." Of course, from the manner of making the dots, and the extremely small space they cover, their re-enforcement of each other in the composite was almost impossible, and, in fact, like other subordinate characters, they disappear almost completely. This latter is the part of the name which one would have expected to exhibit the greatest amount of uniformity, as in point of fact it does, with the exception of its terminal "g," which shows more variation than any of the other letters, because at this point the limit of coincidence between the tangent line of the writing and the curve, of which the right forearm was the radius, had been passed, and a freer movement of the fingers was compensating for the increasing divergence. [Note. It is likely that Washington sometimes raised the hand between the end of the long "s"

1

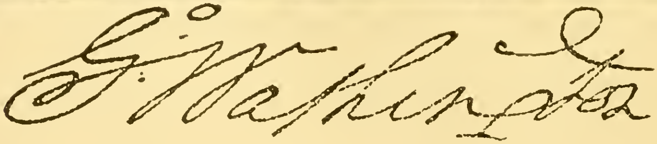
G:Washington

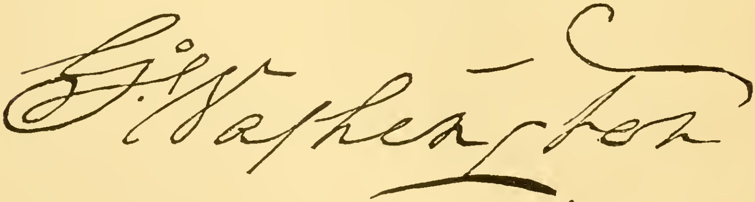
2

G:Washington

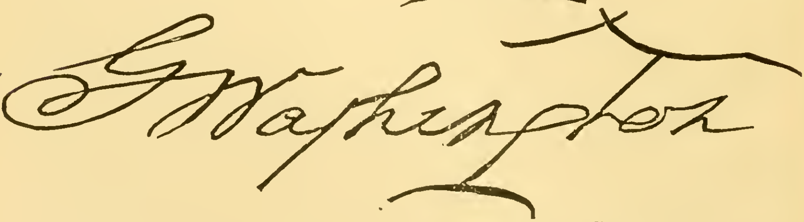
3

G:Washington

4


5

G:Washington

6

G:Washington

7

G:Washington

8

G:Washington

and the beginning of "h," but he does not appear to have moved the elbow. All but the second signature are consistent with this view, and in the 1st, 3d and 5th it is plainly indicated. In the others, as in the flourish above the sixth signature, the pen may not have marked.] The fourth separate act of the penman was the formation of the "ton" after a movement of the arm. The breadth of the space occupied by these three letters is from $\frac{5}{8}$ to $\frac{7}{8}$ of an inch, or considerably within the range of coincidence of the curve and straight line before referred to; and owing to this fact there is only a moderate degree of re-enforcement of the letters in the composite, because these letters might fall into the first or last parts of the 2-inch space which was the limit of movement with a fixed elbow. It is worthy of note that even in this case the middle letter of the three is darker in the composite than either of the outside letters. The fifth and last movement was the flourish which dots the "i" and crosses the "t" by one stroke. This was done in the freest of free hands—often, as it seems probable, without resting hand or arm on the table at all. Therefore there is no coincidence of the lines in this part of the composite and the *region* of variation is wider than that of any other part of the signature.

All the signatures used in the accompanying plate (seven in number) are unquestionably genuine. With the exception of one, which is the property of the writer, they were carefully chosen from a number of authenticated signatures in the possession of the Historical Society of Pennsylvania.

No. 1 is on a letter, dated December 18, 1776, from near the Falls of Trenton, and addressed to Washington's brother Samuel.

No. 2 is on a letter dated Headquarters, November 4, 1777, and is addressed to the writer's great-grandfather, Lt.-Col. Persifor Frazer, then a prisoner of war in Philadelphia.

No. 3 is on a letter dated September 27, 1777, and is to Wm. Henry, of Lancaster.

No. 4 is the Composite of all the rest.

No. 5 is on a letter dated Headquarters in Morristown, February 22, 1777. The person to whom the letter was addressed is not stated.

No. 6, dated September 26, 1793, is affixed to the commission of David Lenox.

No. 7, of the same date, is affixed to David Lenox's appointment as agent for the relief and protection of American Seamen.

No. 8, dated May 24, 1799, closes a letter to Thomson Mason.

On the Structure and Affinities of the Amphiumidæ. By E. D. Cope.

(Read before the American Philosophical Society, February 5, 1886.)

By all authors, the genus Amphiuma has been included in the same family division with Protonopsis and Megalobatrachus until 1866. At that time the writer of this paper proposed to separate it from the latter genera as the type of a family Amphiumidæ, while the other genera were placed in another family with the name Protonopsidæ. This course has not been followed by later writers; in the Catalogue of the British Museum by Dr. Boulenger (1882), for instance, the three genera being included in one family, the Amphiumidæ.

The reasons for keeping the Amphiumidæ distinct from the Protonopsidæ were stated to be the following :*

AMPHIUMIDÆ : "An axial cranial bone (? vomer) in front of orbito sphenoids, and one forming palatal surface in front of parasphenoid. * Parietals prolonged laterally, not reaching prefrontals. Vestibule, wall osseous internally. Premaxillaries consolidated. Occipital condyles on cylindrical pedestal."

PROTONOPSIDÆ : "No anterior axial cranial bone. * * Parietals and prefrontals prolonged, meeting and embracing frontals. Wall of vestibule membranous internally. Premaxillaries separated. Occipital condyles sessile."

The following observations were made on the Amphiumidæ : "The occipital condyles and temporocervical tendon are quite as in Desmognathus ; they have not been previously described.† In *Amphiuma means* there is a minute not articulated bone on the suture between the o. o. frontalia and prefontalia in the situation of the lachrymal. There are some approximations to Cæcilia in Amphiumidæ. It does not appear to have been noticed that the * * free margin of the frontal seems to foreshadow the overroofing of the orbit and temporal fossa seen in Cæcilia. There is also a very large foramen or canal passing through the o. maxillare from near its middle to the orbit, foreshadowing the *canalis tentaculiferus* of Cæcilia : a narrow one occurs in the same situation in Protonopsis. Further the prominent horizontal anterior inferior processes of the vertebral centra are the same in Amphiuma and Cæcilia."

Occasion for the revision of these views having presented, the following facts and conclusions have been reached.

The characters assigned as above to the two families Amphiumidæ and Protonopsidæ are abundantly sufficient for retaining them as distinct. The form of the occipital condyles might be excepted from this estimate, and the axial bone in front of the parasphenoid proves to be abnormally cut off in the specimen then examined. The Protonopsidæ agree with other

* Journal Academy Philadelphia, 1866, p. 104.

† They were described by Dr. J. G. Fischer, Anatomisch. Abhandl. üb. Perennibranch. u. Derotrem. Erstes Heft, p. 61 1864.

Urodela in all of the characters given, except in the exclusion of the frontals from the supraorbital border, and in the membranous characteristic of the internal wall of the vestibule. The Amphiumidæ differ from other Urodela in the presence of a large ethmoid bone (the one referred to as ? vomer in the diagnosis above quoted), in the presence of temporal ridges, and of two anteriorly directed hypapophyses of the precaudal vertebræ.

It is interesting to notice that three of the four characters just cited are shared by the Cæciliidæ. The presence of the ethmoid is of especial importance, as it is an element constantly wanting in the Urodela. I have not found it in Desmognathus, Anaides, Spelerpes, Amblystoma, Salamandra, nor Protonopsis ; nor is it present in Necturus or in Siren. It is, on the contrary, always present in Cæciliidæ* (see Plate v, E). The double anterior hypapophyses are otherwise confined to the same family.

The Cæciliidæ are generally regarded as representing a distinct order, which bears the names Apoda, or Gymnophiona. The definition given to this order by Mr. Boulenger† is : "No limbs ; tail rudimentary. Males with an intromittent copulatory organ. Adapted for burrowing." Of these definitions none is of ordinal value. The tail in some species is distinct. The intromittant copulatory organ in *Dermophis mexicanus*, *Gymnopis proximus*, and *Herpele ochrocephala*, is not an especial organ, but is merely the everted cloaca. The hard papillæ observed by Günther‡ in the *Ichthyophis glutinosus* are wanting in the above species. The protrusion of the cloaca is effected by two especial muscles, which are wanting in Amphiumidæ. As to limbs, their extremely rudimentary character in Amphiuma is well known. To regard their condition as indicating ordinal separation from the Cæciliidæ is not in accordance with our practice in similar cases in the Reptilia, as in the order Lacertilia. The characters of these parts and their supporting arches not having been heretofore given, I describe them below.

I have endeavored to sustain the order Gymnophiona by the character of the fusion of the nasal and premaxillary bones found in the majority of the genera.§ But Stannius‖ shows that these bones are distinct in Ichthyophis. Huxley states (Anatomy of Vertebrate Animals, p. 155) that in *Ichthyophis glutinosus* a distinct bone nearly encircles the orbit. This he compares to the supra and postorbital bones found in the Stegocephali. But in Chthonerpeton, Cæcilia, Dermophis and other genera, this bone forms part of the maxillary, so that it is not characteristic of the family, and may not be homologous with the bones which occupy the same position in Stegocephali. Wiedersheim calls it maxillary.

With these facts in view I have united¶ the Cæciliidæ with the Urodela,

* See Wiedersheim, Anatomie der Gymnophionen, Jena, 1879.

† Catalogue of the British Museum, 1882, p. 88.

‡ Reptiles of British India (Roy. Society), p. 441.

§ American Naturalist, 1884, p. 26.

‖ Zoötomie der Amphibien, 1856, p. 44.

¶ American Naturalist, 1885, p. 244, note.

a proposition which I now fully believe to be sustained by the evidence. *The Cæciliidæ is a family of Urodela, connected with the typical forms through the Amphiumidæ.*

Wiedersheim (l. c. p. 95) has attempted to trace the ancestry of the Cæciliidæ to the Stegocephali of the Carboniferous period, from which he supposes them to have arisen by a process of degeneration. He remarks that in order to demonstrate this proposition it is only necessary to discover a type with rudimental limbs which shall connect the two.

That the Cæciliidæ is a type which has resulted from a degeneration, I have also proposed,* but I have derived them from the Urodela rather than from the Stegocephali direct. They have, like Amphiuma, essentially the same cranial structure as the Urodela, which is widely different from that of the Stegocephali, in the absence of the intercalare, supratemporal and postorbital bones. And these characters are fully maintained in various genera of Stegocephali which have rudimental limbs. Amphiuma then is the annectant type with rudimental limbs, which Dr. Wiedersheim sought for. The circumstance that his eyes were turned towards the Stegocephali indisposed him to recognize this fact.

The only portion of the shoulder girdle of this genus which is ossified is the scapula. The coracoid cartilages of opposite sides are distinct from each other, and there is a production of the præcoracoid region. The humerus is truncate at both extremities, making its articulations with cartilage only. The carpus is undivided cartilage. The osseous ilium is quite short and slender ; it has a long superior cartilaginous portion, which is attached to an equally long cartilaginous sacral rib. The inferior element is an undivided plate, which is wider than long, and presents an obtuse angle anteriorly. The posterior portion of each is occupied by a round discoid ossification, which forms the posterior border, but does not reach either the acetabulum or its fellow. The femur is rather long and has a distinct trochanter, but no head nor condyles. The articulations are cartilaginous, as is the tarsus, which is also undivided. The tibia and fibula are about one-sixth the length of the femur, and the fibula is a little shorter and more slender than the tibia. The phalanges in both feet are well ossified.

The general characters of these parts are described in Stannius' Handbuch der Zoötomie,† but only as included in the definitions of the order to which Amphiuma is referred.

Plate VI.

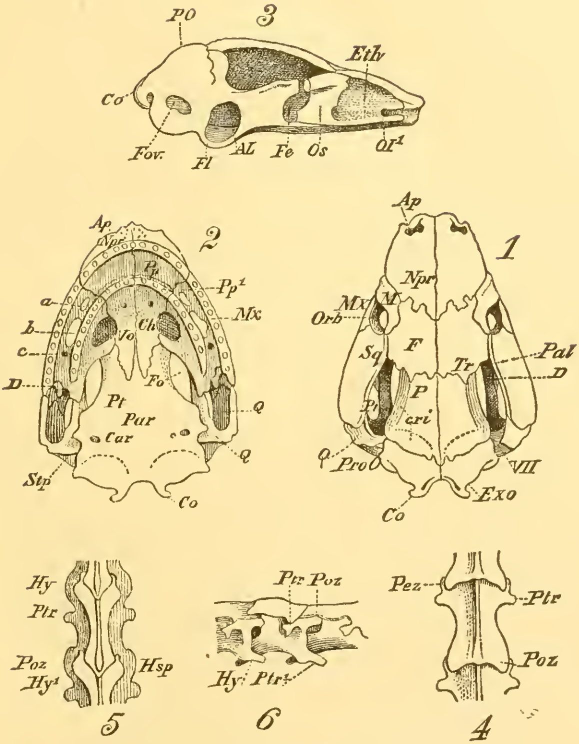
Amphiuma means Gard. One-third natural size. Original. From Georgia.

Fig. 1, skull, left side.

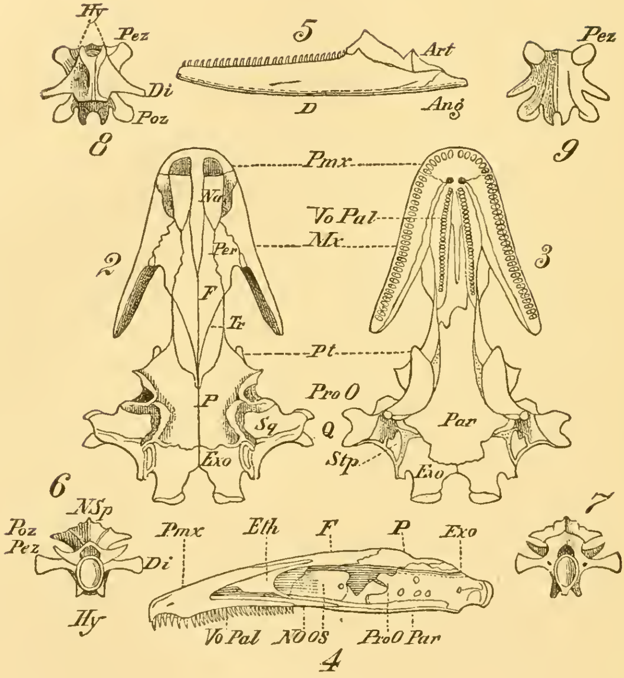
Fig. 2, do. from above.

* American Naturalist, 1885, p. 244.

† Rostock, 1856.



Chthonerpeton indistinctum R. and L.



Amphiuma means Gard.

Fig. 3, skull, from below.

Fig. 4, do. right half, from within.

Fig. 5, left mandibular ramus, external view.

Figs. 6–9, an anterior dorsal vertebra ; fig. 6, front ; 7, rear ; 8, bottom ; 9, top.

Plate VII.

Chthonerpeton indistinctum R. and L. Three-eighths nat. size. After Wiedersheim. From Brazil.

Fig. 1, skull, from above.

Fig. 2, do. from below.

Fig. 3, do. left half, from within.

Figs. 4–6, one and parts of two other vertebræ ; 4, from above ; 5, from below ; 6, right side.

EXPLANATIONS OF LETTERS.

Pmx., Premaxillary.
Mx., Maxillary.
Na., Nasal.
Npr., Nasopremaxillary.
Pef., Prefrontal.
F., Frontal.
P., Pariëtal.
Tr., Temporal ridge.
Sq., Squamosal.
Exo., Exoccipital.
Pro O., Proötic.
OS., Orbitosphenoid.
Eth., Ethmoid.
Par., Parasphenoid.
VoPal., Vomeropalatine.
Pt., Pterygoid.
Stp., Stapes.
Q., Quadrate.
Co., Occipital condyle.
Art., Articular.
Ang., Angular.
D., Dentary,
Di., Diapophysis.
Pez., Prezygapophysis.
Poz., Postzygapophysis.
Hy., Hypapophysis.
Hsp., Hypapophysial spine.
NSp., Neural spine.
Ch., Posterior nares.
Ap., Anterior nares.
a, Naso-palatal foramen.
b, " " "
c, " " "
Car., Carotid foramen.
Orb., Orbit.

Stated Meeting, March 19, 1886.

Present, 19 members.

President, Mr. Fraley, in the Chair.

Lieut. A. W. Wyckoff, U. S. N., Dr. Owen Jones Wistar, and Dr. Charles A. Oliver, were presented to the Chair and took their seats.

Donations to the Library were reported from China Branch of the Royal Asiatic Society; Physikalische Central-Observatorium and K. Akademie der Wissenschaften, St. Petersburg; K. K. Naturhistorische Hof-Museum and K. Akademie der Wissenschaften, Wien; Nassauische Verein für Naturkunde, Wiesbaden; Astronomische Nachrichten, Kiel; Deutsche Geologische Gesellschaft and Verein zur Beförderung des Garten Baues, Berlin; Physikalisch-Medicinische Gesellschaft, Erlangen; Società Toscana di Scienze Naturali, Pisa; Société de Géographie and Mr. H. Welter, Paris; Statistical Society, Hong Kong; Meteorological Office and "Nature," London; Philological Society, Cambridge, England; Manchester Literary and Philosophical Society; Institut Canadien-Française, Ottawa; Canadian Institute, Toronto; Harvard College, New Haven; Publishers of the "Traveller's Record," Hartford; Dr. L. B. Bush, of New York; Brooklyn Entomological Society; Trenton Natural History Society; Franklin Institute, Pennsylvania Historical Society, College of Pharmacy, Dr. D. Jayne & Son and Mr. Henry Phillips, Jr., Philadelphia; Delaware Historical Society; American Chemical Society and American Journal of Philology, Baltimore; United States Naval Institute, Annapolis; Department of State, Hon. Samuel J. Randall, John H. Hickcox, and Engineer Department, Washington; Editor of "The Industrial South," Richmond; Denison University, Granville; Publishers of the "Engineering Era," Cleveland; Washburn College, Topeka; University of California; Mr. Juan Ignacio de Armas of Havana; Deutsche Wissenschaftliche Verein zu Santiago.

A chair was presented on behalf of the Executors of the late Dr. George Hamilton, of this city, formerly the property of Dr. Chapman, sometime the President of the Society, to whom it had been given by Joseph Bonaparte, ex-King of Spain, from his residence at Bordentown, N. J.

A letter accompanied the gift from Mr. J. McClure Hamilton, the son of the donor, to whom the thanks of the Society were voted.

Letters accepting membership were read from Prof. F. A. Genth, Jr. (Philad'a, March 15th, 1886); Ensign Louis Duncan, (U. S. S. *Juniata*, New York Navy Yard, March 15th, 1886).

A letter of envoy was read from the Statistical Society of London, and also asking for certain of the Society's publications, which was referred to the Secretaries with power to act.

A letter was read from the Institute Canadien-Française requesting exchanges, which was similarly referred.

A letter was read from Dr. Clemens Winkler, Freiberg in Sachsen, announcing the discovery by himself of a new nonmetallic element to which he had given the name of *Germanium.*

The death of Dr. Austin Flint was announced as having taken place at New York on the 13th day of March, 1886, in the 74th year of his age.

The Lackawanna Institute of Science at Scranton, Pa., was ordered to receive the Catalogue of the Library of the Society and the Proceedings, to begin with No. 117.

Secretary Brinton presented two papers by Dr. W. J. Hoffman, one on the Selish Language and another on the Waitshumni Dialect.

Dr. Horn explained the process among the Piutes of sweetening acorn meal by percolation with water so as to render the product edible.

Lieut. Wyckoff made a verbal communication on the action of heavy vegetable or fish oils in reducing heavy combing waves to long swells that would not injure a vessel. A discussion upon the subject ensued which was participated in by Messrs. Brinton, Dudley, Horn, Holland, Ingham and Oliver.

Various diplomas of Dr. Franklin's were exhibited, lately found in the possession of the Society.

Pending nominations Nos. 1078 to 1103 and new nominations Nos. 1104 and 1105 were read, and, after reading the minutes, the Society was adjourned by the President.

Stated Meeting, April 2, 1886.

Present, 15 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Lieut. Geo. B. Anderson, U. S. A., West Point, N. Y., and Prof. Serge Nikotin, Geological Survey of Russia, St. Petersburg, Russia, newly-elected members, by letter accepted membership in the Society.

Donations to the Library were announced from the following sources, viz: South African Philosophical Society, Cape Town, Africa; Geological Survey of India; Société Impériale des Naturalistes de Moscow, Russia; Zoologischer Anzeiger, Leipzig; Prof. Reuleaux of Berlin; Senckenbergische Naturforschende Gesellschaft, Frankfort-am-Main; Oberlausitzer Gesellschaft der Wissenschaften, Görlitz; Verein für Erdkunde, Halle A. S.; Prof. G. vom Rath of Bonn; Prof. E. Renevier of Lausanne; K. Nordiske Oldskrift Selskab, Copenhagen; R. Accademia dei Lincei, Rome; R. Accademia de Scienze Lettere ed Arti, Modena; R. Academia de la Historia, Madrid; Bureau des Longitudes, Société Zoölogique de France, École Polytechique, Musée Guimet, Société de Géographie, and Prof. Léon de Rosny, Paris; Académie de Dijon; Royal Society, Royal Geographical, Meteorological and Astronomical Societies, Society of Antiquaries, Geological Society, Bath and West of England Society, and the publishers of the "Diplomatic Review," London; Philosophical and Literary Society of Leeds; National Board of Trade, Boston; State Museum of Natural History and Geological Survey of New York, Albany; Engineers' Club of Philadelphia; University of Pennsylvania, Philadelphia Board of Trade, Publishers of the "American Naturalist," Mr. Henry Phillips, Jr., and Dr. J. Minis Hayes; Dr. J. Curwen of Warren, Pa.; the Johns Hopkins University; U. S. Fish Commission, U. S. Geological Survey, Philosophical Society of Washington, D. C.; University of Virginia; Georgia Historical Society; Rev. Stephen D. Peet of Chicago, Ill.; Mercantile Library Association, San Francisco, and the Imp. Observatorio do Rio de Janeiro.

Photographs for the Society's album were received from Lieut. A. B. Wyckoff, U. S. N., Hon W. Townsend, and E. F. im Thurn.

On motion, the President was requested to transmit the thanks of the Society to the Royal Society for the gift of its Catalogue of Scientific Papers.

On motion, the South African Philosophical Society (Cape Town), and the Oneida County (N. Y.) Historical Society were placed on the exchange list to receive Proceedings from No. 96.

Acceptances of Membership: Prof. Serge Nikotin (St. Petersburg, March 12, 1886), Lieut. Geo. L. Anderson, U. S. Army (West Point, N. Y., March 22, 1886).

Letters of Envoy were received from the South African Philosophical Society, Cape Town, Africa; Bureau of Longitudes, Paris; Royal Society, Bath and West of England Society, and the publishers of the "Diplomatic Review," London; U. S. Geological Survey, Washington.

Acknowledgments for No. 122, as follows: Portland Society of Natural History; New Hampshire Historical Society; Profs. Robt. C. Winthrop and S. P. Sharples of Boston; Prof. H. A. Hagan of Cambridge, Mass.; American Antiquarian Society, Worcester; Essex Institute; Rhode Island Historical Society, and Rhode Island Society for the Encouragement of Domestic Industry; Connecticut Historical Society; Mr. Geo. F. Dunning of Farmington, Conn.; University of the City of New York; Astor Library; Profs. Henry M. Baird and John J. Stevenson of New York; U. S. Military Academy, West Point; Profs. James E. Oliver and T. Fred'k Crane of Ithaca, N .Y.; Prof. C. H. F. Peters of Clinton, N. Y.; New Jersey Historical

Society; Prof. W. Henry Green of Princeton, N. J.; Mr. Wm. John Potts of Camden, N. J.; Pennsylvania Hospital, The Numismatic and Antiquarian Society, College of Physicians, Prof. J. P. Lesley, Dr. Persifor Frazer, Messrs. Samuel Wagner, Henry Phillips, Jr., and Dr. Isaac Norris of Philadelphia; Mr. Thomas Meehan of Germantown; Dr. R. H. Alison of Ardmore, Pa.; Profs. Pliny Chase and L. B. Hall, Haverford College; Hon. W. Townsend of West Chester; Rev. J. A. Murray of Carlisle; the Wyoming Historical and Geological Society; Profs. Traill Green and J. W. Moore of Easton; U. S. Naval Institute; the Signal Office, and the Surgeon-General's Office, and Prof. J. H. C. Coffin of Washington; Leander McCormick Observatory; Virginia Historical Society; Prof. J. W. Mallet and Messrs. Schele de Vere and Jed. Hotchkiss of Virginia; Georgia Historical Society; Cincinnati Society of Natural History; Prof. James Morgan Hart, of Cincinnati; Prof. Leo. Lesquereux of Columbus, Ohio; Dr. Robert Peter of Lexington, Ky.; Prof. Daniel Kirkwood of Bloomington, Ind.; Chicago Historical Society; Prof. Henry S. Frieze of Ann Arbor, Mich.; State Historical Society of Wisconsin; Kansas Historical Society.

Dr. Frederick S. Krauss, of Vienna, acknowledged the receipt of his separata; Academia Royale Danoise des Science et Lettres (117, 118, 119); Société de Physique et d'Histoire Naturelle, Geneva (115, 116); Sig. G. Battista Rossi of Rome, Italy (117, 118, 119); Mr. Robert N. Toppan, of Cambridge, Mass. (117, 118, 119, 120, 121, 122); Lieut. A. B. Wyckoff, Drs. Charles A. Oliver and J. W. Holland of Philadelphia (121, 122); Mr. Heber S. Thompson of Pottsville, Pa. (Diploma and 122); Rev. Thos. C. Porter of Easton, Pa. (121, 122).

Committee on Prof. Cope's paper was continued.

Lieut. Wyckoff read a paper on the Use of Oil in Storms at Sea.

Mr. Ashburner gave a review at some length of the structural geological features attending the occurrence of natural gas.

Nominations Nos. 1078 to 1106 and new nominations Nos. 1107 and 1108 were read.

The rough minutes were read, and the Society was adjourned by the presiding member.

Stated Meeting, April 19, 1886.

Present, 11 members.

President, Mr. FRALEY, in the Chair.

Dr. John H. Brinton, a newly-elected member, was presented to the Chair and took his seat.

Donations for the library were received from the following: The Royal Society of Tasmania; Prof. Serge Nikitin of St. Petersburg; Zoologische Anzeiger, Leipzig; Prof. G. vom Rath of Bonn; Würtembergische Vierteljahrshefte für Landesgeschichte; R. Nordiske Oldskrift Selskab, Copenhagen; Academie Royale de Belgique; R. Accademia dei Lincei, Rome; Société Toscana di Scienze Naturali; Institution Ethnographique, Paris; R. Academia de la Historia, Madrid; Royal Society, "Nature," and Mr. William Blades of London; Ronsdon Observatory, Devon; Cambridge Philosophical Society; Yorkshire Geological and Polytechnic Society; the publishers of "The Citizen" and Mr. Hamilton Andrews Hill of Boston; Rhode Island Historical Society; American Journal of Science, New Haven, Conn.; New York Shakespeare Society; Oneida Historical Society, Utica, N. Y.; Brooklyn Entomological Society; College of Pharmacy and Hydrographic Office, Philadelphia; Johns Hopkins University; Chief Signal Office, Census Office and Mr. J. H. Hickcox of Washington, D. C.; Elliott Society of Science and Arts, Charleston, S. C.; State Historical Society of Wisconsin; University of California; Mr. C. B. Bradley of Sacramento, Cal.; Imperial Observatorio da Rio de Janeiro; Mr. S. H. Scudder, Cambridge, Mass.; Mr. Henry Phillips, Jr., Philadelphia.

Letters of acknowledgment were received as follows: Rev. H. Clay Trumbull and Rev. Daniel R. Goodwin of Philadelphia; Mr. John Haines of Germantown; Maryland Historical Society; Mr. Charles V. Riley of Washington; Cincinnati Observatory; Universities of Tennessee and California; Mr. George Davidson of California (122); Royal Society of Victoria (116, 117, 118 and Register of Papers); R. Accademia dei Lincei and R. Istituto Lombardo (117–120); Royal Institution and Radcliffe Observatory (121); Society of Antiquaries of London (120, 121); Mr. Robert N. Toppan of Cambridge, Mass. (119); Oneida Historical Society (96–122 and miscellaneous pamphlets).

Letters of envoy were received as follows: Oneida Historical Society, Utica, N. Y., and the Chief Signal Officer, U. S. Army, Washington, D. C.

Photographs were received for the Society's Album from Charles V. Riley of Washington, D. C., and Dr. Traill Green of Easton, Pa.

The death of John Welsh was announced as having taken place at Philadelphia on the 10th day of April, 1886, in the 82d year of his age, and on motion the President was authorized to appoint a suitable person to prepare an obituary notice.

The Committee on Prof. Cope's paper was continued.

Pending nominations Nos. 1081 to 1108, and new nominations Nos. 1109, 1110, 1111, were read, and the Society was adjourned by the President.

Stated Meeting, May 7, 1886.

Present, 4 members.

Mr. Law, in the Chair.

Donations were announced to the library from the following sources: Mining Department, Melbourne; Physical Central-Observatorium, St. Petersburg; K. K. Geologische Reichsanstalt, K. K. Zoologisch-Botanische Gesellschaft, K. K. Central Anstalt für Meteorologie und Erd-Magnetismus, Vienna; Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Munich; Prof. Dr. G. D. E. Weyer of Kiel; K. P. Akademie der Wissenschaften, Berlin; K. Gesellschaft der Wissenschaften, Göttingen; Naturwissenschaftliche Gesellschaft, St. Gallen; Académie Royale de Copenhagen; Statistika Central Byrån, Stockholm; Académie Royale des Sciences, &c., Bruxelles; Société de Geographie, Société Americaine de France, Institution Ethnographique and Prof. Léon de Rosny of Paris; Instituto y Observatorio de Marina, San Fernando; R. Biblioteca Nazionale Centrale di Firenze; Cav. Damiano Muoni of Milan; Royal Society, Royal Institution, Zoölogical Society, Royal Astronomical and Geographical Societies, "Nature," Journal of Forestry of London; Manitoba Historical Society; Canadian Record of Science, Montreal; American Academy of Arts and Sciences, Massachusetts Historical Society, Boston; Essex Institute; Yale College, American Journal of Science, New Haven; Meteorological Observatory and New York Academy of Sciences; Brooklyn Entomological Society; Buffalo Historical Society; Geological Survey of New Jersey; Franklin Institute, American Pharmaceutical Association, Board of Directors of City Trusts, Hydrographic Office, Mr. Henry Phillips, Jr. and the publishers of The American Naturalist, Philadelphia; Board of Commissioners of Public Charities of Pennsylvania, Harrisburg; Prof. Ira Remsen, Johns Hopkins University, and The American Journal of Archæology, Baltimore; Department of State and War Department, Washington; Messrs. A. C. McClurg & Co., Chicago; University of Michigan.

Letters of acknowledgment were received from the K. Danske Videnskabernes Selskab, Copenhagen (116 and Register of Papers); Lackawanna Institute of History and Science (117, 118, 119, 120, 121, Cat. Parts 1, 2, 3, 4); South Kensington Museum, Cambridge Philosophical Society, and University Library, Prof. Geikie (121); Dr. J. T. Rothrock and Prof. L. M. Haupt of Philadelphia (122); Zoological

Society of London (120, 121); Institut Canadien-Français, and the Manitoba Historical Society, Canadian Institute (121, 122); Annales des Mines, Paris (Trans. XIV, 2).

Prof. Cope requested permission to withdraw the paper offered by him for the Transactions on February 5, 1886, which on motion was granted and the paper was presented by him for the Proceedings.

On motion the Committee on same appointed February 5, 1886, was discharged.

Prof. Cope offered for the Transactions "A systematic catalogue of the Vertebrata found in the beds of the Permian Epoch in North America," which was referred to a Committee to be appointed by the President.

Dr. A. S. Gatschet of Washington, presented through the Secretaries a paper on The Beothuk Language (second paper); with a vocabulary.

Pending nominations Nos. 1081 to 1111 were read.

Dr. Frazer exhibited the map to accompany his Geology of York County, Pa., stating the colors were in accordance with the new International method of the late Geological Congress at Berlin. Dr. Frazer also exhibited a plate to accompany his paper on the application of Composite Photography to handwriting.

On motion the appropriation for the map was increased to $60 and that for the photographic plate to $56.

And the Society was adjourned by the presiding member.

Stated Meeting, May 21, 1886.

Present, 37 members.

President Fraley in the Chair.

Donations to the library were received from the following: Geological Survey, of India; Naturwissenschaftlicher Verein, Bremen; Flora Batava, Leyden; Académie R de Belgique;

Société R. des Sciences de Liège; R. Accademia dei Lincei, Rome; R. Biblioteca Nazionale Centrale di Firenze, and Mr. Alessandro Chapelli; Institution Ethnographique, Paris; Royal Society, Royal Geographical Society, Meteorological Council, "The Asclepiad," "Nature," of London; and Sir Lowthian Bell, Prof. C. Piazzi Smyth, of Edinburgh; Boston Society of Natural History, Museum of Comparative Zoölogy, Cambridge; Free Public Library of New Bedford; American Chemical Society, New York; Historical Society of Pennsylvania, Zoölogical Society of Philadelphia, Engineers' Club, Fairmount Park Association, University of Pennsylvania, College of Pharmacy, Charles A. Oliver, M.D., Hon. Richard Vaux, Henry Phillips, Jr., and Prof. Edward V. d'Invilliers, of Philadelphia; Johns Hopkins University and Chemical Journal, Baltimore; U. S. Naval Institute, Smithsonian Institution; Col. Charles C. Jones of Augusta, Ga., and the Iowa State Historical Society.

Letters of envoy were received from R. Instituto di Studi Superiori in Firenze, and the Meteorological Office, London.

Letters of acknowledgment were read from K. K. Central-Anstalt für Meteorologie und Erdmagnetismus (120); Fondation de P. Teyler van der Hulst (120, 121); Prof. W. P. Blake, of New Haven (122).

Notice was received from "The Young Men's Association" and "The Young Men's Library," that they had consolidated, and changed their name to "The Buffalo Library."

On motion, the *Biblioteca Nazionale Centrale, Firenze, Italia*, was placed on the exchange list and ordered to receive the Proceedings of the Society from No. 121.

A letter accepting membership was read from Dr. Edward Pepper (Paris, May 7, 1886).

Prof. Cope presented for the Proceedings "An Analytical Table of the Genera of Snakes." He requested a plate for his paper on Amphiuma, which the Society ordered at an estimated cost.

Prof. T. B. Stowell presented through the Secretaries a paper on the "Trigeminus Nerve in the Domestic Cat," accompanied by a plate; on motion the Secretaries were empowered to act on the application.

The President announced that he had appointed as a Committee on the paper of Prof. Cope, presented at the last meeting, Messrs. Allen, Jayne and Horn, who reported the paper worthy of publication, which was ordered by the Society.

The President reported that he had received and handed over to the Treasurer $129.33, the amount of the Michaux rentes due on the first of April, 1886.

The proceedings of the Board of Officers and Council were submitted together with the following resolution recommended by it:

"That the further consideration of the Report and the recommendations therein contained, which was referred to the Board of Officers and Council by resolution of the Society, March 5, 1886, be indefinitely postponed."

Dr. Frazer offered the following amendment to the resolution:

Resolved, That the Report of the Special Committee, appointed February 5, 1886, to examine, etc., etc., which has been referred to the Board of Officers and Council by resolution of the Society of March 5, 1886, be recommitted to the Special Committee just appointed with instructions to present it with such alterations and amendments as may seem desirable at the meeting of the Society on October 15, 1886.

A point of order was taken and it was decided by the President that a motion to postpone was entitled to precedence. And the question recurring on the resolution submitted by the Board, it was adopted by a vote of 26 yeas to 11 nays, the yeas and nays being demanded by Dr. Frazer.

This being the evening for the balloting for candidates for membership, the following gentlemen were declared duly elected members of the Society:

2073. Samuel W. Pennypacker, Philadelphia.
2074. John T. Napier, Philadelphia.
2075. William Spohn Baker, Philadelphia.
2076. Benjamin Sharp, M. D., Philadelphia.
2077. Henry Reed, Philadelphia.

2078. John Marshall, M. D., Philadelphia.
2079. Merrill Edwards Gates, New Brunswick, N. J.
2080. William K. Brooks, Baltimore, Md.
2081. Herbert B. Adams, Baltimore, Md.
2082. R. Somers Hayes, St. Louis, Mo.
2083. John C. Branner, Bloomington, Ind.
2084. Abel Hovelacque, Paris, France.
2085. Emil Levasseur, Paris, France.
2086. Victor Duruy, Paris, France.
2087. Marquis de Nadaillac, Paris, France.
2088. Francis Pulzsky, Buda-Pesth.
2089. Otto Donner, Helsingfors.
2090. Angelo de Gubernatis, Florence, Italy.
2091. Paul Albrecht, Bruxelles.
2092. Josef Szombathy, Vienna.
2093. Dionysius Stuer, Vienna.
2094. Edward Suess, Vienna.
2095. Aristides Brezina, Vienna.
2096. W. W. Skeat, Cambridge, England.
2097. J. P. Postgate, Cambridge, England.
2098. Richard C. Temple, Ambala, India.
2099. Lord Rayleigh, London.
2100. William Crookes, London.
2101. Francis Galton, London.
2102. Duke of Argyll, London.
2103. Jesus Sanchez, Mexico.
2104. Antonio Peñafiel, Mexico.

And the Society was adjourned at 10 o'clock by the President.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

ERRATUM.

Page 456, line 22, for *just* read *first.*

[illegible] tions which otherwise would be obscure, it is none the less true that morphology must precede physiology ; knowledge of structure forms the basis of knowledge of function. It may be added that human physiology, so called, is almost entirely comparative physiology ; isolated experiments, independent of those performed upon animals exclusive of man, cannot establish law.

The influence of the nervous system upon function, and the complexity of physiological experimentation arising from this cause, are familiar to every laboratory student of this subject.

These considerations are a sufficient apology for the present "Study of Nervus Trigeminus" as a contribution to comparative neurology.

Reasons for the selection of the domestic cat have been stated elsewhere (Anatomical Technology, p. 55, v. Bibliography, **33**). The study of N. Vagus (The Vagus Nerve in the Domestic Cat, **27**) and the present study cannot fail to convince that in general plan, and even in detail of structure and distribution, the nervous system of the cat forms a desirable basis for comparative neurology, and possesses special advantages as a preliminary to anthropotomic neurology.

The writer is not aware that any one has published the details of the distribution of the trigeminus nerve in the domestic cat. He regrets that he has not been able to obtain Swan's work (**29**), in which are described the cranial nerves of the jaguar.

He cannot reconcile the wide discrepancy between the origin, distribu-

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXIII. DECEMBER, 1886. NO. 124.

The Trigeminus Nerve in the Domestic Cat (Felis domestica).

By T. B. Stowell, Ph.D.

(*Read before the American Philosophical Society, May 21, 1886.*)

The importance of the study of comparative neurology may be argued from the standpoint of anatomy, physiology, pathology and biology.

The value attached to such study depends largely upon individual bias, arising from education or from the end to be served by such knowledge.

Admitting that physiology may determine or suggest anatomical relations which otherwise would be obscure, it is none the less true that morphology must precede physiology; knowledge of structure forms the basis of knowledge of function. It may be added that human physiology, so called, is almost entirely comparative physiology; isolated experiments, independent of those performed upon animals exclusive of man, cannot establish law.

The influence of the nervous system upon function, and the complexity of physiological experimentation arising from this cause, are familiar to every laboratory student of this subject.

These considerations are a sufficient apology for the present "Study of Nervus Trigeminus" as a contribution to comparative neurology.

Reasons for the selection of the domestic cat have been stated elsewhere (Anatomical Technology, p. 55, v. Bibliography, **33**). The study of N. Vagus (The Vagus Nerve in the Domestic Cat, **27**) and the present study cannot fail to convince that in general plan, and even in detail of structure and distribution, the nervous system of the cat forms a desirable basis for comparative neurology, and possesses special advantages as a preliminary to anthropotomic neurology.

The writer is not aware that any one has published the details of the distribution of the trigeminus nerve in the domestic cat. He regrets that he has not been able to obtain Swan's work (**29**), in which are described the cranial nerves of the jaguar.

He cannot reconcile the wide discrepancy between the origin, distribution, etc., of this nerve in American cats, and the origin, etc., as published by Mivart (**18**, p. 271).

The ectal origin has been described by Wilder (**33, 34**).

Most of this work was done in the anatomical laboratory of the Cornell University, where special facilities are afforded for original research.

Preparation: The cats were injected with the "starch injection mass" (Anatomical Technology, 2d ed., p. 140–141, **34**). Brains were dissected "recent" and "hardened in alcohol;" there are advantages peculiar to each for tracing the ultimate distribution of nerve-filaments. Dissections were verified from both kinds of specimens. For preliminary examination, it is suggested that the student begin at the foramina of exit and trace peripherad; this will avoid confusion in identification and the inadvertent severing of anastomotic filaments. A more thorough dissection can subsequently begin with any of the peripheral rami—*e. g.*, N. digastricus or N. auriculo-temporalis—and proceed centrad.

NERVUS TRIGEMINUS.

Synonymy: *Nervus trigeminus; N. divisus seu gustatorius; N. quintus, seu tremellus, seu mixtus, seu sympatheticus medius, seu sympathicus medius, seu anonymous, seu innominatus; Par trigeminum seu quintum nervorum cerebralium, seu trium funiculorum; Trifacial; The fifth pair of nerves.*

This nerve presents the following characters, viz:

General Characters: The constancy of its characters and the striking resemblance, even of details, to the human trigeminus; the size—it is the largest of the cranial nerves; the analogy to the spinal nerves—the origin and the double function refer this nerve to that class of cranial nerves which admits of ready comparison with the spinal nerves (this homology is incomplete, by reason of the unequal distribution of the sensory and the motor filaments); the two roots, the larger is ganglionic, the smaller is without ganglion; these root functions are sensory and motor respectively.

To the ganglionic or sensory division is referred the sensibility of the face, cheek, forehead, external ear (auris ectalis), pili tactiles, vibrissæ, eye (conjunctiva), teeth, lips, mouth, nose, dorsum of tongue; the non-ganglionic or motor division is distributed chiefly to the muscles of mastication; to these functions may be added the influence of this nerve upon the glands (parotid, submaxillary, sublingual, lachrymal, buccal (?)), and its undetermined action upon the middle ear.

There are several ganglionic masses ectad of the cranium which sustain intimate relations with this nerve. Each of these ganglia seems to communicate with a motor, a sensory and a sympathic root or nerve, and thence to distribute filaments to structures more or less contiguous.

Physiological Characters:

1. Simple nerves of sensation.
2. Mixed or myelic nerves.

3. Nerves of common sensation with a specialized function and with motor filaments.

4. Nerves which directly or through their relation with N. sympathicus indirectly control or modify glandular secretion.

It is unsatisfactory to attempt to classify the function of N. tensor tympani and the filament to the tentorium cerebelli.

DESCRIPTION.

Origin: The study of the entocranial portions of the trigeminus nerve includes the description of the ental (deep) and the ectal (apparent) origins of both portions.

The ental origin has not been satisfactorily determined. Preliminary work based upon Mondino's Golgi's perchloride of mercury method (Journal of Royal Microscopical Society, N. S. V., Part 5, p. 904, 16) indicates a method for the solution of this difficult problem.

The method for tracing nerve-tracts in the brain and spinal cord as published in Brain, Vol. viii, p. 86, may prove serviceable in this connection.

The impracticability of positively establishing the relations of the two roots without serial transverse sections leaves the ental origin involved in obscurity; the following general relations, determined under a magnifying power of 15–20 diameters, may serve to indicate the wide-spread origin of this nerve, and also the necessity of making serial sections along a considerable portion of the neuron.

The fasciculi, by whose confluence the nerve-trunks are formed, may be designated the

Proximate roots: From morphological considerations alone it would be natural to treat this nerve as having two roots, the motor and the sensory.

Radix motoria: The motor root generally—not invariably—consists of two packets, the dorsal or cerebellar, and the ventral or epicœlian.

The fasciculi of the dorsal root often lie free of the pons, or they interdigitate with the pons; they may be traced along with medipeduncular fibres to the cerebellum; the motor root frequently contains fibres from the pons.

The larger or ventral root generally lies wholly free of the pons (some of its fibres may interdigitate with the pons). It forms the caudal border of the emarginate pons, and may be traced caudad of the prepeduncle to the floor of the epicœle, about 2 mm. laterad of the meson, at which point the fibres bend abruptly ventrad.

The two-fold origin of this root is suggestive of difference of function.

Radix sensoria: The sensory root seems to have a four-fold origin; these roots, by virtue of their course, may be named cephalic, dorsal, caudal and ventral roots respectively. *Rx. cephalica* may be traced with some radical fibres of the prepeduncle into the floor of the epicœle, and thence cephalad to the region of the preopticus.

Do not these fibres suggest an ental origin similar to the anthropotomic origin demonstrated by Meynert (**28**, p. 732 *et seq.*) and by Spitzka (**26**, The Central Tubular Grey, p. 72).?

Rx. dorsalis is apposed to the medipeduncle, and is traceable with it into the cerebellum.

Rx. caudalis extends parallel with the meson to a region of the metencephal just entad of the olive.

This considerable fascicle points to an ental origin several mm. caudad of a transection through the caudal border of the pons, and in the region of the olive.

Rx. ventralis: The fourth radicule comes from the epicœle in the same region as the ventral root of Rx. motoria; its course is laterad, and lies caudad of the medipeduncle, and ventrad of the medipeduncle and prepeduncle.

Ectal Origin: There is some variation in the ectal origins of this nerve in different animals. This variation may be referred to the variation in general configuration of the brain, and does not prevent homologization.

"When the pons is less developed than in man, the nerve (trigeminus) is attached behind (caudad of) that part between it and the trapezium of the medulla oblongata" (**30**, Vol. ii, 270).

Wilder summarizes as follows: "In the cat the nerve is always nearer the caudal than the cephalic border of the pons." "Sometimes the entire nerve passes just caudad of the pons, which is then usually somewhat emarginate at that point." "Sometimes, perhaps more often, some of the fibres of the nerve interdigitate with those which form the caudal margin of the pons" (**33**).

As already indicated, the proximate roots by their confluence form two nerves with distinct ectal origins, but which are intimately related in their distribution.

Radix motoria (Rx. mtr.), the smaller of these nerves, lies upon the mesal border of Rx. sensoria. It is a slender ribbon-like packet composed of 6–9 funiculi; it sustains this general relation for about 5 mm.; near the cephalic border of the pons it crosses the ventral surface of a large flattened ganglion, G. gasseri, q. v., and finds its exit with N. mandibularis through the oval foramen. Its distribution is given with N. mandibularis.

Radix sensoria (Rx. sn.), the larger and ganglionic nerve, takes its ectal origin from the proximate roots which lie chiefly caudad of the pons. The caudal border of the nerve is not infrequently in a line with the caudal border of the pons, but this relation is occasioned by the emarginate border of the pons against which the nerve-trunk rests.

In the examination of the brains of *Felis leo* and *F. concolor* (one of each) and *F. domestica* (a large number), in the museum of Cornell University, I have not found a single instance in which any fibre of the pons passes wholly caudad of the trigeminus. Only a few of the fibres of the cephalic border of Rx. sensoria ever interdigitate with the pons, and this condition does not exist in the majority of brains examined. In some of the brains hardened in alcohol a few filaments from the pons seem to be continuous with Rx. sensoria. In injected brains the sensory root is separated from the motor by an arteriole, a small twig from A. basilaris inferior.

In one instance a fascicle from the trapezium crossed the base of the trigeminus in such relation as to be easily mistaken for fibre from the pons The emargination of the pons may have led to a misconception of the freedom of origin of this root. In one case cited by Wilder (unpublished) a fascicle from the cephalic surface of the sensory root passed centrad near the middle of the pons.

Summary—Ectal Origin: 1. Fibres of the pons are found caudad of the lateral and cephalic moiety of the motor root.

2. Sometimes the motor root is entirely free of the pons.

3. The entire motor root never penetrates the pons.

4. The sensory root never penetrates the pons.

GANGLION GASSERI.

Synonymy: *Ganglion gasseri; Ganglium gasseri; G. gasserianum; G. semilunare; Moles gangliformis; Intumescentia gangliformis seu semilunaris; Tænia nervosa Halleri; Ganglion of the fifth nerve*, etc.

Description (Fig. G.): At the cephalic border of the pons the sensory root is involved in a large flattened ganglion; this ganglion is lodged in the fossa upon the dorsal surface of the basi-sphenoid bone caudad of the foramen ovale, Fm. rotundum and Fm. lacerum anterius; the lateral angle is covered by the ventral wing of the osseous tentorium; the tentorium cerebelli is intimately related with the dorsum of G. gasseri, and is with difficulty separated from it. The ganglion is a flattened, irregular body 8 mm. long by 4 mm. wide; the cephalic border is trichotomous, and gives origin to the principal rami of the sensory root; the mesal border is nearly straight, and is in contact with the processus clinoideus; the lateral border is crescentic, and is characterized by a peculiar enlargement at its caudal extremity; this eminence is the origin of the first rami of the trigeminus; one ramus (Pe) enters the hiatus Fallopii, and gives origin to several funiculi, by which it is related with the facial nerve through three canals in the petrous portion of the temporal bone, and also with the glosso-pharyngeal and vagus nerves (through foramen jugulare). From the lateral angle of the eminence a filament (Tn) is given to the tentorium cerebelli; it lies apposed to the petrosal ramus ectad of the facial nerve.*

Upon its ventral surface G. gasseri is in relation with the motor root, and also with the large petrosal nerve which proceeds from the geniculate ganglion (this nerve follows the aqueductus fallopii, emerges from the hiatus fallopii, crosses G. gasseri and joins the vidian nerve just centrad of the vidian canal).

* This can be best demonstrated by exposing the base of the brain, by the removal of the basioccipital and basisphenoid bones, and then with nippers and arthrotome (34, pp. 63. 66), gradually removing the petrous portion of the temporal bone. This will expose the tortuous canal with the included nerves.

The mesal border of G. gasseri is contiguous with the oculomotorius (iii) upon its venter, and with the trochlearis (iv) upon the dorsum. The cephalic border is involved more or less in a dense rete arteriale from A. carotidea externa, and receives filaments from the adjacent plexus sympathicus carotideus.

ECTOCRANIAL RAMI.

Ectad of the cranium the trigeminus is represented by three nerve-trunks and their respective rami. These trunks may be regarded as offsets of the Gasserian ganglion ; they leave the cranium by distinct foramina. By virtue of distribution, they are named N. mandibularis, N. maxillaris and N. ophthalmicus. (Fig. Man. Mx. Oph.)

NERVUS MANDIBULARIS.

Synonymy: *N. mandibularis ; Inferior maxillary branch ; Mandibular nerve.*

General Characters: This is the lateral ramus of the trigeminus ; it is also the largest and widest in distribution. The motor root (Rx. motoria) is given exclusively to this trunk just pheripherad of the Gasserian ganglion—hence its varied character and two-fold function. It supplies sensory and motor structures and glandular organs. Its rami are distributed to the integument of the ear, the cheek and the chin ; to the vibrissæ, the labial papillæ, the teeth and gums of the mandible, the sensory organs upon the dorsum of the tongue ; to the muscles of mastication and to the salivary glands.

Special Description: N. mandibularis is the lateral offset of the Gasserian ganglion ; just peripherad of the ganglion it is joined by the motor root (Rx. mtr.) of the trigeminus ; peripherad of this union the motor and the sensory fibres require physiological rather than morphological identification ; its foramen of exit is the foramen ovale ; peripherad of the cranium the trunk divides into six or more rami, which require separate descriptions :

N. temporo-auricularis: *Superficial temporal ; temporal cutaneous.*

Origin: This nerve takes its ectal origin at the foramen ovale ; it is the lateral ramus of the nerve-trunk. (Fig. Tmp. aur.)

Course: It is first directed ventro-laterad, entad of the muscles and the A. carotidea externa ; it lies close to the zygomatic process ; at the ventrad border of the process it bends dorsad over the process, and lies caudad of the A. temporalis externa and entad of the submaxillary and the parotid glands. The general course is toward the cephalic border of the external ear (auris ectalis). Entad of the parotid gland it divides into two principal rami, which, by reason of general direction, are designated cephalic and caudal.

Communicating Rami and Relations: Just caudad of the zygomatic process this trunk gives a small twig to the mandibular articulation ; it sustains relations with the otic ganglion by a slender fascicle which may be regarded as the root, or one of the roots, of the ganglion ; it also joins the facial nerve, and gives filaments to the base of the ear (cartilago auditorius). Dorsad of the meatus auditorius the auriculo-temporal nerve lies entad of the parotid gland ; in this region its course is entad of the facial nerve, with which nerve it assumes plexiform relations (Fig. Tmp. Fac.). A. temporalis lies between N. tmp. aur. and N. tmp. fac.; ramuli (N. N. parotidei) enter the substance of the gland (Gl. par.). Near the middle of the gland the auriculo-temporal nerve divides into cephalic and caudal rami (Fig.).

N. tmp. aur. cephalicus becomes a distinct nerve at the cephalo-dorsal angle of the parotid gland. Its course is toward the eye until it reaches the zygomatic border of the masseter muscle, when it follows the border of the muscle to the angle of the mouth. It anastomoses freely with N. temporo-facialis (Fig. Tmp. fac.), which lies upon the ectal surface of the masseter muscle just dorsad of the Stenon's duct, and terminates in the plexus at the angle of the mouth, plexus labialis (Pl. lab.). It sends filaments to the integument between the eye and the base of the ear (auris ectalis), to the cheek ventrad of the eye, to the vibrissæ, the dorsal lip, and to the papillæ on the ental surface of the lip and to the mucosa in the region of the premolar teeth (Fig. p. m.).

N. tmp. aur. caudalis is distributed chiefly to the external ear ; it may be traced with the terminal arterioles of A. temporalis, along the cephalic border of the ear ; terminal filaments are given to the long hairs which line the helix (Fig. Pili) ; a considerable ramulus enters the meatus near the tragus (tr.), and descending centrad supplies the external meatus ; other filaments are distributed to the frontal region. A small twig from the caudal border of this ramus just peripherad of the bifurcation of N. tmp. aur. anastomoses with the facial and terminates in the ventro-lateral border of the ectal ear and the hairs (Pili) between the lateral pocket and the tragus. This nerve does not appear to supply the dorsal surface of the external ear.

N. massetericus has its origin at the foramen ovale from the dorsum of the mandibular nerve (Fig. Mass.), in common with N. temporalis internus (Tmp. int.) ; 2 mm. peripherad of the common origin, this nerve becomes a distinct ramus ; its course is dorsad for 8–10 mm., when it penetrates the masseter muscle and is directed to the caudal border of the malar muscle. Along its dorsal border it gives off 6–10 ramuli to terminate in the masseter muscle.

N. temporalis internus: The deep temporal has a common origin with the masseter, q. v. About 5 mm. peripherad of the origin an anastomotic filament connects these rami. The course of N. tmp. int. is dorsad and mesad of the temporal artery ; it is therefore concealed by the artery when viewed from the side. About 8 mm. from its origin the ramus divides into cephalic and caudal ramuli (Fig.) ; these supply the fan-shaped temporal muscle ; the length of the caudal ramulus is 45–50 mm.

N. pterygoideus externus: This small nerve has its origin from the mesal border of the mandibular nerve (Fig. Pter. ext.) : about 2 mm. from its origin it separates into three rami, which may be traced 8–10 mm. and then penetrate the pterygoid muscle, upon which muscle its terminal filaments ramify.

N. buccalis is a large nerve which separates from the mesal border of the mandibular nerve (Fig. Buccalis) just ventrad of the deep temporal The first 5 mm. of its course is involved in the dense rete of the carotid artery ; its direction is toward the caudal angle of the maxilla ; it is apposed to the buccal artery, and lies between the pterygoid and the temporal muscles. It gives filaments to the mucosa of the mouth (Fig.), a few filaments to the malar border of the masseter muscle, and at the angle of the mouth it joins the plexus already named—Plexus labialis (Pl. lab.).

N. dentalis inferior together with N. lingualis form the principal rami or continuation of the mandibular nerve. It becomes a distinct nerve about 5 mm. peripherad of the foramen ovale. It lies ectad of the pterygoid muscle, and enters the foramen infradentale with the mandibular artery. It lies along the dental canal ventrad of the artery, and gives filaments to the teeth (Fig. m., p. m., canine, incis.) and to the cancellous interior of the mandible ; a considerable fascicle continues peripherad through the mental foramen (Fm. men.); the terminal filaments anastomose with filaments of its platetrope.

N. mentalis is the continuation of the dental nerve peripherad of the mental foramen ; it divides into several fasciculi, which anastomose in plexiform relations upon the ventral lip, the chin and the mucosa of the mandible. (N. digastricus and N. mylo-hyoideus join this plexus.)

N. mylo-hyoideus is given from the mandibular nerve about 10 mm. centrad of the infra-dental foramen ; its course is apposed to the facial artery ; it lies entad of the artery as it crosses the mandible. Ventrad of the mandible it gives an anastomotic filament to the facial ; it continues 1–2 mm. mesad of the submental artery, and, following its arterioles, is distributed to the mylo-hyoid muscle.

N. digastricus is a branch of the mylo-hyoid, or it may be regarded as a branch of the mandibular nerve peripherad of the point where the mylo-hyoid nerve lies ventrad of the mandible. About 3–4 mm. peripherad of this origin it divides into cephalic and caudal rami (Fig.). The *cephalic ramus* is apposed to the submental artery, supplies the distal half of the digastric muscle, and terminates in plexiform relations with the mental nerve ; the *caudal ramus* follows the digastric artery caudad about 10 mm., and supplies the digastric muscle as far as the angle of the mandible.

N. lingualis has a common origin with the dental nerve ; 5 mm. peripherad of the foramen ovale it takes a distinct course mesad of the dental nerve ; it lies ectad of the pterygoid muscle, apposed to a small arteriole just entad of the carotid and the dental arteries ; 15 mm. peripherad of its origin it takes three courses :

(1) The cephalic ramus, N. pharyngeus (Phar.), is distributed to the

pharyngeal mucosa and along the ental surface of the mandible to the symphysis.

(2) The middle ramus, the trunk proper, bends around the lateral border of the tongue, and enters its substance with the lingual artery 30 mm. proximad of the tip.

(3) The caudal ramus enters the lingual muscle with the lingual artery about 25 mm. caudad of the tip ; this nerve seems to supply the muscle-fibre.

The middle and caudal rami assume plexiform relations ; their numerous filaments generally accompany ramifying and anastomosing arterioles, and may be traced to the dorsum of the tongue ; the caudal ramus sustains plexiform relations with the hypoglossal nerve. (XII.)

The lingual receives a considerable accession from the facial nerve, the chorda tympani (Fig. Chorda).

N. submaxillaris: Just mesad of the origin of the digastric artery this branch separates from the lingual nerve ; it lies ectad of the artery apposed to Wharton's duct, which it freely supplies, and continues dorsad into the substance of the sublingual and submaxillary glands ; it terminates in a small ganglionic mass, G. submaxillare (G. S. max.), near the origin of Wharton's duct. From this ganglion filaments may be traced to the substance of the gland.

Chorda tympani: This nerve is an anastomotic branch between the lingual and the facial. Its physiological action upon salivation, as well as its tortuous course, gives to it a special interest. It separates from the facial as this nerve emerges from the cranium at the ganglion geniculatum (intumescentia gangliformis) ; it returns a short distance in the canal of the nerve trunk, and enters a canal in the bulla ; it penetrates the bulla, which it crosses dorsad, and enters the tympanum through a small foramen, iter chordæ posterius ; it crosses the tympanum about the middle of the malleus, somewhat mesad of the bone, and emerges through a minute foramen, iter chordæ anterius, or the canal of Huguier, into the Glaserian (?) fossa, thence along the canal to the ectocranial foramen ; as it emerges from the cranium it lies ventrad of the carotid and the pterygoid arteries and ectad of the pterygoid muscle ; it joins the lingual nerve 5–10 mm. peripherad of the foramen ovale.

N. pterygoideus internus has a common origin with N. tensor tympani from the lateral border of the mandibular nerve just ventrad of the auriculo-temporal nerve (Fig. Pter. int.). It lies parallel with the lingual nerve for 5 mm. ; it crosses the cephalic border of the external carotid artery, and accompanies the pterygoid artery ; its course is entad of the chorda tympani, and supplies the distal portion of the pterygoid muscle.

N. tensor tympani: As the common nerve (V. supra) crosses the cephalic border of the carotid artery, N. tensor tympani (Fig. Ten. tym.) separates and bends around the ventral border of the artery, enters the otic ganglion, thence lies in the Glaserian fissure and terminates upon the spherical tensor tympani muscle. This nerve does not seem to be incorporated with the ganglion.

G. oticum: *Otoganglium; G. auriculare; Auricular ganglion, Ganglion of Arnold*, etc. (Fig. Otic.)

Upon the tensor tympani nerve just dorsad of the carotid artery, at the hiatus fallopii, is a small pinkish ganglion, oval in outline, about 2 mm. in long diameter. It is related by anastomotic filaments with the sympathic plexus (Sym.) around the carotid artery; with the auriculo-temporal nerve by a twig dorsad of the carotid artery (Fig. root); the artery appears to pass between the two roots (?) of the nerve, the ganglion being at their confluence. Two slender fascicles from the otic ganglion enter the hiatus fallopii and join the facial nerve. (Fig. Pe.)

NERVUS MAXILLARIS.

General Description: This is the middle ramus of the trigeminus; it is intermediate in size between the other rami; its course is immediately cephalad from the Gasserian ganglion through the foramen rotundum, the foramen of exit. The ectocranial trunk crosses the spheno-palatine space, lies along the infraorbital fossa, and penetrates the infraorbital foramen. In its course it is dorsad of the maxillary artery. The length of the trunk from the ganglion Gasseri to the foramen infra-orbitale is about 40 mm.

It supplies the integument of the forehead, cheek, dorsal lip, side of the nose; the vibrissæ, conjunctiva, lachrymal gland, maxillary teeth, palate, pharynx, and the membrane over the turbinated bones.

Detailed Description and Rami: N. maxillaris (Fig.), at the foramen of exit, is about 2 mm. in diameter; at its ganglionic origin, G. gasseri, it is somewhat intumescent; upon the ventral surface of this enlargement it receives a considerable filament from the large superficial petrosal of the facial. This anastomotic filament lies obliquely across the ventral surface of the Gasserian ganglion, and penetrates the rete carotideum to reach the nerve. The central 5 mm. of its ectocranial course is involved in a dense rete of the carotid artery and the carotid plexus, from which plexus it seems to receive filaments. The distribution of the nerve is given in the description of the rami.

N. orbitalis (Fig.) is the first ramus of the ectocranial trunk, and is given off at the foramen of exit; its course is dorsad, and extends about 2 mm., being involved throughout its course in the rete already described; it is the common origin of N. temporalis and N. malaris, q. v.

N. temporalis (Fig. Tmp.) is the caudal ramus of the orbital nerve; its general course is toward the post-orbicular process (processus post orbicularis); 2–5 mm. peripherad of its origin it divides into cephalic and caudal rami.

R. cephalicus (Fig. Tmp. ce.), the larger ramulus, passes ventrad of the post-orbicular process, and is distributed to the conjunctiva and integument of the dorsal lid, and to the lachrymal gland; it sustains anastomotic relations with the palpebral nerve.

R. caudalis (Fig. Tmp. ca.), a small ramulus, passes caudad of the process, bends caudad, and terminates in the integument over the forehead ; it anastomoses with the auriculo-temporal nerve.

N. malaris is the lateral ramus of the orbital ; its course is direct to the malar foramen (a small foramen in the malar bone just dorsad of the cephalic end of the zygomatic process) ; it penetrates this foramen, lies in a groove entad of the orbicular muscle, which it perforates near the angle of the eye, and is distributed to the ventral lid and cheek over the malar bone (this is the subcutaneous malar nerve of anthropotomy) ; its terminal filaments reach the labial plexus.

N. palatinus cephalicus (Fig. Plt. ce.) : About the middle of the rete carotideum three rami are detached from the ventral surface of the maxillary nerve ; these remain in the sheath for several mm. The cephalic ramus (Fig. Plt. ce.) lies ventrad of the palatine artery and enters the palatine foramen (the dorsal end of the posterior palatine canal) ; it sends an anastomotic filament to N. palatinus caudalis (Fig. Plt.). Just centrad of the palatine foramen (Fig. Fm. plt. p.) a large accession is received from the spheno-palatine ganglion (Sph.).

(In some cases a fascicle from this nerve enters a small foramen just caudad of the posterior palatine foramen, and, following a canal in the palatine bone, joins the nerve at the posterior palatine foramen). Peripherad of this foramen (Fm. plt. p.) the nerve lies close to the hard palate, and joins the naso-palatine nerve at the anterior palatine foramen (Fm. plt. a.) ; it sends numerous filaments to the rugæ upon the roof of the mouth and to the adjacent mucosa.

G. spheno-palatinum (Sph.), *Ganglion of Meckel:* This ganglion is located just caudad of the palatine and the spheno-palatine foramina ; its cephalic angles or prolongations enter these foramina (Fig.) : it is flesh-colored, 6 mm. × 2 mm., flattened, irregular in outline, the mesal border slightly concave ; the lateral border is irregular by reason of the attachment of nerves ; its roots are two large rami (N. N. sph. plt. Fig. root) of the maxillary nerve, which take origin just peripherad of the cephalic palatine nerve, and are included in the common sheath with that nerve for 2–4 mm. ; the roots are inserted into the lateral angle of the ganglion about 1 mm. apart.

Relations: This ganglion (Sph.) is related with the maxillary nerve by two roots ; with the carotid plexus (N. sympathicus) by two filaments (Sym.) from the caudal border between the roots and the vidian nerve ; with the cephalic palatine by a large fascicle from the cephalo-lateral angle. It is the origin of the naso-palatine nerve (N. plt.) at the spheno-palatine foramen ; the origin of N. pharyngeus near the vidian nerve ; of N. palatinus caudalis at the lateral border caudad of the palatine foramen, and of N. vidianus at the meso-caudal angle.

N. palatinus caudalis (posterior) : This nerve (Fig. Plt.) takes its origin from the lateral border of the spheno-palatine ganglion just centrad of the palatine foramen ; its course is ventrad and caudad ; 2–5 mm. from the ganglion it divides into two ramuli, the shorter of which (Fig. cephalic) is distributed to the roof of the mouth caudad of the rugæ; the longer (Fig. caudal) bends caudad and supplies the soft palate to its caudal border; the caudal ramulus receives an anastomotic twig from N. palatinus cephalicus.

N. pharyngeus, a small nerve, has its origin from the spheno-palatine ganglion at the origin of the vidian nerve (possibly the nerve is an offset of N. vidianus); it supplies the pharyngeal mucosa (not shown in the diagram).

N. naso-palatinus is the principal offset of the spheno-palatine ganglion cephalad; it enters the spheno-palatine foramen (Fm. Sph.), lies upon the floor of the nares, passes ventrad through the anterior palatine foramen (Fm. plt. a.), and anastomoses with the cephalic palatine nerve (Plt. ce.). Numerous filaments from this nerve are traced in plexiform relation upon the membrane which covers the turbinated bones and the floor of the nares.

N. N. dentales caudales: Dorsad of the caudal angle of the maxillary bone a single filament is given off which penetrates the alveolus and supplies the molar tooth (Fig. m.); just cephalad, two considerable fasciculi (Dent. ca.) separate, lie along the infraorbital fossa, penetrate small foramina in the bone and terminate in the premolar teeth (Fig. p. m.); these dental nerves anastomose freely before they penetrate the bone, and also sustain a similar relation throughout the cancellous tissue of the alveoli; filaments of these ramuli join the cephalic dental nerve (dent. ce.).

N. dentalis cephalicus: Just caudad of the infraorbital foramen (Fig. Fm. inf. orb.) a considerable fascicle, N. dentalis cephalicus, penetrates the dental foramen (Fm. d.), together with an arteriole; it lies cephalomesad along a canal in the cancellous tissue of the maxillary bone, and gives nerve-supply to the canine tooth; it continues mesad until the terminal filaments anastomose with the nasal plexuses upon the turbinated bone in the region of the premaxilla. This nerve receives filaments from the caudal dental rami, and becomes considerably enlarged in the canal between the canine tooth and the foramen which leads to the prenares.

Is this enlargement the ganglion of Bochdalek? (Fig. B.)

N. infra-orbitalis is the continuation of the maxillary peripherad of the infra-orbital foramen (Inf. orb.). The nerve-trunk divides into a leash of terminal fasciculi.

N. labialis supplies the dorsal lip, the papillæ on its ental surface, the adjacent mucosa and the vibrissæ.

N. nasalis terminates upon the integument which covers the nasal cartilage.

N. palpebralis is distributed to the ventral lid and the conjunctiva as far mesad as the nasal duct.

N. lachrymalis takes a dorsal course around the orbit, and terminates in the lachrymal gland, where it anastomoses with the lachrymal nerve, an offset of the orbital (Tmp. ce.), q. v.

N. Vidianus is a ribbon-like offset of the meso-caudal angle of the spheno-palatine ganglion (Fig. Vidian); its course is caudad to the vidian canal. (The cephalic foramen of this canal is ventrad of the foramen lacerum anterius; the canal is 5–10 mm. in length. The caudal foramen opens upon the dorsum of the basi-sphenoid bone.) It lies along the canal, and at the caudal foramen the entocranial nerve lies ventrad of the Gasserian ganglion, and sends filaments to the eustachian tube, to the pharyngeal mucosa, and becomes N. petrosus superficialis major, which relates it to the facial nerve through a foramen in the petrous portion of the temporal bone.

At the cephalic end, near the spheno-palatine ganglion, two filaments are given to the ophthalmic nerve; the nerve is related with the maxillary through filaments which join the nerve-trunk just peripherad of the rete carotideum.

NERVUS OPHTHALMICUS.

General Description: N. ophthalmicus (Fig. Oph.) is the mesal offset of the Gasserian ganglion; it is the smallest of the three nerve-trunks which proceed from the ganglion. The entocranial relations are with the trochlear nerve, which rests upon its dorsal surface (a tracer is required to separate the sheaths of these nerves); sometimes—not invariably—these nerves are related by anastomotic filaments with the oculo-motorius (III) along its ventral surface, and with the carotid artery by the rete carotideum which involves the nerve-trunk. The foramen of exit is the foramen lacerum anterius. The ectocranial relations are described in the distribution of the two rami, N. frontalis and N. oculo-nasalis. It is distributed to the integument of the forehead, dorsal lid, side and end of the nose, to the pili tactiles, to the conjunctiva, the lacus lacbrymalis, and the membrane over the turbinated bones; to the trochlear and the ciliary muscles; to the lachrymal gland; to the dura mater. It communicates with the sympathic nerve. Its function is largely sensory.

Special Description: The central 5 mm. of the ecto-cranial trunk is involved in a dense rete carotideum; about 3 mm. peripherad of the foramen lacerum anterius the trunk divides into two rami, N. frontalis and N. oculo-nasalis.

N. frontalis is directed dorsi mesad, and bends around the caudal surface of the globe of the eye, lying ectad of the muscles; there are really two fasciculi in a common sheath; when upon the dorsi-meson of the globe the course is abruptly cephalad parallel with the meson to the musculus orbicularis palpebræ; before the nerve perforates the muscle, a considerable trunk, **N. supra trochlearis** (Fig. S-tro.), separates, and, following the supra-orbital ridge just entad of the fascia, it gives filaments to the dorsal lid, to the nasal duct, the angle of the eye (caruncula), and terminates upon the nasal integument; an anastomotic filament relates this ramus with the palpebral branch of the maxillary nerve. Peripherad of the point where N. frontalis pierces the orbicular muscle, it is known as

N. supra orbitalis (Fig. S-orb.). As this nerve crosses an arteriole 2–3 mm. peripherad of the muscle it divides into two terminal rami; the lateral ramus is directed laterad, and is given to the tactile hairs (Fig. Pili); the mesal ramus unites in plexiform relations with other rami over the forehead and the integument between the eyes. (I do not find a lachrymal branch to this nerve.)

N. oculo-nasalis (Fig. Nasalis) is the mesal ramus of the ophthalmic nerve; it is directed mesad upon the caudal surface of the globe; it lies entad of the rectus dorsalis muscle, ventrad of the ramus of the oculomotorius nerve (III.), which supplies the muscle, and dorsad of the optic nerve; it is apposed to the ophthalmic artery until it crosses the optic nerve; 8 mm. peripherad of origin at the lateral border of the rectus dorsalis muscle it sends 2–3 filaments (Rx. longa) 6 mm. long ventro-cephalad to join the ciliary nerve (these nerves are probably the radix longa ganglii ciliaris of anthropotomy). Just laterad of the optic nerve a considerable fascicle crosses the ophthalmic artery and rests upon the dorsum of the optic nerve; this is **N. ciliaris longus.** It gives 3–5 filaments to the short ciliary nerve (cil. br.); about 2 mm. centrad of the globe the nerve divides into 5–8 small fascicles, which perforate the sclerotic coat and lie along the ental surface of this tunic (I have not satisfactorily demonstrated the termination). Opposite the mesal border of the optic nerve several filaments are given to the plexus carotideus (sympathicus, Fig. Sym.). The nerve-trunk, the caudal ethmoid (Eth. ca.), lies ectad of the mesal rectus muscle and entad of the trochlear; it enters the foramen ethmoideum caudale (Fm. eth. ca.) (posterius), accompanied by the arteria ethmoidea caudalis; entad of the foramen, filaments of the nerve are distributed (1) dorsad to the dura mater which covers the olfactory lobes (Olf.); (2) ventrad to the hypophysis (Hy.); (3) cephalad to the ethmo-turbinated bone (Tur.); (4) mesad to join the platetrope (Plat.) in the meson, while the ramus (Fig. externus) continues in a canal or groove in the frontal and nasal bones just laterad of the meson to the nasal cartilage (Ctl. nasalis), where it terminates in plexiform relations with other ramuli of the trigeminus and facial nerves.

N. infra trochlearis: Upon the dorsal border of the mesal rectus muscle the largest branch separates as the infra-trochlear nerve (Inf. tro.); this rests upon the ectal surface of the muscle entad of the trochlear muscle, and is directed cephalad to the border of the globe; 8–10 mm. peripherad of the origin this nerve gives off a filament which remains in the common sheath for some distance, and is distributed to the trochlear muscle (M. tro.) laterad of the "pulley;" the main nerve lies ventrad of the pulley, and is distributed to the conjunctiva (Cnj.) of the dorsal lid, the angle of the eye (lacus lachrymalis) and the side of the nose; it sustains plexiform relations with terminal filaments of the supra-trochlear nerve (S. tro.); centrad of the pulley a filament from the infra-trochlear nerve, together with the arteria ethmoidea cephalica (anterior), enters the cephalic ethmoid foramen (Fm. eth. ce.), and terminates upon the membrane over the turbinated bones.

GANGLION OPHTHALMICUM.

Synonymy: *G. ophthalmicum; G. semilunare; G. ciliare.*

Description: This small pinkish ganglion (Fig. G. oph.) is somewhat triangular in outline; just mesad of the lateral rectus muscle it rests by its base upon the ramus of the oculo-motorius nerve (III), which supplies the ventral oblique muscle, about 1 mm. peripherad of the origin of the ramus (this ramus does not seem to be incorporated in the ganglion). From the apex of the ganglion three filaments are sent cephalad to the globe; these lie ventrad of the optic nerve, and sustain plexiform relations with the long ciliary nerve (ciliaris) before they perforate the sclerotic tunic mesad of the optic nerve.

N. ciliaris brevis: The principal offset (Cil. br.) of the ophthalmic ganglion takes its origin from the apex of the ganglion and rests upon the lateral surface of the optic nerve; 3 mm. peripherad of the ganglion, at the point of contact with the optic nerve, it receives two filaments (radix longa) from the oculo-nasal nerve, and one or more filaments from the carotid (sympathic) plexus; along the side of the optic nerve it sustains anastomotic relations with the radix longa; 2–4 mm. centrad of the globe this nerve splits into 8–12 filaments, which perforate the sclerotic tunic around the optic nerve and lie along its ental surface (cf. N. ciliaris longus).

SUMMARY.

A. ANATOMICAL.

1. **Origin**: (*a*) Ental; not demonstrated.
   (*b*) Proximate roots; from the mesencephal, the cerebellum, the floor of the epicœle and the metencephal.
   (*c*) Ectal; *sensory root*, caudad of the pons; cephalic fibres sometimes interdigitate with the caudal fibres of the pons.
   Motor root, near the caudal border of the pons, sometimes wholly free of it.
2. **Foramina of exit**: Fm. ovale; Fm. rotundum; Fm. lacerum anterius.
3. **Ganglia**: (*a*) Entocranial, G. gasseri, just centrad of the foramina of exit; upon the sensory root.
   (*b*) Ectocranial, G. oticum, in the Gasserian fossa; G. submaxillaris, in the submaxillary gland, near the origin of the Wharton's duct; G. spheno-palatinum, just caudad of the foramen palatinum and foramen spheno-palatinum; G. ophthalmicum, upon the oculo-motor nerve, between the lateral rectus muscle and the optic nerve.
4. **Relations of Ganglia**: (*a*) Entocranial; G. gasseri, with the facial through the petrosal nerve; with N. sympathicus through filaments to the carotid plexus.
   (*b*) Ectocranial; G. oticum, with the auriculo-temporal, the pterygoid (internal), the facial, the tensor tympani and the sympathic nerves; G. submaxillare, with the lingual nerve; G.

spheno-palatinum, with the spheno-palatine, the palatine, the vidian, the cephalic palatine and the naso-palatine nerves; G. ophthalmicum, with the oculo-motorius and the ciliary nerves.

5. **Principal Rami**: respective origins; distributions:

(*a*) **Nerve-trunks**: N. mandibularis at G. gasseri.
N. maxillaris at G. gasseri.
N. ophthalmicus at G. gasseri.

(*b*) **Rami of N. mandibularis**:

N. temporo-auricularis: The origin is at the oval foramen; the distribution is to the ectal ear, the cheek, the vibrissæ, the dorsal lip; anastomotic filaments are given to the facial nerve and to the labial plexus.

N. massetericus: The origin is at the oval foramen, the distribution is to the masseter muscle.

N. temporalis internus: The origin is common with the masseter nerve; the distribution is to the temporal muscle.

N. pterygoideus externus: The origin is at the oval foramen; the distribution is to the pterygoid muscle.

M. buccalis: The origin is at the oval foramen; the distribution is to the masseter muscle, the mucosa of the mouth and the labial plexus.

N. lingualis: The origin is common with the internal dental nerve at the oval foramen; the distribution is to the tongue, the mucosa of the mouth; it sustains commissural relations with the facial nerve through the chorda tympani, and with the hypo-glossal nerve; it gives off a pharyngeal nerve.

N. dentalis: The origin is common with the lingual; it is distributed to the mandibular teeth, to the chin; it becomes the mental nerve peripherad of the foramen mentale.

N. mylo-hyoides: The origin is common with the dental nerve; the distribution is to the mylo-hyoid muscle.

N. digastricus is a ramus of the mylo-hyoid; it is distributed to the digastric muscle.

N. pterygoideus internus: The origin is at the oval foramen; the distribution is to the pterygoid muscle.

N. tensor tympani has a common origin with the pterygoid, and is distributed to the tensor tympani muscle.

Chorda tympani is a commissural ramus from the lingual to the facial nerve.

(*c*) **Rami of N. maxillaris**:

N. orbitalis: The origin is at the round foramen; the distribution is to the dorsal lid, the lachrymal gland and the integument over the temple.

N. malaris: The origin is common with the orbital; the distribution is to the cheek, the dorsal lid and the labial plexus.

N. spheno-palatinus is a ramus from the maxillary nerve 5 mm. peripherad of the round foramen ; it is one of the roots of the spheno palatine ganglion.

N. palatinus cephalicus is a ramus of the maxillary nerve just peripherad of the spheno-palatine, and is distributed to the rugæ of the mouth and to the palate ; it also anastomoses with the naso-palatine nerve.

N. palatinus caudalis is an offset of the spheno-palatine ganglion, and is distributed to the soft palate and the rugæ of the mouth.

N. naso-palatinus is an offset of the same ganglion cephalad to the turbinated bones ; its terminal filaments anastomose with the cephalic palatine.

NN. dentales are given off from the maxillary nerve just dorsad of the alveoli, and, penetrating the bone, are distributed to the maxillary teeth.

N. nasalis, N. labialis, N. palpebralis, are terminal filaments of the maxillary nerve peripherad of the infra orbital foramen, and are distributed to the side of the nose, to the papillæ and to the integument of the dorsal lip, the vibrissæ, the labial plexus and the ventral lid.

N. vidianus is a commissural nerve from the spheno-palatine ganglion to the facial nerve through the petrosal nerve, N. petrosus superficialis major.

(*d*) **Rami of N. ophthalmicus:**

N. frontalis: The origin is at the foramen lacerum anterius ; the nerve becomes N. supra-orbitalis and N. supra-trochlearis ; it is distributed to the forehead, the tactile hairs, the dorsal lid, the conjunctiva, the lacus lachrymalis and the side of the nose.

N. oculo-nasalis: The origin is at the foramen lacerum anterius ; it becomes the infra-trochlear and the caudal ethmoid nerves.

N. ciliaris longus is a ramus at the border of the optic nerve ; its termination is not demonstrated.

N. ciliaris brevis is a ramus from the ophthalmic ganglion ; its termination is with the long ciliary nerve.

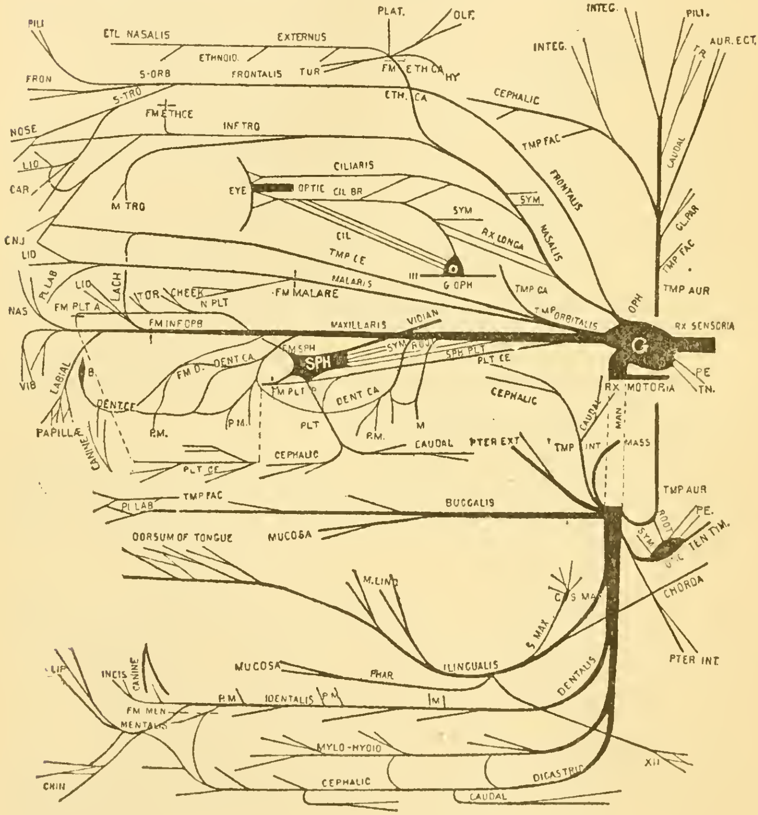
N. infra trochlearis, a ramus at the border of the mesal rectus muscle, is distributed to the trochlear muscle, the conjunctiva and the integument of the dorsal lid, the lacus lachrymalis and the side of the nose.

N. ethmoideus caudalis is the continuation of the trunk entad of the ethmoid foramen ; it is distributed to the dura mater, to the turbinated membrane ; it anastomoses with its platetrope, and becomes the *nervus externus*, which is given to the septum narium and to the nasal cartilage.

B. Physiological.

This nerve is chiefly sensory ; there are fibres from the motor root and from the sympathic ganglia ; it is a nerve of the special sense, taste ; it sustains peculiar relations to glandular secretion in the lachrymal and salivary glands.

The indirect relation of this nerve with the facial, the glosso-pharyngeal and the vagus may have a profound pathological signification.



EXPLANATION OF ABBREVIATIONS USED IN THE DIAGRAM.

No attempt has been made to draw the diagram to a scale or to show relations in perspective. To avoid confusion it was thought expedient to represent even the same structure in different parts of the diagram—*e. g.*, the labial plexus and the eyelid.

III, N. oculo-motorius ; XII, N. hypoglossus ; Aur. ect., auris ectalis ;

B., ganglion of Bochdalek ; Ca., caudal ; Ce., cephalic ; Car., caruncula ; Cil., N. ciliaris ; Cil. br., N. ciliaris brevis ; Cnj., conjunctiva ; Dent., N. dentalis ; Eth. ca., N. ethmoideus caudalis ; Fm. eth., foramen ethmoideum ; Fron., N. frontalis ; G., ganglion gasseri ; Gl. par., glandula parotidea ; G. s-max., ganglion submaxillare ; Hy., hypophysis ; Integ., integument ; Inf-tro., N. infra-trochlearis ; Lach., N. lachrymalis ; M., dens molaris ; Man., N. mandibularis ; Mass., N. massetericus ; M. ling., musculus lingualis ; M. tro., musculus trochlearis ; Nas., N. nasalis ; N-plt., N. naso-palatinus ; O., G. ophthalmicum ; Olf., nerve to olfactory lobe ; Oph., N. ophthalmicus ; P. M., dens premolaris ; Pter., N. pterygoideus ; Pe., N. petrosus ; Pili., tactile hairs of forehead and of ear ; Plat., the point in the meson where the ethmoid nerve joins its platetrope ; Pl. lab., plexus labialis at the angle of the mouth ; Plt., N. palatinus ; S orb., N. supra-orbitalis ; Sph., ganglion spheno-palatinum ; S-tro., N. supra-trochlearis ; Sym., anastomotic filaments to N. sympathicus ; Ten. tym., N. tensor tympani ; Tn., nerve from G. gasseri to the tentorium cerebelli ; Tmp. aur., N. temporo-auricularis ; Tmp. fac., anastomotic filaments to the temporo-facial nerve, VII ; Tmp. int., N temporalis internus ; Tur., filaments to the membrane over the turbinated bones ; Tr., filament to the meatus in the region of the tragus.

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An Analytical Table of the Genera of Snakes. By E. D. Cope.

(*Read before the American Philosophical Society, May 21, 1886.*)

The following key was prepared as preliminary to a discussion of the genera and species of North American Snakes to be published by the Smithsonian Institution. As this work will not be ready for publication for some months, I publish the present extract from it by permission of the Secretary, Prof. S. F. Baird. It is to be hoped that it may be useful in clearing up some of the obscurity which has existed with regard to the definitions of some forms; and that it may show that in some instances exact definition requires further separation of such groups, while in others combinations are necessary.

For the definitions of genera which I have not seen, I am especially indebted to my colleagues in this department, Drs. Peters, Günther, Jan, Krefft, and others.

OPHIDIA.

The families of snakes are distinguished by the following osteological characters:*

A. Opisthotic intercalated in the cranial walls (*Angiostomata*).

* No ectopterygoid; palatines bounding choanæ posteriorly; ethmoturbinal forming part of roof of mouth; rudiments of pelvis (*Scolecophidia*).†

I. Maxillary bone fixed to prefrontal and premaxillary; a pubis CATODONTA.‡

II. Maxillary bone vertical and free from all others; no pubis EPANODONTA.§

** An ectopterygoid; palatines not bounding choanæ posteriorly.

III. Maxillary bone free, horizontal........................TORTRICINA.

† A coronoid bone.

a. Rudimentary posterior extremities.............*Tortricidæ* Müller.

aa. No rudiments of posterior extremities........*Uropeltidæ* Müller.

B. Opisthotic attached scale-like to cranial walls, and produced freely. Ectopterygoid present (*Eurystomata*).

IV. Maxillary bone horizontal, in contact with the premaxillary, and furnished with solid teeth. No rudiments of pelvis.........ASINEA.

a. Rudiments of posterior extremities (*Peropoda*).

β. Coronoid bone present.

Supraorbital and postorbital bones, and premaxillary teeth present *Pythonidæ* Cope.

No supraorbitals or premaxillary teeth; postorbitals present .*Boidæ* Cope.

*This arrangement was first published by the writer in the Proceedings of the Philadelphia Academy for 1864, p. 230. The definitions of the lower primary divisions were derived from J. Müller.

†The characters of this division as I originally gave them (Proceedings Academy Philada., 1864, p. 230) were derived from J. Müller, which have been shown to be partially erroneous by Duméril and Bibron, and Peters.

‡Includes only the family *Stenostomidæ*.

§One family, the *Typhlopidæ*.

ββ. No coronoid bone.

No supraorbitals nor postorbitals nor premaxillary teeth . *Charinidæ* Cope.

αα. No rudiments of posterior extremities (*Colubroidea.*)

β. Coronoid bone present.

No postorbital or supraorbital bones ; premaxillary teeth present *Xenopeltidæ* Cope.

ββ. No coronoid bone.

γ. Postorbital bone produced over the superciliary region.

No gastrosteges.................................*Acrochordidæ* Cope.

Gastrosteges present.............................. *Nothopidæ* Cope.

γγ. Post orbital bone not extending over the superciliary region.

δ. Nostril in or between nasal plates.......... *Colubridæ* Auct.

ε. Vertebral hypapophyses confined to the anterior part of the column.................................. *Colubrinæ.*

εε. Vertebral hypapophyses extending throughout the column *Homalopsinæ* Cope.

δδ. Nostril in the rostral plate.............*Acontiophidæ* Gthr.

V. Os maxillare horizontal, thickened in front, and not reaching the premaxillare anteriorly, and bearing a perforate tooth PROTEROGLYPHA.

α. Caudal hypapophyses bifid ; caudal neural spines and pleurapophyses short.

Postfrontal bones wanting ; fang grooved................*Elapidæ* Cope.

Postfrontals present ; fang grooved ....*Najidæ* Cope.

Postfrontals present ; fang not grooved ....*Dendraspididæ* Gthr.

αα. Caudal hypapophyses simple ; caudal neural spines and pleurapophyses elongate.

A postfrontal bone.................................*Hydrophidæ* Gthr.

VI. Maxillary bone vertical, not reaching premaxillary, articulating with the prefrontal by a ginglymus, and to the ectopterygoid without imbrication, and bearing a perforated tooth........SOLENOGLYPHA.

Maxillary bone not excavated ; fang not grooved in front; no postfrontal bone....................................*Atractaspididæ* Gthr.

Maxillary bone not excavated ; fang grooved in front ; a postfrontal *Causidæ* Cope.

Maxillary bone not excavated ; fang not grooved ; a postfrontal *Viperidæ* Gray.

Maxillary bone excavated by a large chamber ; fang not grooved in front ; a postfrontal.................................. *Crotalidæ* Gray.

In the following pages I present synoptical diagnoses of the genera of the Ophidia arranged in key form. These are placed under subfamily heads, which are not, with the exception of the Homalopsinæ, defined. It is not certain, therefore, that their contents are in all cases properly limited or distributed. It remains a desideratum to discover the characters of the natural divisions of the Colubridæ, if any there be. The characters presented by Duméril and Bibron, and by Günther, are important but insufficient. For the definition of the genera distinct characters exist, although the subject is one of much difficulty. The object of definition being, as I imagine, precision, and the consequent increased facility of determination, I have employed all structural characters whatever, and only neglected them where it is evident that they are inconstant within the limits of a species. I find of the greatest importance the grooved or non grooved characters of the posterior teeth, and the absence or number of the scale-pits. The division or non-division of the anal scutum is also of much importance, although in a very few genera (*e. g.*, Xenodon) it is not constant. Relying, as the system always must, on exact characters, I have not allowed considerations of "physiognomy" to change a result where it conflicts with structure, which is, however, rarely the case. The tendency of some authors to neglect characters and to depend on "physiognomy" destroys precision and explains nothing, besides rendering identification of species most laborious, resting as it must in that case on purely empirical methods. I also do not use as generic characters the number of rows of scales, or of labial scuta, believing that these are only available in the distinction of species.

In a few instances I have not been able to examine the skeletons of genera of doubtful position, so that their reference to a family division may yet have to be altered. I have, however, studied the fine series in the museums of Paris and Washington, besides a considerable number in my own collection. For the characters of many genera which I have not seen I have had to rely on the descriptions of others, especially of Drs. Peters and Günther.

EPANODONTA.

TYPHLOPIDÆ.

I. Muzzle covered above by rostral and internasal scuta.

α. Two ocular plates and a preocular.

One nasal plate.................................... *Letheobia* Cope.

aa. One ocular and a preocular.

One nasal plate.................................... *Typhlops* Schn.

Two nasal plates.................................. *Helminthophis** Pet.

aaa. One ocular and no preocular.

One nasal plate.................................... *Typhlina*† Wagl.

Two nasal plates.................................. *Liotyphlops*‡ Pet.

II. Muzzle and front with five symmetrical scuta.

Two nasals and a preocular.................... *Anomalepis* Jan.

CATODONTA.

STENOSTOMIDÆ.

Superciliary scales present.................... *Stenostoma* Wagl.

No superciliary scales.......................... *Rena* B. & G.§

* *Idiotyphlops* Jan.

† *Pilidion* Dum. Bibr. *Typhlinalis* Gray.

‡ *Rhinotyplops* Pet.

§ *Catodon* D. & B., not of Lacep. *Siagonodon* Peters.

TORTRICINA.

TORTRICIDÆ.

Intermaxillary bone dentate ; eye covered by a single scute. *Tortrix* Oppel.
Intermaxillary edentulous ; eye surrounded by distinct scales *Cylindrophis* Wagl.

RHINOPHIDÆ.

I. Tail terminating in a large shield.
Rostral plate produced posteriorly, separating the nasals. *Rhinophis* Hemp.
Rostral not produced ; nasals in contact.................. *Uropeltis* Cuv.
II. Tail scaly to end.
Tail terminating in a disk of keeled scales ; supraorbitals and postocular confluent.................................... *Silybura* Gr.
Tail compressed, truncated, terminating in a bicuspid scale, the points superposed ; postocular distinct.................. *Plectrurus* D. & B.
Tail tapering, terminal scute ending in a horizontal ridge ; no chin-groove *Platyplectrurus* Günth.
Tail tapering, ending in a single point ; no chin groove *Teretrurus* Bedd.
Tail with smooth scales, terminating in one or two points ; postocular united with superciliary ; a median chin-groove.. *Melanophidium* Gthr.

ASINEA.

XENOPELTIDÆ.

Eyes not covered with a plate ; head with normal shields, with an interparietal added ; scales smooth ; anal and subcaudals divided ; teeth equal .... *Xenopeltis* Reinw.

PYTHONIDÆ.

I. Premaxillary teeth present.
a. Fossæ in labial plates of both jaws.
Scuta on end of muzzle only.............................. *Morelia* Gray.
Scuta extending to between orbits...................... *Python* Daudin.
Scuta covering vertex and muzzle........ .... *Liasis** Gray.
aa. Fossæ in inferior labials only.
Muzzle shielded to frontal region......................... *Nardoa* Gray.
aaa. No labial fossæ
Head shielded ; tail prehensile........................ *Aspidiotes* Krefft.
Head with nine regular shields above ; rostrals plate protuberant; tail not prehensile.................................. *Loxocemus* Cope.
II. No premaxillary teeth.†
Labial plates with fossæ ; vertex and front squamous ; nostril in one nasal ; scales smooth .... *Chondropython* Meyer.
Head covered with large scuta......................... *Aspidopython* Meyer.

* *Liopython* Hubrecht.
† *Teste* Boulenger.

BOIDÆ.

I. Tail prehensile.

a. Scales smooth.

β. Labial fossæ present.

Plates on muzzle only.................................*Xiphosoma** Wagl.
Plates extending over muzzle and front................*Epicrates*† Wagl.

ββ. No labial fossæ.

Muzzle and front scaled ; nasal plates meeting..........*Lichanura* Cope.
Muzzle and front scaled ; nasal plates widely separated.......*Boa*‡ Linn.
Muzzle and front scutate ; nares vertical.................*Eunectes* Wagl.
Muzzle and front with scuta divided on the median line ; nares lateral *Chilabothrus*§ D. & B.
Muzzle and front with median scuta ; nares lateral...*Ungualiophis* Meyer.

aa. Scales carinate.

Top of head with symmetrical plates ; nares between two *Ungualia*‖ Gray.
Top of head with symmetrical plates ; nares in a single plate *Bolieria*¶ Gray.
Plates on muzzle only.................................*Casarea*** Gray.
Top of head scaly ; rostral plate forming border of mouth. *Enygrus* Wagl.
Top of head scaly ; labial plates meeting below rostral plate *Trachyboa* Pet.

II. Tail not prehensile.

a. Palatine teeth well developed.

β. Rudiments of hind limbs visible.

A mental groove ....*Gonglyophis* Wagl.
No mental groove..*Eryx*†† Daud.

ββ. No visible rudiments of hind limbs.

Scales keeled ; head very distinct.........................*Erebophis* Gthr.

aa. Palatine teeth none (Peters).

Scales smooth ; top of head with symmetrical plates to between orbits ; one nasal.......................................*Calabaria*‡‡ Gray.

CHARINIDÆ.

Head scutate above ; scales smooth ; tail not prehensile ; palatine teeth *Charina*§§ Gray.

* *Corallus* and *Chrysenis* Gray.

† *Epicarsius* Fisch.

‡ *Acrantophis* Jan.

§ Includes *Homalochilus* Fisch.; *Pelophilus* D. & B. (=*Sanzinia* Gray); *Dendrophilus* Jan, and *Piesigaster* Seoane.

‖ *Tropidophis* D. & B. *Notophis* Hallow.

¶ *Platygaster* D. & B.

** *Leptoboa* D. & B.

†† *Cusoria* Gray.

‡‡ *Rhoptrura* Peters; may belong to the Charinidæ.

§§ *Wenona* B. & G.

ACROCHORDIDÆ.

Body compressed, acute below.......................*Chersydrus* Cuv.
Body round, flat below...........................*Acrochordus* Hornst.

NOTHOPIDÆ.

Scales above granular, with rows of tubercular scales; urosteges simple; no frontal or pariëtal plates.......................*Xenodermus* Rhdt.
Scales squamous; urosteges double; head scaly, with frontal and pariëtal plates....................................*Nothopsis* Cope.

COLUBRIDÆ.

Head conic, not distinct from the body, which is cylindric and rigid CALAMARINÆ.
Head slightly distinct, short; teeth entire, not enlarged in front CORONELLINÆ.
Head similar to last; posterior tooth grooved ....SCYTALINÆ.
Head more distinct and elongate, body and tail longer; teeth entire, not longer in front.......................................COLUBRINÆ.
Like the last, but grooved teeth posteriorly............PHILODRYADINÆ.
Very slender; pupil horizontal; grooved teeth..........DRYOPHIDINÆ.
Less slender, not compressed; middle teeth elongate, posterior teeth grooved ....PSAMMOPHIDINÆ.
Anterior maxillary and mandibular teeth enlarged........LYCODONTINÆ.
Anterior teeth not abruptly enlarged, posterior grooved; head wide, very distinct, body compressed............................DIPSADINÆ.
Anterior teeth not abruptly enlarged, the posterior weak and not grooved; head very distinct from the body, which is compressed; no œsophageal teeth.................................LEPTOGNATHINÆ.
Maxillary teeth few and rudimental; body slender; hypapophyses piercing throat, and capped with enamel..................DASYPELTINÆ.
Hypapophyses spinous to caudal region; anterior teeth not enlarged; body not slender; head distinct....................HOMALOPSINÆ.

CALAMARINÆ.

I. Posterior maxillary tooth grooved.

* Subcaudal scuta.

One nasal; anal undivided...............................*Uriechis** Pet.
Two nasals; anal divided........................*Cercocalamus* Gthr.

** Subcaudal scutella.

† No internasals.

One nasal, no preocular...........................*Amblyodipsas* Pet.
One nasal, a preocular............................*Apostolepis* Cope.

†† Two internasals; prefrontals united together.

One nasal; a preocular...................................*Phalotris* Cope.

††† Internasals united with nasals.

Postnasal distinct, anal divided.....................*Stenorhina* D. & B.

†††† Two internasals and two prefrontals.

* *Polemon* Jan.

a. Nasal plate single.

No preocular; no loreal.............................. *Calamelaps** Gthr.

A preocular; rostral not prominent...................*Elapomorphus* † Wieg.

A preocular; rostral prominent......................... *Ogmius* Cope.

aa. Two nasal plates.

β. Two anal scuta.

No preocular; a loreal...................................*Enulius*‡ Cope.

A preocular; no loreal...................................*Tantilla*§ B. & G.

A preocular and loreal, tail smooth.....................*Hydrocalamus* Cope.

A preocular and loreal, tail short, rugose...............*Procinura* Cope.

ββ. One anal scutum.

A loreal and preocular; tail smooth....................*Scolecophis* Cope.

II. Posterior maxillary teeth smooth.

* Subcaudal scuta.

† Internasals united.

Scales smooth...*Aspidura* Wagl.

Scales keeled...*Haplocercus* Gthr.

††. Internasals and prefrontals distinct.

a. Rostral not produced.

Postoculars not distinct from temporals; one nasal; loreal joined to preocular...*Achalinus* Pet.

Postocular, preocular, and two nasals....................*Elapops*‖ Gthr.

aa. Rostral produced.

Two nasals and a loreal and preocular...............*Rhinochilus* B. & G.

** Subcaudal scutella.

† Nasal scuta well developed.

‡ No internasal scuta.

‖ Rostral plate produced.

Prefrontals separated by rostral; nasals and first labial confluent *Ficimia* Gray.

Prefrontals in contact; nasal distinct; rostral little produced *Conopsis* Gthr.

Rostral much produced................................*Rhynchonyx*¶ Pet.

‖‖ Rostral not produced.

Nasal confluent with first labial; preocular and loreal distinct *Sympholis*** Cope.

Nasal distinct; loreal and preocular united.......... *Geophidium*†† Pet.

‡‡ One internasal scutum.

‖ Prefontals united.

Rostral much produced.............................*Ligonirostra*‡‡ Cope.

‖‖ Two prefrontals (rostral not produced).

* *Micrelaps* Bœttg.

† *Urobelus* Rhdt.

‡ Not of Bocourt Miss. Sci. Mex.

§ *Homalocranium* D. & B.

‖ *Pariaspis* Cope.

¶ *Xenocalamus* Gthr.

** *Chilorhina* Jan.

†† *Xylophis* Bedd.

‡‡ *Temnorhynchus* Smith.

Scales keeled ; no preocular, two anals................*Haldea** B. & G.
Scales keeled ; no loreal ; a preocular ; anal double.... *Falconeria* Theob.
Scales smooth ; no preocular, two anals..................*Farancia* Gray.
Scales smooth ; no loreal ; a preocular..................*Pseudoeryx*† Fitz.
Scales smooth ; no loreal nor preocular ; one anal ; (? teeth)
Calamophis Meyer.

‡‡‡ Two internasals ; one prefrontal.

Rostral much produced..............................*Prosymna* Gray.
Rostral not produced, teeth equal....................*Trimetopon* Cope.
Rostral not produced, teeth diacranterian..............*Colorhogia* Cope.

‡‡‡‡ Two internasals and two prefontals.

§ Rostral plate reaching frontal.

Nasals and first labial confluent.......................*Gyalopium* Cope.

§§ Rostral plate not reaching frontal.

a. Posterior maxillary teeth elongate.

Two nasals well separated from preocular................*Arrhyton* Gthr.
Two nasals in contact with frenoöcular..............*Leptocalamus* Gthr.

aa. Teeth equal.

β. Superciliary plate absent.

Two nasals and a frenoörbital........................*Colophrys* Cope.

$\beta\beta$. Superciliary present.

γ. Rostral plate produced.

δ. Nasal plates distinct below.

No loreal ; anal divided ; two nasals....................*Geagras*‡ Cope.
A loreal ; anal entire ; two nasals.....................*Cemophora* Cope.
A loreal ; anal divided ; one nasal.....................*Chionactis*§ Cope.

$\delta\delta$. Nasal plates united with first labial.

A preocular and a divided anal....................*Chilomeniscus*‖ Cope.

$\gamma\gamma$. Rostral plate not produced.

ε. Palatine bones with teeth.

η. One nasal plate ; one anal plate.

Scales smooth......................................*Homalosoma*¶ Wagl.

$\eta\eta$. One nasal and two anal plates.

Loreal and preocular present.........................*Contia*** B. & G.
Loreal present, no preocular .... *Abastor*†† Gray.
Neither loreal nor preocular.......................*Oxyorrhos* Fischer.‡‡

$\eta\eta\eta$. Two nasal, one anal plate.

Maxillary bone very slender ; scales smooth ; a frenoörbital plate
Stenognathus§§ D. & B.

* *Conocephalus* D. & B.

† *Dimades* Gray. *Calopisma* D. & B. *Hydrops* Wagl.

‡ *Enulius* Boc. *Sphenocalamus* Fisch. *Pseudoficimia* Boc.

§ *Lamprosoma* Hallow.

‖ *Bergenia* Steindachner.

¶ *Rhabdium* D. & B.

** *Cryptodacus* Peters. *Eirenis* Jan.

†† *Carphophiops* Gerv. *Carphophis* D. & B. *Celuta* B. & G.

‡‡ 1879 ; *Atractocephalus* Sauv. ? 1880.

§§ *Platypteryx* D. & B.

Maxillary more robust ; scales smooth ; a frenoörbital plate *Rhabdosoma** D. & B.

Maxillary more robust ; scales keeled ; a frenoörbital plate *Elapoides*† Boie.

$\eta\eta\eta\eta$. Two nasal and two anal scuta.

A loreal ; no preocular ; two pairs geneials............ *Virginia* B. & G.

A loreal ; no preocular ; one pair geneials............. *Adelphicus*‡ Jan.

A loreal and a preocular ; two pairs geneials...... ..... *Sonora* B. & G.

No loreal ; a preocular ; jaws weak.................. *Brachyorrhos* Kuhl.

$\varepsilon\varepsilon$. Palatine bones without teeth.

Two anals and nasals ; a loreal and a preocular............ *Oligodon* Boie.

Two anals and nasals ; a loreal and no preocular...... *Colobognathus* Pet.

††. Nasal scutum minute.

No internasals ; preoculars present...... .... *Calamaria* Boie.

Two internasals ; a preocular..................... *Pseudorhabdium* Jan.

Two internasals ; no preocular......................... *Oxycalamus* Cant.

†††. No nasal scutum.

No loreal, nor pre- nor postocular................. *Typhlogeophis* Günth.

CORONELLINÆ.

I. No palatine teeth.

Anals two ; one internasal ; scales smooth............... *Tripeltis*§ Cope.

Anal plate divided ; two internasals; scales smooth....... *Oligodon*‖ Boie.

II. Palatine teeth present.

a. Dentition isodont or syncranterian.

β. Anal plate divided.

γ. Angular bone enclosed by the dentary.

ε. Teeth equal.

One scale-pit, rostral not produced.................... *Diadophis* B. & G.

No scale-pits, rostral not produced................... *Rhadinæa*¶ Cope.

Rostral large, produced, with acute edge in front ; two nasals ; loreal present.. *Scaphiophis* Pet.

$\varepsilon\varepsilon$. Teeth longer posteriorly.

Tail short ; rostral produced........................... *Simotes* D. & B.

Tail short ; rostral not prominent ; one scale-pit....... *Coronella*** Laur.

Tail very long ; rostral not prominent................ *Pliocercus*†† Cope.

$\gamma\gamma$. Dentary bone attached loosely to the apex of the angular.

Teeth equal ; no scale-pits........................ *Henicognathus* D. & B.

$\beta\beta$. Anal plate undivided.

* *Rhabdium*, D. & B.

† *Geophis* Wagl. *Catastoma* Wagl

‡ *Rhabdosoma* Boc. not D. & B. *Rhegnops* Cope.

§ Gen. nov. type *Oligodon brevicauda* Gthr.

‖ ? *Rhynchocalamus* Gthr.

¶ *Ablabes* Günth. not D. & B. *Enicognathus* Jan.

** *Mizodon* Fisch.

†† *Elapochrus* Pet. *Cosmiosophis* Jan.

Rostral plate produced both anteriorly and posteriorly. . *Holarchus** Cope.
No scale-pits; rostral plate not produced. . . . . *Megablabes* Gthr.
Two scale-pits. . . . . *Ophibolus*† B. & G.

aa. Dentition diacranterian.

β. Rostral plate normal.

γ. Anal plate entire.

Eye bounded by scales below; lores plane. . . . . *Cyclagras*‡ Cope.
Eye resting on labial plates; lores plane. . . . . *Xenodon*§ Boie.
Eye on labials; lores grooved; two scale-pits. . . . . *Teleolepis* Cope.

γγ. Anal plate divided.‖

δ. Scale-pits present (one).

Head very distinct; robust. . . . . *Xenodon* Boie.
Head little distinct; slender. . . . . *Liophis* Wagl.

δδ. No scale-pits.

ε. Rostral plate normal.

Tail short; pupil erect; lores flat. *Hypsiglena*¶ Cope.
Tail short; pupil round; body robust. . . . . *Opheomorphus* Cope.
Tail short; pupil round; body slender. . . . . *Aporophis* Cope.
Tail very long; pupil round; slender. . . . . *Dromicus* Bibr.

εε. Rostral plate produced backwards and laterally, not forwards.

Anal divided; loreal present. . . . . *Lytorhynchus*** Pet.

β,β. Rostral trihedral and produced.

Anal divided; scales keeled. . . . . *Heterodon* Beauv.
Anal divided; scales smooth. . . . . *Lystrophis*†† Cope.
Anal entire; scales smooth. . . . . *Lioheterodon* Dum.

Scytalinæ.

a. Anterior teeth elongate.

Scales smooth; rostral plate obtuse. . . . . *Macroprotodon* Guich.

aa. Anterior teeth short.

β. Rostral plate not protuberant.

γ. Two rows of subcaudal scutella.

δ. Anal plate entire.

ε. Vertebræ with expanded neural spines.

Prefontals united; a loreal; scales smooth. . . . . *Gerrhosteus* Cope.

*Gen. nov., embracing all species with entire anal plate hitherto referred to Simotes.

† *Lampropeltis* Fitz., Cope, *Bellophis* Lockingt.

‡ *Lejosophis* Jan.

§ *Xenodon suspectus* Cope; *X. colubrinus* Gthr.; *X. angustirostris* Pet.; and *X. bipræocularis* Cope; and double or single in *X. rhabdocephalus* Wied.

‖ *Pseudoxyrrhopus* Günthr. (?*Homalocephalus* Jan.) is probably identical with one of the genera of sect. γγ, but the character of the scale-pits is unknown.

¶ *Pseudodipsas* Pet. *Comastes* Jan.

** *Catachtein* Jan, *Ophirhina* Bocage.

†† Type *Heterodon dorbignyi.*

εε. Vertebræ with narrow compressed neural spines.

Scale-pits double; pupil erect; rostral plate normal; two prefrontals. *Oxyrrhopus** Wagl.

Rostral plate normal; one nasal plate; two prefrontals *Tomodon* D. & B.

Rostral plate separating internasals; scale pores single; two prefrontals. *Trimerorhinus*† Smith.

δδ. Anal plate double.

ε. Scales smooth.

No scale-pits; tail short; rostral obtuse; nasals two; pupil round *Erythrolamprus*‡ Boie.

One scale-pit; loreal not in orbit; rostral obtuse; nasals two; pupil round.................................... *Tachymenis* Wiegem.

Loreal entering orbit; pupil erect; rostral obtuse; nasals two *Tarbophis*§ Fleisch.

One nasal plate; no scale-pits; rostral truncate; pupil erect *Manolepis*‖ Cope.

εε. Scales keeled.

Pupil erect; anal double............................. *Dryophylax* Wagl.

γγ. One row of subcaudal scuta.

Two preoculars; head distinct; body compressed....... *Ditypophis* Gthr.

Two preoculars; body round; head not distinct.... *Hologerrhum* Günth.

One preocular; body round.......................... *Scytale*¶ Boie.

ββ. Rostral plate protuberant.

γ. Rostral not recurved.

Loreal not entering orbit; pupil round; two nasal plates; rostral moderate...................................... *Conophis* Pet.

Scales not grooved; rostral very prominent.......... *Rhamphiophis* Pet.

Scales grooved; rostral prominent...................... *Rhagerhis* Pet.

γγ. Rostral plate recurved.

One row of subcaudal scuta......................... *Phimophis*** Cope.

Two rows of subcaudal scutella..................... *Rhinostoma* Wagl.

COLUBRINÆ.

A. Posterior maxillary teeth not abruptly longer than those that precede them.

1. Rostral plate expanded transversely and with free lateral borders.

Several preoculars; scales smooth, anal and subcaudals double *Salvadora*†† B. & G.

2. Rostral plate not expanded and free laterally.

* Two median dorsal row of scales.

One preocular plate............................ *Herpetodryas*‡‡ Boie.

* Includes *Brachyrhytum* D. & B.

† *Psammophylax* (Fitz) Günther.

‡ *Coniophanes* Hallow.

§ Günther says (Catal. Brit. Mus. p. 33) "anal bifid."

‖ Type *Tomodon nasutus* Cope.

¶ *Olisthenes* Cope.

** *Rhinosimus* D. & B. preoccupied.

†† Preoccupied in botany, hence *Phimothyra* Cope.

‡‡ *Phyllosira* Cope.

Two preocular plates..... .... *Zaöcys* Cope.

** One median dorsal row of scales.

† Body little or not compressed.

‡ Internasals not confluent with nasals.

a. Several loreal plates.

Two or more preoculars.................................... *Ptyas* Cope.

aa. One loreal (rarely two).

β. Four or more prefontals.

Anal entire; scales keeled.................................. *Pityophis* Holbr.

ββ. Two prefrontals only.

γ. Two nasal plates.

δ. Anal entire.

Scales smooth; rostral produced........................ *Rhinechis** Mich.

One preocular: rostral not produced.................... *Spilotes*† Wagl.

δδ. Anal double.

ε. One preocular.

Form robust; tail moderate.................................. *Coluber*‡ L.

Form elongate; tail long.................................... *Drymobius*§ Cope.

Form very slender; tail very long........................ *Dendrophis* Boie.

εε. Two preoculars.

Scales keeled.. .... *Elaphis* Aldv.

Scales smooth.. *Bascanium*‖ B. & G.

γγ. One nasal plate.

Scales keeled; a loreal plate............................. *Cyclophis*¶ Gthr.

Scales smooth; a loreal plate............................. *Liopeltis* Cope.

Scales smooth; no loreal............................. *Phragmitophis* Gthr.

‡‡ Internasals confluent with nasals.

Scales smooth with one pit; anal divided.............. *Symphimus* Cope.

†† Body much compressed.

One nasal plate; a frenoörbital......................... *Dryocalamus* Gthr.

Two nasals; a frenoörbital; teeth equal............ *Odontomus*** D. & B.

Two nasals; loreal and preocular distinct............. *Gonyosoma* Wagl.

One nasal; a loreal; scales keeled; teeth equal......... *Phyllophis* Gthr.

AA. Posterior maxillary tooth abruptly longer than those which precede it.

a. Maxillary tooth series uninterrupted (one preocular).

β. Moderately elongate.

Scales smooth; two nasals; a frenoörbital........ *Nymphophidium* Gthr.

Scales keeled; one loreal; one preocular.............. *Herpetoreas* Gthr.

ββ. Very slender.

* *Arizona* Kenn.

† *Cynophis* Gray. *Compsosoma* D. & B. *Cælognathus* Fitz. *Geoptyas* Steind.

‡ *Calopeltis* Bp. *Grayia* Gthr. *Heteronotus* Hallow, nom. praeocc. hinc *Glaniolestes* Cope. *Lejonotus* Jan.

§ *Dendrophidium* Cope.

‖ *Masticophis* B. & G.

¶ *Opheodrys* Fitz., Cope. *Philophyllophis* Garm.

** *Hydrophobus* Gthr.

γ. Anal double.

Scales keeled; no loreal .... *Leptophis** Bell.

Scales keeled; a loreal .... *Hapsidophrys* Fisch.

Scales smooth; a loreal .... *Philothamnus*† Smith.

γγ. Anal single.

Scales smooth; a loreal .... *Chlorophis*‡ Hallow.

aa. A toothless space in front of the long maxillary tooth.

β. One preocular; anal double.

γ. Form very elongate.

A loreal; scales smooth .... *Uromacer* D. & B.

γγ. Form moderately elongate.

A loreal; scales smooth, with two pits .... *Alsophis* Cope.

No loreal; scales smooth .... *Ocyophis*§ Cope.

ββ. Two or more preoculars.

Orbit resting on labials; one loreal; two anals; two scale-pits *Zamenis* Wagl.

Orbit surrounded by scales; anal single; two scale-pits; one loreal *Periops* Wagl.

Orbit surrounded by scales; two or more loreals; anal single; two scale-pits .... *Chilolepis* ‖ Cope.

"Numerous small scales occupying the place of the frontals;" eye resting on scales .... *Spalerophis* Jan.

Orbit resting on labials; two anals; one scale-pit .... *Tyria*¶ Cope.

One anal; no scale-pits .... *Zamenophis* Gthr.

PHILODRYADINÆ.

A. Body rounded, not compressed.

a. Scales grooved.

Crown and lores grooved; one nasal; two loreals .... *Malpolon*** Fitz.

aa. Scales smooth.

Two loreals; middle teeth equal .... *Callirhinus* Gird.

One loreal; median teeth equal .... *Philodryas* Wagl.

One loreal; median maxillary teeth long .... *Jaltris* Cope.

aaa. Scales keeled.

One loreal; median teeth equal .... *Tropidodryas* Cope.

AA. Body slender, compressed.

a. Subcaudal scutella.

Nostril normal; two nasals; two anals .... *Chrysopelea* Boie.

Nostril round in a single nasal; two anals .... *Ichthycyphus* Gthr.

Nostril semicircular, valvular .... *Dromophis* Pet.

aa. Subcaudal scuta.

Anal divided .... *Bucephalus* Sm.

* *Ahætulla* Gthr. *Thrasops* Hallow.

† *Rhamnophis* Gthr. *Gastropyxis* Cope.

‡ *Herpetæthiops* Gthr.

§ Type *Dromicus ater* Gosse.

‖ Type *Coluber cliffordii* Schl.

¶ Type *T. dahlii* Fitz.

** *Cœlopeltis* Wagl. *Taphrometopon* Brandt.

DRYOPHIDINÆ.

I. Middle maxillaries not elongate, posteriors grooved.

a. An elongate nasal appendage.

Nasal and anal scuta undivided; scales keeled..........*Langaha* Brug.

aa. No nasal appendage.

Scales keeled....................................*Dryophis** Boie.

Scales smooth....................................*Dryinus* Wagl.

II. Middle maxillaries elongate; posteriors grooved.

a. An elongate nasal appendage.

Pupil horizontal.................................*Passerita* Gray.

aa. No elongate nasal appendage.

A loreal plate; prenasals joined on the middle line.....*Gephyrinus*† Cope.

A loreal plate; nasals not joined.......................*Tragops* Wagl.

No loreal plate; nasals separate.....................*Tropidococcyx* Gthr.

PSAMMOPHIDINÆ.

Anal entire; a loreal.............................*Psammodynastes* Gthr.

Anal divided; a loreal............................*Psammophis* Wagl.

Nostril in prenasal; no loreal.........................*Mimophis* Gthr.

LYCODONTINÆ.

I. Anterior maxillaries not isolated.

a. Subcaudal scuta double.

β. Dorsal scales of equal size.

Two nasals; nostril in the anterior; a loreal; body much compressed *Lycodryas* Gthr.

Two nasals; nostril between; body not compressed; lores plane *Boödon*‡ D. & B.

Two nasals; body not compressed; lores longitudinally grooved *Bothrophthalmus*§ Schl.

Two nasals; nostril in the anterior.................*Lycophidium*‖ Fitz.

One nasal; a loreal...................................*Metoporhina* Gthr.

ββ. Dorsal scales of unequal size.

Vertebral series smooth; body compressed..........*Hormonotus* Hallow.

Vertebral series smooth; body round..................*Lamprophis* Fitz.

Vertebral series bicarinate; body round............*Simocephalus*¶ Gray.

aa. Subcaudal scutella entire.

Two nasals; scales equal, smooth....................*Holuropholis* Dum.

* *Thelotornis* Smith. *Cladophis* Dum.

† Type *Dryophis fronticincta* Gthr.

‡ *Eugnathus* D. & B.

§ Belongs perhaps to Colubrinæ.

‖ *Alopecium* D. & B.

¶ *Heterolepis* Sm. *Diaphorolepis* Jan.

II. Anterior maxillaries isolated.

α. Subcaudals in two rows.

β. Nareal region with a pit.

Scales smooth ; anal entire.......................... ...*Bothrolycus* Gthr.

β. No nareal pit.

γ. Longest teeth at middle and posterior end of maxillary bone.

Two nasals ; body round..............................*Dinodon** D. & B.

γγ. Longest teeth at front of maxillary.

Scales keeled ; two nasals ; a loreal ....*Ophites* Wagl..

Scales smooth ; two nasals ; a loreal......................*Lycodon* Boie.

Scales smooth ; two nasals ; no loreal..............*Tetragonosoma* Gthr.

Scales smooth ; one nasal ; a loreal ....*Leptorhytaon* Gthr.

αα. Subcaudal plates in one row.

Scales keeled ....*Cercaspis* Wagl.

Scales smooth......................................*Cyclocorus* D. & B.

LEPTOGNATHINÆ.

α. Subcaudal scuta entire.

Teeth of equal lengths.................................*Anoplodipsas* Pet.

Teeth elongate posteriorly.............. ....*Dipsadoboa* Gthr.

Teeth longer anteriorly..............................*Amblycephalus* Kuhl.

αα. Subcaudal scuta in two rows.

β. A median geneial plate.

Maxillary bone very short ; one nasal plate............*Asthenodipsas* Pet.

Maxillary bone long ; two nasal plates.................*Mesopeltis*† Cope.

ββ. No median geneial plate.

Teeth weak ; equal ; two nasals..................*Leptognathus* D. & B.

Teeth longer in front ; one nasal..........................*Pareas* Wagl.

DIPSADINÆ.

I. Subcaudal scuta.

Parietal plates replaced by scales; other plates normal..*Pythonodipsas* Gthr.

II. Subcaudal scutella.

α. No teeth anterior to the grooved maxillary.

Scales smooth ....*Opisthoplus* Pet.

αα. Median maxillary teeth not much shortened.

Nostril large, between two nasals and the internasal ; vertebral scales larger.......................................*Rhinobothryum* Wagl.

Two nasals enclosing nostril ; body elongate, compressed, anal entire ; vertebrals generally larger.............................. *Dipsas*‡ Laur.

Two nasals enclosing nostril ; body less compressed ; anal double ; vertebral row not larger ; one loreal.........................*Sibon*§ Fitz.

* *Eumesodon* Cope.

† *Asthenognathus* Boc.

‡ *Boiga* Fitz. *Triglyphodon* et *Himantodes* D. & B. *Eudipsas* Gthr. *Toxicodryas* Hallow.

§ *Crotaphopeltis* Fitz. *Leptodira* Gthr.

No nasal ; vertebrals equal.......................... *Hemidipsas** Gthr.

aaa. Median maxillary teeth shortened.

Two nasals and two or more loreals ; anal double ; vertebrals equal. *Trimorphodon* Cope.

DASYPELTINÆ.

No grooved maxillary tooth ; no loreal plate ; scales keeled ; head very distinct.......................................*Dasypeltis*† Wagl.

A grooved maxillary tooth ; a loreal plate ; scales smooth ; head little distinct.......................................*Elachistodon* Rhdt.

HOMALOPSINÆ.‡

I. A grooved posterior maxillary tooth.

* Muzzle with a pair of tentacular processes.

One internasal plate ; parietals undivided.................*Herpeton* Lac.

** No tentacular processes.

a. Scales keeled.

β. One internasal plate.

Pariëtal plates undivided.............................*Homalopsis* Kuhl.

ββ. Two internasal plates.

Pariëtal plates subdivided. ....*Cerberus* Cuv.

aa. Scales smooth.

β. One internasal plate.

γ. Gastrosteges with two keels.

Pariëtal plates subdivided..............................*Hipistes*§ Gray.

γγ. Gastrosteges not keeled.

Nasal plates in contact behind rostral ; eye resting on labial plates *Hypsirhina*‖ Wagl.

Nasal plates in contact ; eye bounded below by scales. .*Tachyplotus* Rhdt.

Nasal plates separate ; eye on labials..................*Fordonia*¶ Gray.

Nasal plates separate ; eye bounded with scales below. .*Cantoria*** Gird.

ββ. Two internasal plates.

Supraorbital and posterior labial plates subdivided ; two anals *Homalophis* Pet.

Nasals in contact behind rostral ; pariëtals entire.........*Ferania*†† Gray.

Two pairs of prefrontals ; nasal plates separate, undivided ; eye on labials ; anal double.......................................*Heleophis* Müller.

II. Posterior maxillary teeth not grooved.

* Scales keeled.

† Dentition diacranterian.

* *Chamætortus* Gthr.

† *Rhachiodon* Jour. *Diodon* Owen. *Anodon* Smith.

‡ Cope, Proceedings Academy Philadelphia, 1861, p. 167.

§ *Bitia* Gray.

‖ *Eurostus* D. & B. Pt. ? *Phytolopsis* Gray.

¶ *Gerarda* Gray. *Campylodon* D. & B.

** *Hydrodipsas* Peters.

†† *Trigonurus* D. & B. *Feranoides* Carlleyle.

One internasal plate ; no scale-pits........................*Helicops* Wagl.
Two internasals ; no scale-pits......................*Amphiësma* D. & B.
Two internasals ; two scale-pits ....*Bothrodytes** Cope.

†† Dentition syncranterian or longer behind.

a. One internasal plate.

No scale-pits .... *Atretium*† Cope.

aa. Two internasal plates.

β. Two nasal plates.

Anal plate divided ; two scale-pits ....*Tropidonotus*‡ Kuhl
Anal plate single ; no scale-pits.......................*Eutænia* B. & G

ββ. One nasal plate.

Anal plate single ; rostral produced laterally ....*Stypocemus*§ Cope.
Anal plate divided ; rostral normal..................*Amastridium* Cope.

††† Dentition isodont, or shorter behind.

a. Anal plate divided.

A loreal plate ....*Regina*‖ B. & G.
No loreal plate...................................*Storeria*¶ B. & G.

aa. Anal plate entire.

β. Two internasals.

Head well distinguished ; a loreal and preocular plates..*Atomarchus* Cope.
Head not distinct ; a loreal and a preocular plate...*Tropidoclonium* Cope.
Head not distinct ; a preocular ; no loreal plate..........*Adelophis* Dugés.
A loreal ; no preocular plate..........................*Ninia*** B. & G.
A loreal and preoculars ; teeth longer anteriorly....*Prymnomiodon* Cope.

ββ. One internasal plate.

Scales keeled ; two nasals and a loreal.
Haldea†† B. & G.

** Scales smooth.

a. Dentition diacranterian.

One internasal ....*Liodytes*‡‡ Cope.

aa. Dentition syncranterian.

One internasal plate ; anals two. ....*Limnophis* Gthr.
Two internasal plates ; anals two....................*Pseudaspis*§§ Cope.

aaa. Dentition isodont.

Two internasals ; anal entire.......................... *Ablabes*‖‖ D. & B.

* Gen. nov.; type *Amphiësma subminiatum* Reinwt; second species *B. tigrinus* = *A. tigrinum* Boie.

† *Tachynectes* Fitz. Cope, Proc. Acad. Phila., 1864, p. 167. *Hydræthiops* Günth. (nares superior).

‡ *Nerodia* B. & G.

§ *Chilopoma* Cope, preoccupied.

‖ *Tretanorhinus* D. & B.

¶ *Ischnognathus* D. & B.

** *Streptophorus* D. & B.

†† *Conocephalus* D. & B.

‡‡ Type *Helicops alleni* Garman.

§§ Type *Coronella cana* L. ; D. & B.

‖‖ *Natrix* Gthr. *Neusterophis* Gthr. *Lycodonomorphus* Fitz. sine diagnosi; nec *Ablabes* Gthr. et auct., = *Rhadinæa*, etc.

ACONTIOPHIDÆ.

Rostral plate deeply grooved below ; nasal single ; cephalic plates normal ; scales smooth ; body round ; teeth, the posterior longest, not grooved..*Acontiophis* Gthr.

PROTEROGLYPHA.

HYDROPHIDÆ.*

I. Gastrosteges wide, flat.

Two pairs of frontal shields..............................*Platurus* Latr

II. Gastrosteges wide, with two keels.

Scales imbricate ; one nasal..........................*Aepysurus* Lacep.

Top of head scaly ; two nasals...................*Pelagophis* Pet. & Dor

III. Gastrosteges narrow, rudimentary, or absent.

* Nasals separated by frontals.

Gastrosteges distinct to vent..............................*Distira* Lacep

** Nasals contiguous.

Head covered with scales behind....................*Acalyptus* D. & B.

Head short, entirely shielded ; no symphyseal notch ...*Hydrophis* Daud.

Head moderate, entirely shielded ; a deep symphyseal notch *Enhydrina* Gray.

Snout long, spatulate....................................*Pelamis* Daud.

NAJIDÆ.

I. Grooved teeth behind two perforated teeth on the os maxillare.

Head-shields normal ; no loreal ; scales smooth ; form fusiform *Ogmodon*† Pet.

II. Solid teeth behind the fang on the os maxillare.

A. Loreal plate present.

Subcaudals entire ; scales smooth.......................*Denisonia* Krefft.

AA. Loreal plate absent.

a. The neck with few scales, not extensible.

β. Subcaudal scuta one-rowed.

γ. Scales of vertebral row equal to others.

Nasals two ; scales smooth ; anal bifid.................*Pseudechis* Wagl.

One nasal ; scales smooth ; anal single..............*Hoplocephalus*‡ Cuv.

One nasal ; scales keeled ; anal single ....*Tropidechis* Gthr.

aa. Scales of vertebral line enlarged.

Scales smooth ; two nasals ; anal entire.................*Bungarus* Daud.

ββ. Subcaudal scuta two-rowed.

* This table is mostly from Günther, Reptiles Brit. India, 355.

† *Labionaris* Brocchi.

‡ *Alecto* Wagl.

γ. Scales of vertebral row equal.

Rostral plate normal ; two nasals.......................*Diemenia** Gray.

Rostral plate narrow ; produced backwards above ; two nasals *Pseudonaja* Gthr.

Rostral wide, prominent, depressed ; one nasal.........*Furina*† D. & B.

Rostral normal ; one nasal ; anal double.................*Cacophis*‡ Gthr.

γγ. Scales of vertebral line enlarged.

Scales smooth....................................*Megærophis*§ Gray.

αα. Neck extensible, covered with more numerous scales.

β. Anal entire ; subcaudals two-rowed.

No postpariëtal plates....................................*Naja*‖ Laur.

Postpariëtals present...................................*Ophiophagus* Gthr.

III. No solid maxillary teeth.

α. Subcaudal scuta in two rows.

β. Rostral plate much developed.

Rostral free at the sides ; scales keeled..................*Cyrtophis* Sund.

Rostral not free ; scales smooth ; anal entire ....*Aspidelaps* Fitz.

Rostral not free ; anal entire ; two nasals ....*Rhinelaps* Gthr.

ββ. Rostral not enlarged.

Scales keeled..*Sepedon* Merr.

Scales smooth ....*Callophis* Gr.

αα. Subcaudal scutella in one row.

One nasal ; a spine at end of tail.......................*Acanthophis* Daud.

ELAPIDÆ.

α. Internasal plate touching the nasal laterally.

One nasal plate ....*Vermicella*¶ Gray.

Two nasal plates ....*Elaps* Schn.

αα. Internasal reaching first labial plate.

One nasal ; no loreal ....*Microsoma* Jan.

DENDRASPIDIDÆ.

No solid teeth behind fang ; anal and subcaudal plates divided ; scales smooth.....................................*Dendraspis*** Schl.

SOLENOGLYPHA.

CAUSIDÆ.

Subcaudals double, anal entire ; scales keeled ; rostral prominent, with recurved border ....*Heterophis* Pet.

**Pseudoelaps* D. & B. *Elapsoidea* Bocage. *Hemibungarus* Pet.; includes *Brachysoma triste* Gthr.

† *Brachyurophis* Gthr.

‡ *Brachysoma* Gthr. *Boulengerina* Dollo.

§ *Xenurelaps* Gthr.

‖ *Tomyris* Eichw.

¶ *Homorelaps* Jan. *Poecilophis* Gthr.

** *Dinophis* Hallow.

Subcaudal and anal plates double; scales keeled; rostral normal *Causus* Wagl.

Subcaudals and anal entire; scales smooth; rostral normal; a loreal *Dinodipsas* Pet.

ATRACTASPIDIDÆ.

Head not distinct; two nasals; a loreal; scales smooth; subcaudals entire *Atractaspis* Smith.

VIPERIDÆ.

I. Urosteges two-rowed.

Nostril between two plates.................................. *Vipera** Laur.

"Nostril between three plates" (Gthr.).................. *Daboia* Gray.

Nostril surrounded by scales and a nasal; horn-like supraocular scales *Cerastes* Wagl.

Nostril surrounded by scales and a supranasal; no supraocular nor nasal horns.. *Bitis*† Gray.

Nostril surrounded by scales and a supranasal; horn-like scales above latter; no supraocular horns .... *Clotho* Gray.

II. Urosteges one-rowed.

Body and tail cylindric.................................... *Echis*‡ Merr.

Body and tail compressed and prehensile................. *Atheris*§ Cope.

CROTALIDÆ.

I. No rattle.

β. Urosteges two-rowed.

Top of head scaled; urosteges four-rowed at end; a caudal spine *Lachesis* Wagl.

Top of head with small scales; tail normal............ *Bothrops*‖ Wagl.

Top of head with large imbricate shield-like scales...... *Peltopelor* Gthr.

Top of muzzle scaled; rest of head shielded.............. *Hypnale* Cope.

Top of head with nine shields; scales carinate.... *Trigonocephalus* Oppel.

Top of head with nine shields; scales smooth........ *Calloselasma*¶ Cope.

ββ. Urosteges one-rowed.

Body and tail cylindric, not prehensile; head scaly...... *Bothriopsis* Pet.

Body and tail compressed, prehensile; head scaly, scales normal *Bothriëchis* Pet.

Body and tail compressed, prehensile; head scaly; a row of scales outside the superciliary shield......................... *Teleuraspis* Cope.

**Pelias* Wagl.

† *Echidna* Wagl. not Forster.

‡ *Toxicoa* Gray.

§ *Pœcilostolus* Gthr.

‖ *Trimesurus* Gray, Gthr., Peters. *Tropidolæmus* Wagler. *Megæra* Gray. *Atropos* Wagl.

¶ *Leiolepis* D. & B. nec Cuv.

Body and tail not prehensile; nine normal head-shields.
*Ancistrodon** Beauv.

II. A rattle.

Head with nine scuta above. .... *Crotalophorus*† Gray.

Head with scales above .... *Crotalus*‡ Linn.

SYNOPSIS OF THE GENERA.

Typhlopidæ	6
Stenostomidæ	2
Tortricidæ	2
Rhinophidæ	7
Xenopeltidæ	1
Pythonidæ	8
Boidæ	16
Charinidæ	1
Acrochordidæ	2
Nothopidæ	2
Colubridæ—	
Calamarinæ	58
Coronellinæ	23
Scytalinæ	18
Colubrinæ	36
Philodryadinæ	9
Dryophidinæ	7
Colubridæ (*continued*)—	
Psammophidæ	3
Lycodontinæ	17
Leptognathinæ	7
Dipsadinæ	7
Dasypeltinæ	2
Homalopsinæ	30
Acontiophidæ	1
Hydrophidæ	8
Najidæ	19
Elapidæ	3
Dendraspididæ	1
Causidæ	3
Atractaspididæ	1
Viperidæ	7
Crotalidæ	12
Total	317

A number of generic names have been given by authors with definitions which do not refer to the dentition. On this account I have been unable to include them in the above tables. I have credited generic names to authors who have published the first description, and not to those who have given them as *nomina nuda*.

ERRATA AND ADDENDA.

Page 486, middle, line δ, omit word "below."

Page 486, below middle, line $\delta\delta$, for "first labial" read "internasals."

Page 487, under Coronellinæ, immediately below line ε, insert a line, viz: Two scale-pits; rostral not produced............*Proterodon* Hallow.

Page 489, in character of genus *Trimerorhinus*, for "scale pores" read "scale-pits."

Page 490, above middle, immediately below line ε, insert a line, viz: Form robust; tail moderate; no scale-pits................ *Grayia* Gthr.; also add the words "two scale-pits" to the characters of the following genera—Coluber and Drymobius; also remove synonymy of Coluber in note ‡, excepting "*Calopeltis* Bp.," and place it to the synonymy of *Grayia*.

* *Cenchris* Daud.

† *Caudisona* Fitz, Wagl. *Systrurus* Garman.

‡ *Caudisona* Laur. *Crotalophorus* Linn., pt., *Uropsophus* Wagl.

Subjective After-Color (Complementary Color). By Charles A. Oliver, M.D.

(Read before the American Philosophical Society, October 1, 1886.)

Last year the writer brought forward, in "The American Journal of the Medical Sciences," a series of papers upon "A Correlation Theory of Color-Perception," in which this subject was exhaustively treated both from theoretical grounds and experimental standpoint. In a desire to isolate a few special data upon "Complementary Color," and to place them upon record, he has separated this part of the paper, and abridged it into a series of definite formulæ, which are here presented to the Society. Before arranging any conclusions, a brief synopsis of the theory will be given, so as to allow a correct understanding of the basis upon which they are placed. Starting with the assumption that all natural imponderable stimuli are the resultants of a mere difference in the number of vibrations of one and the same ether, and that the organs for the receipt of the different varieties must be but analogues and modifications of each other, it was shown by comparison with the senses of touch and hearing that the usually received theories of color-perception are incorrect. The question was then asked, Why take the trouble to give a series of organic elements, a coarse, unnatural division of fibre in an effort to harmonize them with an arbitrary and unscientific naming of visible color, when we have the difference of result dependent upon a difference in cause acting upon an ever-ready material?—a difference in the character of natural impression affecting one and the same organic element to a greater or less degree, producing exact and equivalent answers. It was then shown that each and every optic-nerve fibre tip has a passive receiving power equal to its individual strength; that each and every healthy optic-nerve filament transmits to the color-centre for recognition, nerve-energies equal to as many special sensations as its peripheral tip is capable of receiving; and that the innumerable quantities of nerve filaments, placed side by side on a sheet or membrane, serve to give greater field, and to allow many colors to be seen at one time, thus making our every-day and momentary pictures. These assertions brought forward the following theory. Color-perception takes place through each and every optic-nerve filament. It consists in the passive separation of a specific nerve-energy equal to the exposed natural color, from a supposed "energy-equivalent," resident in the peripheral nerve tip, by an active chemico-vital process of the impinging natural color-vibration upon the sensitized nerve terminal. The separated nerve energy is transmitted to the central terminus of the filament in the cerebral retina, where it is fully evolved into such a condition as to be transformed into an automatic and, finally, an intelligent perception. The moment that the primary portion of this action (*i. e.*, the separation) has taken place, there has been left in the peripheral tip of the primarily impinged sensory filament, a nerve-energy material equal to the difference between that individual nerve's "energy-equivalent" and the transmitted nerve stimulus ; the healthy peripheral nerve tip returning to its "energy-equivalent" or normal nerve power, the moment that the specific energy separated by the received natural vibration has been forwarded for transmission and recognition, whilst the transmitting filament and excited cerebral expansion regain their normal conditions the moment that the energy has passed them. After the consummation of such an action, the filament is again ready for any other natural color-vibration. In other words, a natural wave motion equal to natural color sets a peripherally placed life force into an equivalent life motion, which is transmitted to a central organ of perception where it is perceived. It is the action of natural wave motion upon sensory life motion, the life motion being produced by a loss and restitution of working material, *i. e.*, a chemico-vital action. Thus to see red, the nerve is first supposed to be charged to its normal physiological condition by its inherent vitality and sensitizing material. Vibrations of say five hundred trillions per second (some natural red color), are allowed to be thrown upon this sensitized tip. To see the color, the peripheral negative (an unused energy equal to the commencing sensation of a "green") must be allowed to rest, by the separation of a quantity of nerve-force equal to a supposed red energy, from the "energy-equivalent," through the excitation of the impinging ray. This separated specific energy is transmitted and perceived. The moment that the red-energy has left the nerve tip, the terminal is again charged to its "energy-equivalent" and is ready to receive any other color-vibration that may be cast upon its surface. Each and every natural color causes the separation of a specific energy equal to itself, which is properly transmitted and correctly perceived, if the conducting and central nerve structures be normal and intact.

Based upon this theory, the following conclusions in reference to subjective after-color may be formulated :

First. Definition of Subjective After-Color.—Color-perception resulting directly from provoked remaining nerve energies. The exciting stimulus may be either peripheral or central ; the former is produced from the external world or natural light stimulus, and the latter from some internal stimulation, either in the visual apparatus or in the cerebrum beyond it.

Second. Cause of Subjective After-Color.—"Complementary Color" is caused by the presentation of a second stimulus, either external or internal, of greater power than the remaining nerve-energy left from a previous color-action, before the visual apparatus has had time to return to its normal condition.

Third. Equivalence of Result.—The result is always equal to the difference between the amount of nerve-energy separated by the primary stimulus and the normal condition (energy equivalent) of the impressed portion of the optic-nerve filament.

Fourth. Passing Subjective After-Colors.—Two varieties ; non-reëxposed and reëxposed. The former depends upon the fact that the primary stimulation has been of such great intensity that it has left an irritant action which separates specific nerve-energies from the reforming material as fast as it is poured into the exhausted nerve; this, coupled with the fact that the irritant action is ever decreasing, with a proportionate gain of nerve-energy material, is the cause of the succession of subjective after-colors. The latter variety has the same character of passing subjective after-color, except that here they progress in a *reverse* order. This is readily explained. During the time that the re-impressed tip is gradually gaining sufficient nerve-energy to transmit the second natural white stimulus, there is a corresponding separating process continually taking place, dependent upon the great intensity of the second natural white stimulus. These separated amounts of nerve-energy are forwarded to the perceptive centres where they are recognized. This continues in a definite order of gain until at last the second natural white stimulus is able to be properly received, which is transmitted and perceived as "white."

Fifth. Transferred Subjective After-Color.—This is dependent upon a transformation of a "remaining energy" of one of the primarily used perceptive color-cells belonging to a strongly impressed visual apparatus, to an equivalently placed perceptive color-cell belonging to a weakly impressed visual apparatus, due probably to the fact that at the time of the double action, the perceptive cells of each channel are physically and physiologically thrown into connection with each other. That there is an organic or life connection at such times is known by the blending of the finite results.

Sixth. Simultaneous Contrast-Colors.—These show that either the action of simultaneously powerful and feeble intensities of natural color stimuli, or of a prolonged exposure of a strong and a weak natural color impression upon a series of contiguous peripheral nerve terminals of the same visual apparatus, can readily provoke an internal irritant action in the strongly excited perceptive color-cell, which will, in its turn, cast the entire brunt of its remaining nerve-force upon its feebly excited neighbor, and thus rouse the now secondarily impinged cell into a corresponding action.

Seventh. Alternating Subjective After-Colors.—These are dependent upon momentary alternating regains and discharges of sufficient energy material to perceive color-energies, equal to, first, the primary energy, and then its subjective after-color, after having perceived the subjective after-color.

Eighth. Other Varieties.—These are produced by modifications of the just-described exciting agencies and conditions of physical material.

On the Ikonomatic Method of Phonetic Writing, with Special Reference to American Archæology. By Daniel G. Brinton, M.D.

(Read before the American Philosophical Society, October 1, 1886.)

All methods of recording ideas have been divided into two classes, Thought Writing and Sound Writing.

The first, simplest and oldest is Thought Writing. This in turn is subdivided into two forms, Ikonographic and Symbolic Writing. The former is also known as Imitative, Representative or Picture Writing. The object to be held in memory is represented by its picture, drawn with such skill, or lack of skill, as the writer may possess. In Symbolic Writing, a single characteristic part or trait serves to represent the whole object; thus, the track of an animal will stand for the animal itself; a representation of the peculiar round impression of the wolf's foot, or the three-lined track of the wild turkey, being amply sufficient to designate those creatures. Even the rudest savages practice both these forms of writing, and make use of them to scratch on rocks, and paint on bark and hides, the record of their deeds.

It will be observed that Thought Writing has no reference to spoken language; neither the picture of a wolf, nor the representation of his footprint, conveys the slightest notion of the sound of the word *wolf*. How was the enormous leap made from the thought to the sound, in other words, from an ideographic to a phonetic method of writing?

This question has received considerable attention from scholars with reference to the development of the two most important alphabets of the world, the Egyptian and the Chinese. Both these began as simple picture writing, and both progressed to almost complete phoneticism. In both cases, however, the earliest steps are lost, and can be retraced only by indications remaining after a high degree of phonetic power had been reached. On the other hand, in the Mexican and probably in the Maya hieroglyphics, we find a method of writing which is intermediate between the two great classes I have mentioned, and which illustrates in a striking manner the phases through which both the

Egyptian and Sinitic alphabets passed somewhat before the dawn of history.

To this method, which stands midway between the ikonographic and the alphabetic methods of writing, I have given the name *ikonomatic*, derived from the Greek εικων-ονος, an image, a figure ; ονομα-ατος, a name. That which the figure or picture refers to is not the object represented, but the *name* of that object—a *sound*, not a *thing*. But it does not refer to that sound as the name of the object, but precisely the contrary—it is the sound of the name of some other object or idea. Many ideas have no objective representation, and others are much more simply expressed by the use of figures whose names are familiar and of similar sound. Thus, to give a simple example, the infinitive "to hide" could be written by a figure 2, and the picture of a skin or hide. It is this plan on which those familiar puzzles are constructed which are called *rebuses*, and none other than this which served to bridge over the wide gap between Thought and Sound writing. It is, however, not correct to say that it is a writing by *things* "*rebus* ;" but it is by the *names* of things, and hence I have coined the word *ikonomatic*, to express this clearly.

I shall select several illustrations from two widely diverse sources, the one the hieroglyphs of Egypt, the other the heraldry of the Middle Ages, and from these more familiar fields obtain some hints of service in unraveling the intricacies of the Mexican and Maya scrolls.

The general principle which underlies "ikonomatic writing" is the presence in a language of words of different meaning but with the same or similar sounds ; that is, of *homophonous* words. The figure which represents one of these is used phonetically to signify the other. There are homophones in all languages ; but they abound in some more than in others. For obvious reasons, they are more abundant in languages which tend toward monosyllabism, such as the Chinese and the Maya, and in a lesser degree the ancient Coptic. In these it is no uncommon occurrence to find four or five quite different meanings to the same word ; that is, the same sound has served as the radical for that many different names of diverse objects. The picture of any one of these objects would, to the speaker of the language, recall a sound which would have all these significations, and could be employed indifferently for any of them. This circle of meanings would be still more widely extended when mere similarity, not strict identity, was aimed at.

Such was plainly the origin of phoneticism in the Egyptian hieroglyphic inscriptions. Take the word *nefer*. Its most common concrete signification was "a lute," and in the picture writing proper the lute is represented by its figure. But *nefer* had several other significations in Coptic. It meant, a *colt*, a *conscript soldier*, a *door*, and the adjective *good*. The picture of the lute therefore was used to signify every one of these.

It will be observed that this is an example of a pure ikonograph. The picture is that of the object in full, a lute; but precisely in the same way the second class of figures in picture writing, those which are wholly symbolic, may be employed. This, too, finds ample illustration in the Egyptian hieroglyphics. Instead of the picture of a house, the figure of a square was employed, with one side incomplete. Phonetically, this conveyed the sound *per*, which means *house*, and several other things.

It will readily be seen that where a figure represents a number of homophonous words, considerable confusion may result from the difficulty of ascertaining which of these is intended. To meet this, we find both in Egyptian and Chinese writing series of signs which are written but not pronounced, called "determinatives." These indicate the class to which a word has reference. They are ideographic, and of fixed meaning. Thus, after the word *nefer*, when used for conscript, the determinative is the picture of a man, etc.*

There is little doubt but that all the Egyptian syllabic and alphabetic writing was derived from this early phase, where the governing principle was that of the rebus. At the date of the earliest inscriptions, most of the phonetics were monosyllabic; but in several instances, as *nefer*, above given, *neter*, which represents a banner, and by homophony, a god, and others, the full dissyllabic name was preserved to the latest times. The

* The following elements occur in the old Egyptian writing:

1. Ideographic.—(*a*) Pictures or ikonographs.
   (*b*) Symbols.
   (*c*) Determinatives.
2. Phonetic.—(*a*) Words.
   (*b*) Syllables.
   (*c*) Letters.

monosyllabic signs were derived from the initial and the accented syllables of the homophones; and the alphabet, so-called, but never recognized as such, by the Egyptians, either from monoliteral words, or from initial sounds. At no period of ancient Egyptian history was one sound constantly represented by one sign. In the so-called Egyptian alphabet, there are four quite different signs for the *M*, four for the *T*, three for the *N*, and so on. This is obviously owing to the independent derivation of these phonetic elements from different figures employed ikonomatically.

There are other peculiarities in the Egyptian script, which are to be explained by the same historic reason. For instance, certain phonetic signs can be used only in definite combinations; others must be assigned fixed positions, as at the beginning or at the end of a group; and, in other cases, two or more different signs, with the same phonetic value, follow one another, the scribe thinking that if the reader was not acquainted with one, he would be with the other. I note these peculiarities, because they may be expected to recur in other systems of ikonomatic writing, and may serve as hints in interpreting them.

Evidently, one of the earliest stimuli to the development of phonetics was the wish to record proper names, which in themselves nad no definite signification, such as those drawn from a foreign language, or those which had lost through time their original sense. In savage conditions every proper name is significant; but in conditions of social life, as developed as that of the Egyptians of the earliest dynasties, and as that of the Mayas and Mexicans in the New World, there are found many names without meaning in the current tongue. These could not be represented by any mode of picture writing. To be recorded at all, they must be written phonetically; and to accomplish this the most obvious plan was to select objects whose names had a similar sound, and by portraying the latter, represent to the ear the former. The Greek names, *Alexander* and *Alexandria*, occurring on the Rosetta Stone, were wholly meaningless to the Egyptian ear; but their scribes succeeded in expressing them very nearly by a series of signs which in origin are rebuses.

This inception of the ikonomatic method, in the effort to express phonetically proper names, is admirably illustrated in mediæval heraldry. Very early in the history of armorial bearings, we find a class of scutal devices called in Latin *arma cantantia*, in English *canting arms*, in French *armes parlantes*. The English term *canting* is from the Latin *cantare*, in its later sense of *chanting* or *announcing*. Armorial bearings of this character present charges, the names of which resemble more or less closely in sound the proper names of the family who carry them.

Some writers on heraldry have asserted that bearings of this character should be considered as what are known as *assumptive arms*, those which have been *assumed* by families, without just title. Excellent authorities, however, such as Woodham and Lower, have shown that these devices were frequent in the remotest ages of heraldry.* For instance, in the earliest English Roll of Arms extant, recorded in the reign of the third Henry, about the year 1240, nine such charges occur, and still more in the Rolls of the time of Edward the Second. They are also abundant in the heraldry of Spain, of Italy and of Sweden; and analogous examples have been adduced from ancient Rome. In fact, the plan is so obvious that instances could be adduced from every quarter of the globe. In later centuries, such punning allusions to proper names became unpopular in heraldry, and are now considered in bad taste.

To illustrate their character, I will mention a few which are of ancient date. The well-known English family of *Dobells* carry a *hart passant*, and three bells *argent*, thus expressing very accurately their name, *doe-bells*. The equally ancient family of Boltons carry a device representing a cask or *tun*, transfixed by a crossbow or *bolt*. Few canting arms, however, are so perfect as these. The Swinburnes, who are among those mentioned on the Roll of 1240, already referred to, bear three boar-heads, symbolical of *swine;* the Boleynes carry three bulls' heads, which reminds us of Cardinal Wolsey's pronunciation of the name in Shakespeare's Henry VIII, *Bullen:*

> "Anne Bullen? No; I'll no Anne Bullens for him:
> There's more in't than fair visage.—Bullen!
> No, we'll no Bullens."—*King Henry VIII, Act iii.*

Not rarely the antiquity of such bearings is evidenced by the

*See M. A. Lower, *Curiosities of Heraldry*, Chap. vi (London, 1845). An appropriate motto of one of these bearings was: "Non verbis sed *rebus* loquimur."

loss of the allusion in the current language, and recourse must be had to ancient and obsolete words to appreciate it. The English Harrisons display in their shield a hedgehog, which is to be explained by the French *hérisson*, and testifies to their Norman origin. The Sykes of the north of England show a fountain in their shield, whose significance is first ascertained on learning that in the Northumbrian dialect *syke* means a flowing spring or stream. The celebrated *fleurs-de-lys* of the royal house of France are traced back to the first Louis, whose name was pronounced *Loys*, and from the similarity of this to the common name of the flower, the latter was adopted as the charge on his shield.

Hundreds of such examples could be adduced, and the task of examining and analyzing them would not be an altogether vain one, as the principles upon which they were applied are the same which control the development of ikonomatic writing wherever we find it. But I pass from the consideration of these facts of general knowledge to the less known and much misunderstood forms of this writing which are presented in American archæology.

These are best exemplified in the so-called Mexican picture writing. For many years scholars have been divided in opinion whether this was purely ikonographic or partly phonetic. About forty years ago M. Aubin wrote an essay maintaining that it is chiefly phonetic, and laid down rules for its interpretation on this theory. But neither he nor any who undertook to apply his teachings succeeded in offering any acceptable renderings of the Aztec Codices. I am persuaded, however, that the cause of this failure lay, not in the theory of Aubin, but in the two facts, first, that not one of the students who approached this subject was well grounded in the Nahuatl language; and, secondly, that the principles of the interpretation of ikonomatic writing have never been carefully defined, and are extremely difficult, ambiguous and obscure, enough so to discourage any one not specially gifted in the solution of enigmas. At first, every identification is as puzzling as the effort to decipher an artificial rebus.

There are, indeed, some able scholars who still deny that any such phoneticism is to be found in Mexican pictography. To convince such of their error, and to illustrate the methods employed by these native American scribes, I will present and analyze several typical examples from Aztec manuscripts.

Beginning with proper names drawn from other languages, we find that the Nahuas had a number of such, which, of course, had no meaning in their own tongue. One of their documents speaks of the town of the Huastecas, called by that tribe *Tam-uch*, which means in their tongue "near the scorpions," and by the Aztecs, in imitation, *Tamuoc.** As the Huasteca is a Maya dialect, totally distinct from the Nahuatl, this word had no sense to the ears of the Aztecs. To convey its sound, they portrayed a man holding in his hands a measuring stick, and in the act of measuring. Now, in Nahuatl, the verb "to measure" is *tamachiua*; the measuring stick is *octocatl;* and, to make the latter plainer, several foot-prints, *xoctli*, are painted upon the measuring stick, giving an example of the repetition of the sound, such as we have already seen was common among the Egyptian scribes.

Fig. 1.—Tamuoc.

In another class of proper names, in their own tongue, although they had a meaning in the Nahuatl, the scribe preferred to express them by ikonomatic instead of ikonographic devices. Thus, *Mapachtepec*, means, literally, "badger hill," or "badger town," but in place of depicting a badger, the native writer made a drawing of a hand grasping a bunch of Spanish moss, the *Tillandsia usneoides.* The hand or arm in Na-huatl is *maitl*, the moss *pachtli:* and taking the first syllables of these two words we obtain *ma pach:* the word *tepec*, locative form of *tepetl*, hill or village, is expressed by the usual conventional ideographic or determinative sign.

Fig. 2.—Mapachte-pec.

In other names, the relative *position* of the objects are significant, reminding us of the rebus of a well known town in Massachusetts, celebrated for its educational institutions:

&

Mass.

* *Tam*, near; *uch*, scorpion. *Diccionario Huasteca-Español*, MS., in my possession. This and most of the other instances quoted are to be found in Lord Kingsborough's great work on Mexico, and also in Dr. Peñafiel's *Catálogo Alfabetico de los Nombres de Lugares pertenecientes al Idioma Nahuatl* (Mexico, 1885).

which is to be read, "Andover, Massachusetts," so in the Aztec scrolls, we have *itzmiquilpan* represented by an obsidian knife, *itztli*, and an edible plant, *quilitl*, which are placed above or over (*pan*), the sign for cultivated land, *milli*, thus giving all the elements of the name, the last syllable by position only.

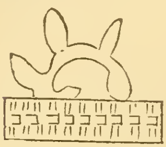


FIG. 3.—Itzmiquilpan.

In one respect I believe the ikonomatic writing of the Mexicans is peculiar; that is, in the phonetic value which it assigns to *colors*. Like the Egyptian, it is polychromatic, but, so far as I know, the Egyptian polychromes never had a phonetic value; they were, in a general way, used by that people as determinatives, from some supposed similarity of hue; thus green indicates a vegetable substance or bronze, yellow, certain woods and some animals, and so on. In heraldry the colors are very important and have well-defined significations, but very seldom, if ever, phonetic ones. Quite the contrary is the case with the Mexican script. It presents abundant instances where the color of the object as portrayed is an integral phonetic element of the sound designed to be conveyed.

To quote examples, the Nahuatl word for yellow is *cuztic* or *coztic*, and when the hieroglyphics express phonetically such proper names as *Acozpa*, *Cozamaloapan*, *Cozhuipilcan*, etc., the monosyllable *coz* is expressed solely by the yellow color which the scribe lays upon his picture. Again, the name *Xiuhuacan*, "the place of grass," is represented by a circle colored pale blue, *hxiutic*. The name of this tint supplies the phonetic desired. The name of the village *Tlapan* is conveyed by a circle, whose interior is painted red, *tlapalli*, containing the mark of a human foot-print. Such examples are sufficient to prove that in undertaking to decipher the Mexican writing we must regard the color as well as the figure, and be prepared to allow to each a definite phonetic value.

FIG. 4.—Acozpa.

It must not be understood that all the Aztec writing is made up of phonetic symbols. This is far from being the case. We discover among the hundreds of curious figures which it presents, determinatives, as in the Egyptian inscriptions, and numerous ideograms. Sometimes the ideogram is associated with the phonetic symbol, acting as a sort of determinative to the latter. An interesting example of this is given at the beginning of the "Manuscripto Hieratico," recently published by the Spanish government.* It is the more valuable as an example, as the picture writing is translated into Nahuatl and written in Spanish

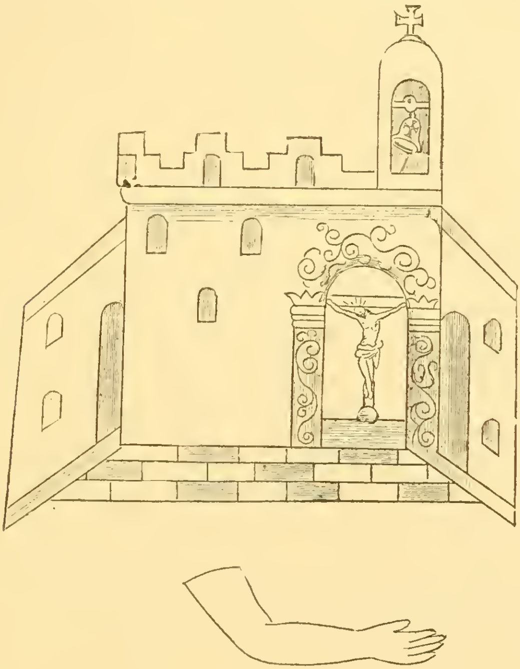


Fig. 5.—Tlamapa.

characters. The date of the document, 1526, leaves no doubt that it is in the same style as the ancient Codices. The page is headed with the picture of a church edifice; underneath is the outline of a human arm, and the legend in Nahuatl is:

In Altepetl y Santa Cruz Tlamapa.

These words mean, "the town of Santa Cruz Tlamapa." The name "*tlamapa*" means "on the hillside," and doubtless originally

* It is given in the appendix to the *Ensayo sobre la Interpretacion de la Escritura Hieratica de la America Central*, by De Rosny, translated by D. Juan de Dios de la Rada y Delgada (Madrid, 1884).

referred to the position in which the village was situated. But the prefix "*tlama*" usually signifies, "to do something with the arms or hands," derived from *maitl*, hand or arm. Hence, the figure of the extended arm gives this dissyllable, *tlama*, which was sufficient to recall the name of the town.

The Aztecs by no means confined the ikonomatic system to proper names. They composed in it words, sentences, and treatises on various subjects. In proportion as it is applied to these connected and lengthy compositions, its processes become more recondite, curious and difficult of interpretation. Without a knowledge of the spoken language considerably more than rudimentary, it would be hopeless for the student to attempt to solve the enigmas which he meets at every step. Yet every well-directed effort will convince him that he is on the right track, and he will constantly be cheered and stimulated to further endeavor by the victories he will win day by day.

Few indeed have the requisite preliminary knowledge and the gift of insight into verbal puzzles to attain brilliant success. Among those who have pursued with marked and gratifying results this intricate study, it gives me pleasure to name Mrs. Zelia Nuttall Pinart. This lady has unraveled a number of the pages of the Vienna Codex and several of the monolithic inscriptions which have been handed down from ancient Mexico. With commendable caution she has refrained from publishing her results until they could be presented, supported by such proofs that they cannot be questioned; but, from a personal examination of them, I do not hesitate to say that they will be found to come up to the highest standard of scientific requirements.*

The analogy which is presented in so many particulars between Mexican and Maya civilization would lead us to infer that the Maya writing, of which we have a number of examples well preserved, should be unlocked by the same key which has been successfully applied to the Aztec Codices. The latest writers on the Maya manuscripts, while agreeing that they are in part, at least, in phonetic characters, consider them mostly ideographic. But it is to be noted that not one of these writers has any practical acquaintance with the sounds of the Maya language, and

*Several of Mrs. Pinart's interpretations were exhibited to the Anthropological Section of the American Association for the Advancement of Science at its last meeting (Buffalo, 1886), and were favorably received by the members.

scarcely any with its vocabulary. From this it is evident that even were these codices in ikonomatic writing, such investigators could make very little progress in deciphering them, and might readily come to the conclusion that the figures are not phonetic in any sense. Precisely the same position was taken by a number of students of Egyptian antiquity long after the announcement of the discovery of Champollion; and even within a few years works have been printed denying all phoneticism to the Nilotic inscriptions.

What induces me to believe that much of the Maya script is of the nature of the Mexican is the endeavor, undertaken for a very different purpose, of Professor Valentini to explain the origin of the so-called Maya alphabet, preserved by Bishop Landa, and printed in the editions of his celebrated "Description of Yucatan."* Professor Valentini shows by arguments and illustrations, which I think are in the main correct, that when the natives were asked to represent the sounds of the Spanish letters in their method of writing, they selected objects to depict, whose names, or initial sounds, or first syllables, were the same, or akin, to the sounds of the Spanish vowel or consonant heard by them. Sometimes they would give several words, with their corresponding pictures, for the same sound; just as I have shown was the custom of the ancient Egyptians. Thus, for the sound *b* they drew a foot-print, which in their tongue was called *be;* for the sound *a* an obsidian knife, in Maya, *ach*, etc. Valentini thinks also that the letter *E* was delineated by black spots, in Maya *eek*, meaning black, which, if proved by further research, would show that the Mayas, like the Mexicans, attributed phonetic values to the colors they employed in their painted scrolls.

Outside of the two nations mentioned, the natives of the American continent made little advance toward a phonetic system. We have no positive evidence that even the cultivated Tarascas and Zapotecs had anything better than ikonographs; and of the Quiches and Cakchiquels, both near relatives of the Mayas, we only know that they had a written literature of considerable ex-

* Valentini's Essay appeared in the *Proceedings of the American Antiqvarian Society*, April, 1880. Landa's work was originally published by the Abbe Brasseur (de Bourbourg) at Paris, 1864, and more accurately at Madrid, 1884, under the supervision of Don Juan de Dios de la Rada y Delgada.

tent, but of the plan by which it was preserved we have only obscure hints. Next to these we should probably place the Chipeway pictography, as preserved on their *meda* sticks, bark records, and *adjidjiatig* or grave-posts. I have examined a number of specimens of these, but have failed to find any evidence that the characters refer to sounds in the language; however, I should not consider it improbable that further researches should disclose some germs of the ikonomatic method of writing even in these primitive examples of the desire of the human intellect to perpetuate its aquisitions, and hand them down to generations yet unborn.

Synonymic List of the North American species of Bufo and Rana, with descriptions of some new species of Batrachia, from specimens in the National Museum. By E. D. Cope.

(Read before the American Philosophical Society, October 1, 1886.)

BUFO Laur.

Bufo punctatus Baird & Girard, Proceedings Academy Philadelphia, 1852, p. 173. *Bufo beldingii* Yarrow, Proceedings U. S. National Museum, 1882, p. 441.
Sonoran and Lower Californian regions.

Bufo debilis Girard, Proceedings Acad. Philadelphia 1854, p. 87. *Bufo insidior* Girard, Proceedings Academy Philadelphia, 1854, p. 88.
Sonoran region.

Bufo columbiensis Baird & Girard, Proc. Ac. Phila., 1853, p. 378. *Bufo boreas* Baird & Girard, Proc. Ac. Phila., 1852, p. 174. *Bufo halophila* Baird & Girard, Proc. Ac. Phila., 1853, p. 301. *Bufo chilensis*, part, Günth., Cat. Batr. Sal. Brit. Mus., 1868, p. 57. *Bufo microscaphus* Cope, Proc. Ac. Phila., 1866, p. 301. *Bufo pictus* Cope, Report U. S. G. G. Expl. W. of 100th Mer., v, p. 522, pl. xxv, f. 4–5.
Pacific region; Western Central region.

Bufo compactilis Wiegm., Isis, 1833, p. 661. *Anaxyrus melancholicus* Tschudi, Faun. Per. Herp., p. 78, pl. ii, f. 5. *Bufo speciosus* Girard, Proc. Ac. Phila., 1854, p. 86. *Bufo anomalus* Günth., Cat. Batr. Salien. Brit. Mus., 1868, p. 57. *Bufo levifrons* Bocourt, Bull. Soc. Philom. (7), i, p. 187. *Dromoplectrus anomalus* Camerano, Atti. Acc. Tor., xiv, p. 882.
Mexican district; Texas.

Bufo alvarius Girard, Baird's Reptilia, U. S. Mexican Boundary Survey. ii, p. 26, pl. xli, f. 1–6.
Colorado Desert.

Bufo hemiophrys Cope.

Superciliary crests not distinct on the muzzle, parallel, nearly straight, terminating abruptly posteriorly in a transverse elevation. The latter meet on the middle line, forming a transverse ridge, with an abrupt descent to the nape. Externally they extend but a short distance, leaving no representatives of the postorbital ridges except a few tubercles in one or two of the specimens. A small supratympanic tuberosity No preorbital ridge. Muzzle vertical at end, nostrils terminal. Membranum tympani a vertical oval, two-thirds the diameter of the eye. Parotoid gland a narrow oval. Dermal tubercles distinguished by their small size and prominence. They form several rows on the back and external face of the tibia. At all other points the skin is closely areolated, the areolæ frequently acutely prominent, especially on the superior face of the tibia and on the sides. The heel of the extended hind leg reaches to the posterior border of the orbit. The posterior foot is wider than in the *B. lentiginosus*, though not relatively shorter. The web is excavated to the line of the middle of the fourth (first) phalange. The metatarsal tubercles are especially large. The internal is very wide and prominent, and has an extensive acute edge ; the external is much smaller, but it also has a free cutting edge, transverse to the length of the tarsus. The length of the head to the position of the postorbital crests, enters the total (to the vent) four and a half times.

The color is brown, marked on the back with a median yellowish line, and two or three rows of brown spots of medium size on each side of it. These spots have one or two tubercles for their center pieces, which are more reddish than the rest of the spot. There are two brown spots on the upper lip, and one below the tympanum. A large spot extends from below the parotoid gland to near the front of the humerus. Posterior to this, with a slight interval, there extends a longitudinal deep brown band, which extends, with interruptions, to the groin. Below this, on the sides, are other dark-brown bands, which form a more or less reticulate pattern. The limbs and posterior feet have dark-brown cross-bands, and there is a very coarse dark brown reticulation of brown or brownish yellow on the posterior face of the femur. The belly is more or less black-spotted ; throat immaculate.

Measurements (*No. 11,927*).	M.
Length of head and body	.059
" " " to posterior edge of m. tympani	.015
Width " " at anterior " "	.023
Length of anterior limb	.034
" " " foot	.014
" " posterior limb	.068
" " tibia	.020
" " tarsus	.010
" " rest of foot	.025

Besides the peculiarities of the head crests, and metatarsal shovels, this species differs from most of the other North American species in having no postorbital crests, and in having the belly spotted. From the *B. lentiginosus fowleri* it differs also in the development of the external metatarsal tubercle, and in the connection between the frontoparietal crests behind.

No. 11,927. Six specimens from the northern boundary of Montana. Collected by Dr. Elliott Coues.

Bufo cognatus Say, Long's Expedition to the Rocky Mountains, ii, 1823, p. 190. *Bufo dipternus* Cope, American Naturalist, xiii, p. 437.
Eastern half of Central region.

Bufo lentiginosus Shaw, Zoölogy, 1803, iii, i, p. 173, tab. 2111.
Eastern and Central regions.

B. l. fowleri Putnam, MSS. Cope Check List North American Batr. and Reptilia, 1875, p. 29 (name only).
Canadian and Hudsonian districts of Eastern region.

B. l. woodhousei Girard. *Bufo woodhousei* Girard, Proc. Ac. Phila., 1854, p. 86; Baird, U. S. Pacific R. R. Reports, x, p, 44. pl. xxv, f. 1. *Bufo frontosus* Cope, Proc. Ac. Phila., 1866, p. 301; Rept. Expl. U. S. Surv. W. of 100th Mer., Capt. G. M. Wheeler, 1877, v, pp. 520, 627.
Central region.

B. l. americanus Lec., Cope Check List N. Amer. Rept. & Batr., 1875, p. 29. *Bufo americanus* (Leconte) Holbr., N. A. Herp., v, pl. 4; Dum. & Bibr., p. 695; Hallow, Proc. Ac. Phila., 1856, p. 251; Girard, U. S. Mex. Bound. Surv., ii, p. 25; Wied., Nova Acta, xxxii, p. 121. *Bufo copei* Yarrow & Henshaw, Rept. Batr. Expl. W. of 100th Mer., 1878, p. 4.
Eastern and Austroriparian regions.

B. l. lentiginosus Shaw, Cope Check List N. American Rept. & Batr., 1875, p. 29. *Bufo lentiginosus* Shaw, Zoöl., iii, p. 173; Gird., Proc. Ac. Phila., 1854, p. 86. *Chilophryne lentiginosa* Cope, Proc. Ac. Phila., 1863, p. 357. *Bufo musicus* Latr., Rept., ii, p. 127; Daud. Rain, p. 9, pl. 33, f. 3, and Rept., viii, p. 190; Merr. Teut., p. 185; Gravenh. Delic., p. 59.
Austroriparian region.

Bufo quercicus Holbrook, North American Herpetology, v, p. 13, 1842, tab. iii. *Chilophryne dialopha* Cope, Pr. A. N. S. Phila., 1862, p. 341 (erroneous locality). *Bufo dialophus* Boulenger, Cat. Batr. Sal. Brit. Mus. ed., ii, 1882, p. 319.
Austroriparian region.

Bufo valliceps Wiegm., Isis, 1833, p. 657. *Bufo granulosus* Baird & Girard, Proc. Ac. Phila., 1852, p. 173. *Bufo nebulifer* Girard, Proc. Ac. Phila., 1854, p. 87. *Chilophryne nebulifera* Cope, Proc. Ac. Phila., 1862, p. 357.
Texan district of Austroriparian region; Mexican region, etc.

RANA Linn.*

RANA HALECINA Daudin (Kalm), Hist. Nat. Rept., viii (1803), 122, 432. *Rana aquatica*, Water Frog, Catesby, Carol., ii (1743), 70. *Rana pipiens* Gm., ed. L. Syst. Nat. (1788), 1052–28. *Rana utricularia* Harlan, Sillim. Journ., x (1825), 60. *Rana virginiana* Lam., Syn. Rept., p. 31. *Rana palustris* Guérin, Iconogr. Rept., pl. 26, f. 1. *Rana oxyrhyncha* Hallow, Proc. Acad. Phila. (1856), p. 142. *Rana berlandieri* Baird, U. S. Mex. Bound. Surv. Rept., p. 27, pl. 36, f. 7–10. *Rana lecontei* "B & G." Günther Cat. Bat. Sal. Brit. Mus. 1858, 15 ; Brocchi Miss. Sci. Mex. Rept., p. 14, pl. iv, f. 1. Boulenger Cat. Bat. Sal., B. M. 1882, p. 42 ; nec Baird et Girardii.†
Nearctic realm, except Pacific region.

R. H. SPHENOCEPHALA Cope. *R. oxyrhyncha* Hallow, Proc. Acad. Phila., 1856, p. 142, nec Sundevalii.
Austroriparian region.

R. H. HALECINA Kalm (Cope). *Rana berlandieri* Baird, l. c.
Eastern and Austroriparian regions.

R. H. BRACHYCEPHALA Cope. *R. h. berlandieri* Cope, Check List Batr. Rept. N. Am., p. 32, nec *Rana berlandieri* Baird. *Rana halecina* Boulenger, Cat. Batr. Brit. Mus. ed, ii, p. 41, néc Kalmii.
Central and Sonoran regions.

RANA AREOLATA Baird & Girard. Proceeds. Acad. Phila. 1852, p. 173 ; Baird, U. S. Mex. Bound. Surv., pl. 36, f. 11–12.
Austroriparian region, extending north in Mississippi valley.

R. A. AREOLATA Bd. & Gird. *Rana areolata* Baird & Girard, Proc. Acad. Phila., 1852, p. 173 ; Baird, U. S. Mex. Bound. Surv., pl. 36, f. 11, 12.
Austroriparian region.

R. A. AESOPUS Cope, s. sp. nov.
Florida.

Length of head two and a half times in the total ; tympanic disk a vertical oval ; dorsal spots well separated ; nostril equidistant between end of muzzle and eye.

This singular form may be known at once by the short and squat form of the body as compared with the size of the head, resembling in this some of the Australian Cystignathidæ.

The muzzle is not prominent, and does not project beyond the upper lip. The canthus rostrales are straight, and the top of the head is flat. The tympanic disk is a vertical oval, of which the short diameter is one half the length of the eye. The edge of the vomerine patches of teeth

* The determination of the relations between the North American and European species of this genus have been greatly facilitated by the admirable researches of Boulenger.

† The Mexican specimens referred to in these citations constitute a subspecies, which I call *R. h. austricola*.

are a little posterior to the line connecting the posterior border of the nares. The latter are about as large as the ostia pharyngea.

The dorsolateral glandular ridge is thick and extends a little beyond the sacral diapophysis. There are six or seven rows of short longitudinal glandular tubercles in the space between them. There are similar elongate warts on the sides. The posterior and posteroinferior faces of the femora finely granular; rest of the inferior surfaces smooth.

The first finger is longer than the second and equals the fourth. The heel of the extended hind leg reaches to the middle of the eye. The foot is of moderate length. Three of the phalanges of the fourth digit are entirely free, and the web is excavated to opposite the middle of the first phalange, extending as a margin on each side of the distal half. The inner cuneïform tubercle is not large and has an acute apex; no external tubercle. A slightly defined tarsal dermal ridge.

In alcohol the ground color is light brown, with the dorsolateral ridge and the inferior surfaces straw-color. The spots are a dark brown, and do not appear to have been yellow bordered. The dorsal spots are irregularly rounded, and are in three or four longitudinal rows. There are two rows on the top of the muzzle and head, crossing the inner edge of the eyelid. There are two spots near the external edge of each eyelid. Spots on the sides smaller, in about four rows. The lores and upper lips are rather coarsely marbled with brown; gular region faintly speckled with the same. No band, but a spot on the front of the humerus; a spot on the elbow, and three cross lines on the fore arm. Four narrow cross lines on the femur, and five across the tibia. Three cross bars on the external face of the fifth toe. The posterior face of the femur has numerous rounded brown spots on a light ground.

Measurements (*No. 4743*).	M.
Length of head and body	.062
Width of head at posterior edges of tympana	.020
Length " to " " " "	.024
Length of fore leg	.026
" " fore foot	.012
" " hind leg, to groin	.074
" " tibia	.024
" " tarsus	.013
" " rest of foot	.025

The only specimen of this subspecies which I have seen is the following: No. 4743, Micanopy, Fla. Dr. T. H. Bean.

R. A. CAPITO Leconte, Proc. Acad. Phila., 1855, p. 425.
Floridan district.

R. A. CIRCULOSA Rice & Davis. *Rana circulosa* Rice & Davis, in Jordan's Manual of Vertebrata of Eastern North America, ed. ii, p. 255.
North Central Eastern region. (Illinois.)

Rana palustris Leconte. *R. palustris* Leconte, Ann. Lyc. N. Y., i, p. 282. *R. pardalis* Harlan, Amer. Journ., x, p. 50.

Eastern region.

Rana septentrionalis Baird, Proc. Acad. Phila., 1855, p. 51. *R. sinnata* Baird, l. c.

Eastern region, Canadian and Hudsonian districts.

Rana clamata Daudin, Hist. Nat. Rept., viii (1803), 104–431. *R. clamitans* Daudin, in Sonn. & Lat. Hist. Nat. Rept., ii (1802), 157. *R. fontinalis* Leconte, Ann. N. Y. Lyc., i (1825), 282. *Ranaria melanota* Rafin, Annals of Nature (1820), No. 25. *Rana melanota* (Raf.) Harl., in Sill. Am. Jour. Sc., x (1825), 64. *Rana flavoviridis* Harl., in Sill. Am. Jour. Sc., x (1825), 58 ; *Rana horiconensis* Holbrook, N. A. Herp., 1st ed., iii (1838), 91. *Rana nigricans* Agassiz, L. Sup. (1850), 379, vi, f. 4, 5.

Eastern region.

Rana catesbeiana Shaw. *Rana catesbiana* Shaw, Gen. Zoöl., iii, Amphibia (1802), 106, pl. xxxiii. *Rana boans* Lacep, Hist. Nat. Nuad. Ovip. (1st ed., 1798), ed. Deteoville, i (1819), 270, 315. *Rana pipiens* Harl. (nec. Linnæus), Sill Am. Jour. Sc., x (1825), 62. *Rana mugiens* Merrem., Tentamen Syst. Amph. (1820), 175. *Rana scapularis* Harl., Sill. Am. Jour. Sc., x (1825), 59. *Rana maxima americana aquatica* Catesby, Carol., ii (1743), 72. *Rana couspersa* Leconte, Proc. Ac. Phila., 1855, p. 425.

Eastern region.

Rana temporaria Linn., Syst. Nat., ed. 12, p. 357, pars. *Rana muta* Laur, Syn. Rept., p. 30. *Rana temporaria* Schneider, Hist. Amph., p. 113. *Rana flaviventris* Millet, Faun. Maine et Loire, ii, p. 663. *Rana cruenta* Pallas, Zoögr. Ross.-As., p. 12. *Rana alpina* Risso, Hist. Nat. Eur. mér., iii, p. 93. *Rana scotica* Bell, l. c., p. 102. *Rana platyrrhinus* Steenstr., Amtl.-Ber., 24, Vers. Kiel, p. 131. *Rana fusca* De l'Isle, Ann. Sc. Nat., ser. 5, xvii, 1873. *Rana temporaria*, var. *platyrrhina* Schreib., Herp. Eur., p. 125. *Rana dybowskii* Günth., Ann. & Mag. N.H., 1876, xvii, p. 387; Catal. Bat. Sol. Brit. Mus., ed. i, p. 16.

Europe, Northern and Temperate Asia.

R. t. pretiosa Bd. & Gird. *Rana pretiosa* Bd. & Gird., Proc. Ac. Phila., 1853, p. 378 ; Baird, Proc. Ac. Phila., 1855, p. 378 ; Gird., U. S. Expl. Surv., xii, part ii, p. 304 ; Boulenger, Bull. Soc. Zoöl. Fr., 1880, p. 208 ; Cope, Proc. Ac. Phila., 1883, pp. 20, 33 ; Am. Nat., 1879, p. 435.

Pacific region.

Rana cantabridgensis Baird, Proc. Ac. Phila., 1854, p. 62. *Rana sylvatica* Dekay, N. Y. Fauna, iii, p. 64, pl. 21, 22. *Rana temporaria*, var. *sylvatica* pt. Günth., Cat. Brit. Mus., 1868, p. 17. *Rana temporaria cantabridgensis* Cope, Check. List. N. Amer. Batr. Rept. 1875, p. 32.

Canadian and Hudsonian districts of Eastern region.

R. C. LATIREMIS Cope.

This form looks very different from the true *Rana cantabridgensis.* Muzzle rather obtuse, more so than in the typical *R. cantabridgensis*, and widened posteriorly ; its length at the posterior edge of the tympana entering the length of the head and body three and a half times. The tympanic drum is very distinct, and its long diameter enters that of the eye two-thirds of a time. The nostrils are equidistant between the orbit and the end of the muzzle, and look upwards. The skin is quite smooth everywhere, and the dorsolateral fold is easily obliterated by immersion in alcohol. The heel of the extended hind leg reaches to the middle of the eye ; the second toe reaches nearly to the apex of the knee. The palmation is remarkably wide, leaving but one free phalange and all the digits except the fourth, where two are free. The internal cuneïform tubercle is quite prominent, with an obtuse convex edge ; there is no external tubercle. The internal finger (index) is short and stout, and is very little or not at all longer than the second (third) finger.

Color, above, light brownish-gray ; below, white. There are more or less numerous black spots on the sides, which incline to fuse more or less imperfectly into a longitudinal band along the dorsolateral dermal fold. There are in some specimens a few small black marks on the back between the lateral folds. A dark line along the canthus rostralis. The black "ear patch" is reduced to a black line, which passes from the eye posterior to the tympanic disk, and ceases opposite the inferior border of the latter.

Measurements (No. 13,723).	M.
Length of head and body	.052
Width of head at posterior edge of tympana	.019
Length of " " " " " "	.015
Length of fore limb	.022
" " " foot	.011
" " hind limb to groin	.071
" " tibia	.020
" " tarsus	.012
" " remainder of foot	.025

Four specimens from Lake Alloknagits, Alaska ; obtained by C. L. McKay.

R. C. CANTABRIDGENSIS Baird.

Hudsonian district of Eastern region.

RANA AGILIS Thomas. *Rana temporaria*, var. *arvalis* part Günth., Cat., p. 16. *Rana temporaria* Millet, Faune Maine et Loire, ii, p. 664. *Rana agilis* Thomas, Ann. Sc. Nat., sér. 4, iv, p. 365, pl. 7. *Rana gracilis* Fatio, Rev. Mag. Zoöl., sér. 2, xiv, p. 81. *Rana temporaria*, var. *agilis* Schreb., Herp. Eur., p. 125.

Middle latitudes of Europe (Boulenger).

R. A. AURORA Baird & Girard. *Rana aurora* B. & G., Proc. Ac. Phila., 1862, p. 174, and U. S. Explor. Exped., Herp., p. 18, pl. 11, f. 1–6.
Washington and Oregon.

RANA DRAYTONI Baird & Girard. *Rana draytoni* B. & G., Proc. Ac. Phila., 1862, p. 174; Girard, U. S. Explor. Exped., Herp., p. 23, pl. 11, f. 19–24. *Rana lecontei* Baird & Girard, Proc. Ac. Phila., 1853, p. 301; *Rana nigricans* Hallow, Proc. Ac. Phila., 1854, p. 96; Boulenger, Bull. Soc. Zoöl. Fr., 1880, p. 207; Brocchi, Miss. Sc. Mex. Batr., p. 15, pl. iv, f. 3. *Rana longipes* Hallow, U. S. Explor. Surv., x, 1859, iv, Zoöl., p. 20, pl. x, f. 1. *Epirhexis longipes* Yarrow, Check List and Catal. of Specimens of N. Amer. Rept. Batr., 1883, p. 176, not of Baird and Cope.
Pacific, and Western part of Central regions.

R. D. DRAYTONI Baird & Girard.
California.

R. D. ONCA Cope, in Yarrow's Rept. Expl. Surv. W. of 100th Mer. Zoöl., Vol. v, p. 528, pl. 25, f. 1–3.
Utah.

RANA BOYLII Baird, Proc. Ac. Phila., 1855, p. 62.
California.

RANA SILVATICA Lee. *Rana sylvatica* Lee, Ann. N. Y. Lyc., i (1825), 282. *Rana pennsylvanica* Harlan, Sill. Am. Jour. Sc., x (1825), 58.
Eastern region.

RANA PACHYDERMA Cope, Proc. Ac. Phila., 1883, p. 25.
Northern California and Southern Oregon.

URODELA.

PLETHODON CRASSULUS Cope, sp. nov.

This species has a superficial resemblance to the *P. oregonensis*, but its manifold differences are easily perceived.

The form is quite robust, and the head is large, its width going into the length to the thighs only five times. The tail is very much compressed from the base, and is also shallow; its length equals the distance from its base to the gular fold. The legs are robust, but not very long; when appressed to the side they fail to meet by the length of the posterior foot.

The tongue is large, filling the floor of the mouth. The vomeropalatine teeth are in two short series, which converge backwards without coming into contact, from behind the internal edge of the choanæ. The parasphenoid teeth are in a single, undivided patch, which commences well behind the vomeropalatines. The maxillary and mandibular teeth are minute.

The head, viewed from above, is oval; in profile the muzzle is thick and truncate, and projects beyond the mouth. The edge of the lip is slightly angulate below the nares. The eye is rather large, its length equaling that of the muzzle. The distance between the nostrils is equal to that between the bases of the eyelids at their middles. The toes are short and free, one phalange of the first digit on each foot projecting. The ends of the toes are obtuse and bulbiform. A gular fold. Lateral folds fourteen.

Measurements (*No. 4947*).	M.
Total length	.0625
Length of head and body	.034
" to groin	.0314
" " axilla	.0045
" " line of rictus oris	.006
" " " " eye	.0035
" of fore leg	.0095
" " " foot	.0032
" " hind leg	.0095
" " " foot	.004
Width of head	.0077
" between eyes	.0025

Color, above, uniform dark reddish-brown ; below, uniform light brown.

I have seen but one specimen of this species, as follows :

No.	*No. of specimens.*	*Locality.*	*Collector.*
9447.	1.	California.	Dr. J. G. Cooper.

AMBLYSTOMA DECORTICATUM Cope, sp. nov.

This species has a good deal of affinity in its characters to the *A. paroticum* Baird, but it differs in important points of structure, as well as in its external appearance.

Its general proportions are not slender, and the limbs, especially the posterior ones, are very stout. The tail is long and is compressed from the base. It does not bear a fin at any part. Its length, in the single specimen before me, is equal to that of the head and body (including the vent), less the distance from the eye to the end of the muzzle. The head is short and the muzzle is contracted, and is steeply rounded in profile. The distance from the muzzle to the axilla enters the length from the axilla to the groin one and a half times. The width of the head enters the total length to the groin four times. The limbs when pressed to the side overlap by the length of the fingers.

There is no canthus rostralis, and the lower jaw does not project beyond the upper. The external nares are almost terminal, and are as far apart as the distance between the inner borders of the choanæ. The latter are rather large and are transverse. The vomeropalatine series of teeth form a short trahsverse band which is within the lines of the internal borders of the inner nares, and a considerable distance posterior to them. The tongue is wider than long, but does not fill the wide floor of the mouth laterally.

A dermal groove extends posteriorly from the eye to the side of the neck above the anterior border of the humerus. A branch groove descends a short distance posterior to the eye and turns forwards to the canthus of the mouth. These grooves divide masses of crypts, those on the inferior side of the groove being most prominent. The tract above the groove resembles the parotoid gland of the *Amblystoma paroticum*, but is much less distinctly defined, fading out upwards.

There are eleven well-defined lateral dermal folds, and space for a twelfth, which will probably be found well defined in other specimens. The back from the interscapular region posteriorly, and the superior part of the tail, are thickly studded with crypts. There is a slightly defined gular fold.

The fore limb is as long as from its anterior base to the anterior margin of the eye. The toes are quite short, and their lengths, beginning with the shortest, are 5–2–3–4. The posterior foot is especially robust, and the sole is wider than the length of the longest finger. There are no distinct tubercles on the sole. The lengths of the toes are, beginning with the shortest, 1–5–2–4–3.

Measurements (No. 14,493).	M.
Total length	.174
Length to base of tail	.090
" " groin	.071
" " axilla	.031
" " line of eyes	.005
" of fore leg	.026
" " " foot	.010
" " cubitus	.008
" " hind leg	.026
" " " foot	.0105
Width between nostrils	.005
" " eyes	.006
" of head	.016
" " sole	.008
Depth of tail at middle	.008

The manner of describing the color pattern of this species depends on what we regard as the ground. We can assume that the ground color is represented by a dark chocolate brown and say that this is closely studded with brownish white spots of irregular forms and sizes. On the back, limbs, and top and sides of the head, the pale spots are so close together as to reduce the brown to a net-work ; on the fore legs the pale spots are larger than anywhere else. The spots are few on the tail, and those chiefly near the base. The inferior surfaces are dirty light brown.

The characters which separate this species from the *A. paroticum* are, the much shorter series of vomeropalatine teeth ; the shorter fingers and toes ; the less distinct parotoid glands ; the shorter and more obtuse head, and the coloration.

It is the first and only species of Amblystoma yet found in Alaska.

No.	*No. of specimens.*	*Locality.*	*Year.*	*Collector.*
14,493.	1.	Port Simpson, Alaska.	1885.	T.H.Streets, U.S.N.

Amblystoma lepturum Cope, s.p nov.

This species resembles the *A. cingulatum*, but differs from it in the entirely different form and proportions of the tail. This part is very slender in the *A. lepturum*, with round or vertical oval section, without keel above, and lacking very little of being as long as the head and body together. The legs are of the same proportions as in the *A. cingulatum*; that is, when appressed they are separated by a space equal to the length of the posterior foot, showing their greatly superior length to those of the *A. microstomum*. The body is cylindric. The head is an oval, with produced and rounded muzzle, which projects beyond the lower jaw. The animal resembles a Plethodon rather than the species of Amblystoma, but its vomerine teeth and tongue have all the characters of the *Amblystoma microstomum.*

The vomerine teeth form a convex series extending forwards to a point between the choanæ, where they are slightly interrupted on the middle line. The tongue is large, filling the floor of the mouth, and is extensively free at the sides only. The external nostrils are nearly terminal and are rather near together, the space between them being equal to just half that between the bases of the eyelids, and about three-fifths that between the choanæ. The width between the eyes behind is equal to the axial length from the same to the end of the muzzle. The width of the head enters the length to the groin seven times. The length from the muzzle to the axilla enters the distance from the latter to the groin one and three-fifth times.

The lateral digits are distinct, and the median ones moderately elongate. Their lengths, beginning with the shortest, are, fore foot, 2–5–3–4; hind foot, 1–5–2–3–4. The phalanges are, fore foot, 2–2–3–2; hind foot, 2–2–3–4–2. No palmar or plantar tubercles.

The skin is perfectly smooth, and between the axilla and the groin it is marked by fourteen grooves. There are no dermal margins to the fingers or the tail. The cloacal orifice is a simple slit. There is a distinct postgular fold.

Measurements (No. 14,583).	M.
Total length	.115
Length from end of muzzle to base of tail	.092
" " " " " " groin	.0515
" " " " " " axilla	.020
" " " " " " canthus oris	.0065
" of fore leg	.013
" " " foot	.0055
" " hind leg	.016
" " " foot	.0075
Depth of tail at middle	.0025

The color of the typical specimen in alcohol is purplish brown above and paler below. There are numerous not well-defined whitish spots on the sides and a few on the belly, and there are some very faint and delicate gray lines across the posterior part of the back. The tail is densely speckled with gray on the sides, and delicate gray lines cross the upper surface of thetail in a reticulate manner. The limbs are paler than the back, and the digits are cross-banded with whitish.

The habitat of this species is unknown. The only specimen was found in a jar with a specimen of *Diemyctylus torosus*, and one of *Rana temporaria*, the former Californian, the latter Palæarctic.

AMBLYSTOMA ANNULATUM Cope, sp. nov.

The largest species of the group of the *A. microstomum*, and resembling that species rather than the *A. cingulatum*. However it approaches the last-named species in the form and length of its tail, but exceeds that and all the other species of Group V in the length of that part of the body.

The muzzle is very short, and the head is not distinguished from the neck. The legs are short, and when appressed to the sides are separated by a space of three and parts of two other intercostal spaces, equal to four spaces. The tail is in section cylindric at base, and widely oval to near the extremity, where it is more narrowly oval. It is not angulate and has no dermal margin on the middle line above or below. Its length exceeds that of the head and body by the length of the anterior foot, and it may have been longer, as the extremity is injured.

The head is short, and the width enters the length to the groin six and a quarter times. The front is convex to the upper lip, in profile, and transversely between the orbits. The parietal region is very convex transversely. The width between the canthi oculorum behind exceeds the length from the same point to the end of the muzzle. The nostrils present anteriorly, and they are not quite so close together as in *A. lepturum*, as the distance between them measures two-thirds the width between the eyelids. The vomerine teeth form two transverse fasciculi of several rows of teeth each, between the choanæ, convex forwards, and separated on the middle line by a very short interval.

The skin is perfectly smooth, there is a postgular fold, and the sides are crossed by thirteen folds with space enough at the axilla for a fourteenth. The tail is also very distinctly annulate-grooved. I count thirty-one grooves behind the femora, and the injured extremity is not grooved. Indistinct grooves are apparent on the tails of several of the species of Amblystoma. There are no rows of mucous pores on the head or body of this species, nor accumulations of crypts on the head, body or tail.

The palm is wide, and the fingers not long, though of unequal length. The lengths of the fingers, beginning with the shortest, are 2–5–3–4, and their phalanges number 2–2–3–2. The toes of the hinder foot have, in order of length, 1–5–2–3–4, and of phalanges, 2–2–3–4–2.

Measurements (No. 11,564).	M.
Total length	.186
Length to base of tail	.092
" " groin	.077
" " axilla	.022
" " canthus oris	.009
" of fore limb, from axilla	.0172
" " " foot	.007
" " hind limb, from groin	.022
" " " foot	.012
Width of head	.012
Depth of tail at middle	.009

The typical and only specimen is preserved in alcohol. The color above, everywhere, is dark brown; below, very light brown. The sides are paler, perhaps pale yellow in life, and the color ascends at several points, so as to form cross-bands of moderate width and very well defined. One of them crosses at the occiput, and one at the axillæ; between the latter and the groin there are five, nearly equidistant. There is an imperfect one at the sacrum, and there are seven on the tail, one of them imperfect. The coloration of this species is quite unique in the genus in its regularity.

The locality of the only specimen is unknown.

Notes.—I add here that the *Plethodon iëcanus* Cope proves to be a well-marked species of Anaides. The species was described from a young one. Also that a study of all the Amphiumidæ accessible to me, shows that the two and three-toed forms must be referred to a single species, the *A. means* Gard.

Is there Reciprocity in Trade? And the Consumption of Manufactured Commodities. By Thos. H. Dudley.

(*Read before the American Philosophical Society, October 1, 1886.*)

One of the chief arguments used by the free trader against the protective system in the United States, is that of reciprocity in trade. Indeed it may be regarded as one of the chief corner-stones upon which their free-trade theory is based.

Their formula is, that if I do not buy of you, you will not buy of me. And from it they argue that if the people of the United States continue their protective system and refuse to buy their manufactured commodities of England, the English people will refuse to buy anything of them.

The doctrine, when carried to its legitimate conclusion as they contend for it, is this: We are to repeal our protective laws, so as to enable the English to bring into our markets their manufactured commodities and sell to our people free of duty; and to this extent at least giving the English manufacturer, who pays no taxes in the United States, the right to supplant our manufacturer with his commodities, made in England and by English workmen ; leaving our own people to pay their taxes and to live as best they can without work. If we do not do this, they say, the English people will not buy our surplus agricultural products.

It must be noted here that every dollar's worth of manufactured goods brought from England and sold in the United States, takes just one dollar's worth of work from our people. If it is made or produced in England the workman there gets the benefit, that is, the wages for its production. If made in this country, the workman here gets the benefit, the wages for making it.

When it is remembered that, if it is extended to all our industries, it will amount to hundreds of millions of dollars ; and to hundreds of thousands of working people who will be affected by the transfer of our manufacturing to England, the importance and magnitude of the question is seen, especially upon the working people of this country, the men who have to earn wages by labor in order to live.

But the subject we are considering is that of reciprocity ; and as so much stress has been laid upon it by the free traders in England, as well as by those who sympathize with them in this country, it is of some importance to learn whether as a principle it is true or untrue. In other words, whether it has the effect upon trade that is claimed for it.

The foreign commercial relations or dealings between nation and nation are never carried on by the governments, that is, one government dealing with another government, but by individuals. The individuals of one nation dealing with the individuals of another nation.

If it were the English government dealing directly with the American government, then she might say to us : If you do not repeal your tariff laws and buy your manufactured commodities of us instead of making them yourselves, we, the English, will not buy of you what we may require in agricultural products or anything else. But unfortunately for the argument, it is not the English government dealing with the United States government, or with our people, but it is the English merchant dealing with the American merchant, and the whole transaction is business with both. It is a question of price that governs all their transactions. The English merchant, whether it is provisions or cotton, buys wherever he can purchase what he requires the cheapest. He never looks, considers or cares about the balance of trade, whether it is on the one side or the other. His object in doing business is to make money. And all his contracts and dealings are based on this idea, and he buys wherever he can buy to the best advantage without regard to reciprocity. If it is ten thousand bushels of wheat that he requires, and he can buy it cheaper in New York than he can in Odessa, he buys it in New York ; if on the other hand he can buy it cheaper in the Crimea or India, he buys it there, and not in New York. It is price, and it alone, that controls the matter. And so with every other product or commodity that the English merchant or American merchant deals in. And as a rule this will apply to every commercial transaction in the United States, in England or in any other civilized country. And with reciprocity falls another favorite doctrine of the free traders closely allied to reciprocity, to wit, barter—*that for every import there must be an export.* Mr. Mongredien, in his writings for the Cobden Club of England, states it in this way: "The increased imports which abolition of customs duties would bring about, would necessitate increased exports to the same amount to pay for them, *for there can be no additional import without a corresponding export.*"

The theory of the free traders is, that when you buy a bill of goods in a foreign country and import them, they must be paid for by an export of some product or commodity from the country into the one from which the import came; that an export will follow the import; that it is a mere barter or trade of one product for another product.

This theory of the free traders has been asserted so often and insisted upon with so much persistency for such a period of time that they seem to regard it as admitted, and not even open to criticism, much less contradiction; and they demand that the whole world shall assent to and admit it, and of course all the pernicious and false assumptions and arguments which are based upon it. I have had occasion to comment upon this subject before, in my reply to Mongredien, and pronounced it a fallacy. I repeat it again, and say no greater fallacy has ever been attempted to be palmed off upon an intelligent people. It is neither true in theory nor in practice, and never has been. However beautiful it might be in theory, that if for every import there was a corresponding export, in practice it never has been true, and the trade of the civilized nations of the world for the last hundred years, if we examine it, proves it to be untrue. An export of a product does not follow every import of a product. In the dealings between merchants, whether at home or abroad, whether between each other here in the United States or with those who live in England or in any other country, the contracts or transactions in their dealings with each other are based upon money or cash and not upon barter or trade: that is, are to be paid for in money. and not in barter of one commodity for another commodity; and this applies whether the contract is for cotton, wheat, steel rails or woolen goods; the one who buys agrees to pay for it in cash or money, and a trade of one commodity for another commodity is quite exceptional and out of the common or ordinary mode of mercantile transactions. If Mr. Vanderbilt should want a thousand tons of steel rails, and he should buy them of Naylor, Benson & Co., of London, he would pay for them in cash or money and not in merchandise; and there would be no obligation, either expressed or implied, on the part of the London house or anybody else, that because of the purchase of the rails they should buy grain or other merchandise from Mr. Vanderbilt or any other person in the United States. If there were millions of bushels of wheat piled up in every seaboard city of this country, they would not take it. If you were to appeal to them they would tell you that their business was confined to tin plates and metals, &c., and that they did not deal in grain. If Naylor, Benson & Co., who have sold the steel rails, are not under obligations to reciprocate, and take a corresponding quantity of merchandise in value to the amount for which they sold the rails, in order to make an export follow the import of the rails, who are under obligations to do so? The answer is, no one. And though our granaries may be full and running over with grain, the corn merchant of Liverpool or London will not buy it unless they can purchase it cheaper than they can elsewhere, and then they will take only the quantity which they require and no more. As has been stated, if they can buy it cheaper in Russia or India than they can of us they will buy it there, and that without the least regard to the fact that Mr. Vanderbilt bought his steel rails in England; and it would be the same if we were to stop manufacturing steel rails in the United States and buy all we require in England, even if it should be to the extent of their whole production. This will apply with equal force to every other manufactured commodity made, or product which the earth yields. As has been remarked, it is not the nations, as governments, dealing with other nations, but individuals; and each anxious to make out of every transaction or contract, whether domestic or foreign, all that can be made legitimately, and that without regard to the interests of nations or other individuals. If we examine the statistics of every civilized country on the globe, this will be verified. And permit me here to say, that while every writer upon political economy in England is proclaiming and asserting that for every import there must be an export, and claiming the doctrine of reciprocity in trade as I have stated it—the last named of which has been so often used to frighten our people and especially the farmers of our country, that if we do not buy of them they will not buy of us—there is no country in the world where the fallacy and falseness of these doctrines are shown by their own published trade reports more fully than they are in England. Their aggregate imports for the last thirty years, without one single exception, have every year exceeded their exports. They have not shown in any of their writings or reports that in one single instance the export has followed the import. The figures for the last ten years, as taken from their trade reports, printed by order of Parliament, are as follows:

Years.	*Total Imports.*	*Total Exports.*
1875	£373,939,577	£281,612,323
1876	375,154,703	256,776,602
1877	394,419,682	252,346,020
1878	368,770,742	245,483,858
1879	362,991,875	248,783,364
1880	411,229,565	286,414,466
1881	397,022,489	297,082,775
1882	413,019,608	306,660,714
1883	426,891,579	305,437,070
1884	390,018,569	295,967,583
	£3,913,458,389	£2,776,564,775

Making the total imports for the United Kingdom more than the total exports for the last ten years £1,136,893,614, or in our money $5,502,-565,091.

It is not pretended, in these published reports of their trade, that there has been an export for every import. So far from this, they show right the contrary. They give us the total value of all their exports of British and foreign and colonial produce, and all their imports each year, and they show that their exports fall short of their imports by more than five billion five hundred millions of dollars in the last ten years of their trade. And it has been the same for more than thirty years in their dealings. In each of these years they have published a report of their trade for the year, and in each and every report they give their imports and exports for that year ; and from it we find that each and every year during this period the import has been in excess of the export, virtually admitting that there has not been an export for every import. The appalling figures in these reports of the terrible condition of their trade with foreign nations, stand out in bold relief, and give a crushing denial to their assumed but fallacious dogma. And there is no excuse or explanation given, or pretended to be given, in any one of these annual trade reports that have been published during this time, why the export has not followed the import, as they assert it should have done.

If you include the exports and imports of gold and silver in the United Kingdom, they do not get over the difficulty or to any very great extent change the figures given above as to the excess of the imports over the exports. Persons familiar with the depression of trade in England and the suffering of the working people for want of employment, will find there ample ground to account for the depression and the want and misery that exist there.

A nation cannot continue forever to buy more than she sells and be prosperous any more than an individual can. If the outgoes are more than the income, in time ruin and bankruptcy must follow. It is true of individuals and it is equally true of nations.

The figures in these annual reports of course are made up from the united dealings of the people of the kingdom with the people of other countries. In order still further to prove the falseness of this theory, we will examine these same English reports and take their dealings with the people of some of the other nations.

And first let us take France, their nearest neighbor, and see whether in their dealings with this nation the exports have followed the imports. The figures for the last ten years of their trade are as follows :

Year.	*Imports.*	*Exports.*
1875	£46,720,101	£27,292,455
1876	45,304,854	29,000,273
1877	45,823,324	25,663,602
1878	41,378,896	26,595,958
1879	38,459,096	26,558,333

Year.	*Imports.*	*Exports.*
1880	£41,970,298	£27,990,959
1881	39,984,187	30,085,661
1882	39,090,381	29,758,427
1883	38,363,022	29,409,335
1884	37,437,014	26,339,443
	£414,804,173	£278,694,446
	278,694,446	
	£136,109,727	

The imports for the last ten years from France are £136,109,727 more than their exports, or in our money $658,771,078. If you go back for twenty years you will find the same disparity between the import and export, except for the year of the German war, when the exports exceeded the imports by a small amount.

We will next take Denmark. The figures of their trade with the people of this nation for the last ten years are as follows :

Year.	*Imports.*	*Exports.*
1875	£4,241,671	£2,756,145
1876	4,217,934	2,598,707
1877	3,950,229	2,332,911
1878	4,584,544	1,900,135
1879	4,675,090	1,984,767
1880	5,285,767	2,347,573
1881	4,611,999	2,431,193
1882	5,249,467	2,489,182
1883	6,254,998	2,597,807
1884	5,248,244	2,600,591
	£48,319,943	£24,039,011
	24,039,011	
	£24,280,932	

The imports for the ten years of their trade with Denmark have been more than double the exports, and the imports have been more than double the exports for the last twenty years.

We will now take Sweden and Norway. The figures of their trade with England for the last ten years, are as follows :

Year.	*Imports.*	*Exports.*
1875	£8,918,638	£6,296,995
1876	10,654,311	6,323,606
1877	10,454,475	6,197,099
1878	9,127,397	4,324,333
1879	8,392,723	3,928,682
1880	10,989,000	5,132,408

Year.	*Imports.*	*Exports.*
1881	£10,054,051	£5,037,236
1882	11,758,635	5,107,502
1883	11,834,314	5,410,972
1884	10,529,115	5,304,429
	£102,271,659	£53,063,262
	53,063,262	
	£49,649,397	

It will be observed here that the imports are nearly double the exports for the ten years. And if you go back for twenty years the same disparity exists between the imports and exports.

We will next take their trade for the last ten years with Spain. The figures are as follows :

Year.	*Imports.*	*Exports.*
1875	£8,660,953	£4,294,490
1876	8,763,146	4,796,498
1877	10,842,097	4,267,214
1878	9,115,394	3,794,734
1879	8,398,776	3,758,717
1880	10,669,936	4,078,597
1881	11,027,505	4,393,821
1882	11,488,265	4,847,662
1883	11,623,663	4,876,243
1884	10,157,885	4,750,746
	£99,777,620	£43,858,722
	43,858,722	
	£55,918,898	

The imports are more than double the exports ; and this holds good with Spain for the last twenty years.

The trade with Russia for the last ten years shows the following figures :

Year.	*Imports.*	*Exports.*
1875	£20,708,901	£11,346,316
1876	17,574,488	8,635,655
1877	22,142,422	5,443,973
1878	17,803,852	9,458,729
1879	15,876,585	10,607,083
1880	16,029,695	10,967,517
1881	14,053,221	9,277,438
1882	21,047,722	8,637,568
1883	20,976,182	7,629,883
1884	16,315,408	7,588,556
	£182,528,476	£89,592,718
	89,592,718	
	£92,935,758	

It will be seen that for the last ten years the English people have imported from Russia more than double what they exported to Russia, and during the last twenty-six years there has not been a single year but what the imports have exceeded the exports, and during this whole time they have been more than double.

The figures for the last twenty-six years are as follows :

Imports	£474,080,882
Exports	213,144,167
Excess of imports over exports	£260,936,715

From China, during the last ten years, the imports have amounted to £119,440,038, while the exports to have only been £49,091,938; the imports being very much more than double the exports.

From Egypt, during the last ten years, the imports were £94,528,335, and the exports to only £28,243,538, not one-third the amount of the imports.

From Peru, for the past ten years, the imports from were £35,692,075, and the exports to £11,536,330 ; the imports being three times in excess of the exports.

In all the above instances in the trade between England and the nations mentioned, the export has not followed the import, but England has bought, each and every year, largely in excess of what these nations have bought of her.

The people of these nations, in their dealings, have followed the usual course of business, each taking from the other what they required and nothing more, and that without regard to the balance of trade or the import from or export to, proving fully the untruthfulness of the doctrine that an export always follows an import. In the case of Russia, where the excess of the imports over the exports has been going on for so many years, this excess of imports has been made up, in almost every instance, of agricultural products.

England has been buying breadstuffs and other agricultural products of Russia without any regard to what Russia bought of her. And as long as the Russian farmer can sell his wheat cheaper than it can be bought in the United States or India, so long will the English corn merchant continue to buy it of Russia, and that without regard to whether the Russian merchant buys his woolen goods or hardware of the English merchant or not. And what has been said with regard to wheat applies with equal force to every other commodity that enters into the trade or dealings between man and man in every civilized nation of the world. A man may trade a handsaw for a jackknife, and no doubt this is sometimes done, but it is not the ordinary course of business between merchants ; as a rule they buy what they require and pay for it in cash, and sell it to others in the same manner for cash. If we examine our own trade reports, or those of France, Germany or any other civilized country, we will find the same disparity between the imports and exports, the figures of their dealings confirming what I have said about the import and the export, and that one very rarely, if ever, follows the other. An export does not always follow an import. And there is no reciprocity in trade between nation and nation, each buying from the other what it requires and nothing more, and that without regard to which side the balance of trade is on in their dealings.

Next after ourselves England raises more revenue from custom duties under her tariff laws than any other country in the world; notwithstanding this it has been and is a source of continual complaint on the part of Englishmen that we have tariff laws, and that we make an effort to protect our laboring people and develop our own resources. The English claim that this interferes with their trade, and that we ought to repeal our tariff laws and admit their manufactured commodities into our country free of duty; and one of the tasks which the Cobden Club of England has undertaken is to break down our protective system and establish free trade in its place; yet, notwithstanding our tariff laws and restrictions about which they so much complain, we buy more of her manufactured commodities than any other nation, and this has been the case for the last five years. During the whole of this period no nation has bought so much of her as we.

We are to-day and have been the best customer England has.

In India England has abolished the tariff, so that there is absolute free trade, at least so far as her manufactured commodities are concerned; and she can send and is sending her manufactured commodities there free of duty and of all tariff restrictions, and yet the two hundred and fifty-three millions of people in India, with free trade so far as English commodities are concerned, take less of England than we do. Our fifty-six millions of people in the United States buy more of England than the two hundred and fifty-three millions of people in India, and more than the ninety-eight millions of people living in the Russian empire.

Why is this? The answer is very easily given. It lies in the fact that the people of the United States consume or use of the manufactured commodities of the world nearly twice as much as the people of any other country or nation, I mean *per capita*, man for man. If asked for an explanation why we use or consume more goods, &c., in this country than they do in England, France or any other country, it is easily given. Under our protective system we pay our people double the wages that are paid to the work people of any country in Europe, and this enables them to buy more. Their power to buy depends upon what they receive for their labor. It is the laboring people of a country who more largely than others consume the products of the mills as well as of the earth. In consequence our laboring people are better fed, better housed, better clothed than the working people of any other country; have the means to buy and do buy not only the necessaries of life, but many of the luxuries as well. They thus live better than the working people of other countries, more like human beings ought to live, like God intended that man should live ; for the earth was given to man not only as a place where he is to exist for a time, but as a home with all that is implied in the term, where food and raiment and the comforts of life should be within the reach of every human being who will labor to obtain them, and that in sufficient quantity to enable him to live as a man ought to live, with the comforts of this life about him.

And whilst we admit that all human systems of governments and laws are imperfect, we contend that the one which affords to the masses of the people the best homes and more of this world's goods in the way of food, clothing and those things which are necessary for their comfort, happiness and welfare, is the nearest perfect, and therefore the best.

We claim this for the American system of protection, and that it has accomplished more for the masses of the people than any other system that has ever been devised or practiced, and at the same time made us in power, grandeur and civilization the first nation in the world.

As an evidence of this and the benefit the masses are receiving from it, we point with just pride to the fact which has just been stated, that the people of this country to-day are consuming probably double *per capita* of the manufactured commodities of the world, and more of the agricultural products than the people of any other country or nation, with all the benefits, comforts and advantages resulting from it ; and this of itself, we think, if there was nothing else to commend it, ought to endear it to every human being in our land, and as a system to perpetuate it forever.

Stated Meeting, September 3, 1886.

Present, 8 members.

Vice-President, Dr. W. S. W. Ruschenberger, in the Chair.

Letters of acceptance of membership were read from Prof. Otto Donner, Helsingfors, Finland ; Dr. Aristides Brezina and Prof. Edward Suess, Vienna, Austria ; Prof. Paul Albrecht, Hamburg, Germany ; Victor Duruy, Prof. Abel Hovelacque, Marquis de Nadaillac and Dr. Edward Pepper, Paris, France ; Duke of Argyll, Prof. Wm. Crookes and Capt. Richard C. Temple, London, England ; Lord Rayleigh, London, England ; Mr. William S. Baker, Prof. John Marshall, Prof. John T. Napier, Mr. Samuel W. Pennypacker, Mr. Henry Reed and Prof.

Benjamin Sharp, Philadelphia; Prof. Herbert B. Adams and Prof. William K. Brooks, Baltimore, Md.; Prof. John C. Branner, Bloomington, Ind.; Prof. Antonio Peñafiel, Mexico, Mo.

A letter was read from Mr. Francis Galton, of London, declining membership, for reasons held sufficient by the Society.

Letters of envoy were read from the Geological Survey of India; Société des Naturalistes de la Nouvelle Russie, Odessa; Académie Royale des Sciences, Amsterdam; Bibliothèque de l'Université Royale, Lund; Reale Accademia dei Lincei, Rome; American Antiquarian Society, Worcester; Department of the Interior; United States Geological Survey.

Circulars were received from the United States Naval Observatory as to the continuation of the publication of the "Results of Meteorological Observations made at the Naval Observatory;" from the International Congress of Geology in relation to a proposed geological map of Europe, to be issued under the direction of a specially appointed committee; from the American Public Library and Museum, Frankfurt-am-Main, requesting the Society's publications; from the Verein für Erdkunde in Leipzig, containing the announcement of its Twenty-fifth Anniversary.

Photographs for the Society's album were received from Prof. John C. Branner, of Bloomington, Ind.; Col. Garrick Mallery, of Washington.

Letters indicating a change of address were received from Prof. Japetus Steenstrup, Copenhagen (Frederiksborggade, 18, 2. Copenhagen); Meteorological Office, London (116 Victoria St., S. W.).

Letters were read from Prof. Joseph Hyrtle, of Vienna, stating that on account of blindness he returns No. 122, and requests that nothing further be sent him; the Verein für Vaterländische Naturkunde, Würtemberg, desiring certain of the Society's publications. On motion the request was referred to the Secretaries with power to act.

Acknowledgments were received from Connecticut Historical Society (72); Institut Egyptien (81–87; 89–122); Académie Royale des Sciences, Amsterdam (116–119); Bibliothèque de l'Université Royale, Lund (116–120); Royal Society of New South Wales (116–121); Verein für Vaterländische Naturkunde, Würtemberg, Comité Geologique, St. Petersburg, 117–121); Observatorio Astronómico Nacional Mexicano (117, 118, 119, 122); K. K. Sternwarte in Prag (120); Prof. Japetus Steenstrup, Copenhagen (120, 121); Société Royale de Zoologie, Amsterdam (120, 121, 122); Prof. E. Renevier, Lausanne, Ministre de l'Intérieur, Brussels, R. Academia dei Lincei, Rome, Musée Guimet, Paris (121); Fondation de P. Teyler, Harlem, Meteorological Office, London, Society of Antiquaries, London, Statistical Society, London; Cambridge Philosophical Society, Prof. James Geikie, Edinburgh, Mr. Benjamin Smith Lyman, Denver (122); Deutsche Morgenländische Gesellschaft, Halle A. S., New Bedford Public Library (121, 122); Department of the Interior; Garten-Bau Verein, Berlin (119).

Donations for the Library were announced from Mining Department, Melbourne; Royal Asiatic Society, Hong-Kong; Royal Asiatic Society (North China Branch), Shanghai; Geological Survey of India; Royal Geographical Society of Russia; Comité Geologique, Profs. Otto Stuve and Serge Nikitin, of St. Petersburg; Société Impériale des Naturalistes, Moscow; Society of Naturalists of New Russia, Odessa; Accademia degli Agiati, Roveredo, Austria; K. K. Geologische Reichsanstalt, Vienna; K. B. Akademie der Wissenschaften and Deutsche Gesellschaft für Anthropologie, &c., Munich; Naturforschende Gesellschaft des Osterlandes, Altenburg; Deutsche Geologische Gesellschaft and S. Calvary & Co. (publishers), Berlin; Naturhistorischer Verein and Prof. G. Vom Rath, Bonn; Verein für Erdkunde, Dresden; Naturforschende Gesellschaft, Emden; Prof. Paul Emil Richter of Freiburg; Oberhessische Gesellschaft für Natur- und Heilkunde, Geissen; "Zoologischer Anzeiger," K. Sachsische Gesellschaft der Wissenschaften and Prof. C. F. Zinchen of Leipzig; Naturhistorische Gesellschaft, Nüremberg; Verein für Vaterländische Naturkunde in Würtemberg; Editors of the "Naturforscher," Tübingen; Unterfrank. Kreuxifisherei-Verein, Würtzburg; Société de Physique, &c., Geneva; Société Vandoise des Sciences Naturelles, Société Géologique Suisse and Prof. E. Renevier of Lausanne; Prof. François W. C. Trafford of Zurich; K. Akademie van Wetenschappen and K. Zoologisch Genootschap, Amsterdam; Société Hollandaise de Sciences and Archives Néerlandais, Harlem; Biblioteca Nazionale Centrale, Florence; R. Istituto Lombardo di Scienze ed Lettere, Milan; R. Accademia di Scienze Lettere ed Arti, Modena; R. Accademia di Scienze Lettere ed Arti, Padua; Società Toscana Scienze Naturali, Pisa; R. Accademia dei Lincei, R. Comitato Geologico d'Italia, Biblioteca N. Centrale Vittorio Emanuele and Prof. Guiseppi Sergi of Rome; Accademia Reale delle Scienze and Observatorio R. Università, Turin; R. Istituto Veneto di Scienze Lettere ed Arti; Académie Royale de Belgique, Musée Royale d'Historie Naturelle and Prof. Albrecht, Brussels; K. Universitet, Lund; Société de Géographie, Institution Ethnographique, Société d'Anthropologie, Société des Antiquaires de France, Musée Guimet, École des Mines, Revue Internationale de l'Enseignement, Ministre de l'Instruction Publique and Marquis de Nadaillac, Paris; Société des Sciences Physiques et Naturelles, Bordeaux; Société Séricicole, Montpellier; R. Academia de Ciencias Naturales y Artes, Barcelona; R. Academia de la Historia, Madrid; Instituto y Observatorio de Marina (San Fernando); Royal Society, Linnean, Zoological, Geological and Statistical Societies, Royal Geographical and Astronomical Societies, Meteorological Society and Office, Society of Antiquaries, Victoria Institute, "Nature," Journals of Conchology and Forestry and Dr. Benjamin Ward Richardson of London; Cambridge Philological Society; Royal Cornwall Polytechnic Society, Falmouth; Philosophical and Literary Society of Leeds; Royal Dublin Society and Royal Geological Society of Ireland; Nova Scotian Institute of Natural Science; "The Canadian Record of Science," Montreal; Dr. Robert Bell, Ottawa; Literary and Historical Society, Quebec; Canadian Institute, Toronto; Military Academy, Norwich, Vt.; Mt. Pleasant Classical Institution; Boston Society of Natural History, Massachusetts Historical Society, American Statistical Association, Mr. H. Andrews Hill and the editor of "Library Notes," Boston; Harvard College, Museum of Comparative Zoölogy and Prof. Samuel H. Scudder, Cambridge, Mass.; Essex Institute; "American Journal of Science," College and Oriental Society, New Haven; Entomological Yale Society and Brooklyn Library; Buffalo Library; American Chemical Society and Meteorological Observatory, New York; Vassar Brothers' Institute, Poughkeepsie; Geological Survey of New Jersey; editor of the "Philosophian Review," Bridgeton; College of Pharmacy, Franklin Institute, Historical Society of Pennsylvania, Mercantile Library, Pennsylvania Society for Promotion of Public Economy, Academy of Natural Sciences, Philadelphia Library, Provident Life and Trust Co., Philadelphia Panorama Co., Messrs. S. C. Perkins, Fr. Meinert, Celen Sabbrin, W. S. Baker, R. S. Culin, Henry Phillips, Jr., and McCalla & Stavely, Philadelphia; Wyoming Historical and Geological Society; U.S. Naval Institute, Annapolis; Johns Hopkins University and American Journal of Philology, American Chemical Journal, American Journal of Archæology, Peabody Institute, Baltimore; U. S. Fish Commission, U. S. National Museum, U. S. Geological Survey, U. S. Naval Observatory, National Academy of Sciences, U. S. Government Publications Bureau of Education, Hydrographic Office, Departments of Interior and of State, Virginia Historical Society; Leander McCormick Observatory; Society of Natural History, Cincinnati; Transylvania University; Mr. Charles C. Jones, Jr., of Augusta; Society of Natural History, Brookville, Ind.; Rev. Stephen D. Peet, Chicago; Prof. H. S. Frieze, Ann Arbor; Mr. T. F. Williams, St. Paul; Academy of Natural Sciences, Davenport, Ia.; State Historical Society, Iowa City; Washburn College and Kansas Historical Society, Topeka; Prof. Chas. W. Brooks, San Francisco; Colorado Scientific Society; Dr. Antonio Peñafiel, Mexico; Prof. L. Darapsky, Santiago; Imperial Observatorio, Museo Nacional and Prof. Ladislau Netto, Rio de Janeiro.

The Secretaries reported that they had communicated with various foreign and domestic societies and periodicals in referende to an exchange of publications, and that the following so far had responded favorably, viz:

La Société de Borda, Dax, France; Geographische Gesellschaft, Hannover; Académie de Belles Lettres, Caen, France; R. Accademia degli Agiati, Roveredo, Austria; R. Academia de Ciencias, Barcelona, Spain; Société Sericicole, Montpellier, France; Société des Antiquaires de la Marne, St. Omer, France; Naturforscher, Tübingen, Germany; Cosmos, Paris, France; Verein für Thüringische Geschichte, Jena; Société des Amis des Sciences Naturelles et d'Ethnographie, Moscow, Russia; Société des Sciences et de Geographie, Port-au-Prince; K. Zoolog. Genootschap, Hague; R. Accademia di Scienze, Padova; Soc. Historique et Litt. du Cher, Bourges; Garten-Bau Verein, Darmstadt; Naturwissenschaftliche Gesellschaft, Dresden; La Société Polymathique de Morbihan, Vannes, France.

On motion, the above societies, &c., were placed upon the exchange list to receive Proceedings from No. 96.

La Société Malocologique de Belgique, Bruxelles, requested certain volumes of Transactions, which were ordered to be sent, and that the Society should receive them as published hereafter.

Pending nomination No. 1113 was read.

Mr. Phillips exhibited a photograph of Mt. Ætna in eruption, on May 20, 1886, at 1.30 P.M.

On motion, of Mr. Law, the Society appropriated $100 for the mounting on guards and binding the MS. letters of William Temple Franklin, lately found in the Society's attics.

On motion of Mr. Jordan, the Society agreed to dispense with the meeting of September 17th, and the Society was adjourned by the presiding member.

Stated Meeting, October 1, 1886.

Present, 15 members.

President, Mr. FRALEY, in the Chair.

Mr. W. S. Baker, a newly-elected member, was presented to the Chair and took his seat.

Letters of envoy were received from the Meteorological Office and Statistical Society of London; American Academy of Arts and Sciences, Boston; Boston Society of Natural History; Observatorio Nacional, Córdova, Argentine Republic.

Letters of acknowledgment were received from L' Acadèmie Royale Danoise des Sciences et des Lettres, Copenhagen (120, 121); Royal Society of London (121); Boston Society of Natural History (119–122); Natural History Society, Montreal, Canada (123); Institut Canadian-Français, Ottawa, Canada (123); Canadian Institute, Toronto, Canada (123); Historical and Scientific Society of Manitoba, Winnipeg, Canada (123); Portland Society of Natural History, Maine (123); New Hampshire Historical Society, Concord (123); Museum of Comparative Zoölogy, Prof. Alexander Agassiz, Mr. Robert N. Toppan, Cambridge, Mass. (123); Essex Institute, Salem (123); American Antiquarian Society, Worcester, Mass. (123); Rhode Island Historical Society, Providence (123); Connecticut Historical Society, Hartford (123); University of the City of New York, New York Historical Society, Prof. Henry M. Baird, Prof. J. J. Stevenson, New York (123); Prof Walter LeConte Stevens, Brooklyn, N. Y. (123); Prof. C. H. F. Peters, Clinton, N. Y. (123); U. S. Military Academy, West Point, N. Y. (123); New Jersey Historical Society, Newark (123); Numismatic and Antiquarian Society, Mr. Thomas M. Cleemann, Prof. J. Solis Cohen, Mr. Patterson DuBois, Prof. James W. Holland, Mr. W. W. Jefferis, Prof. John M. Maisch, Dr. Chas. A. Oliver, Mr. Henry Phillips, Jr., Mr. Thos. N. Walter, Philadelphia (123); Rev. J. A. Murray, Carlisle, Pa. (123); Prof. M. H. Boyé, Coopersburg, Pa. (123); Profs. Traill Green and J. W. Moore, Easton, Pa. (123); Lackawanna Institute of History and Science, Scranton, Pa. (123); Wyoming Historical and Geological Society, Wilkes-Barre, Pa. (123); U. S. Naval Institute, Annapolis, Md. (123); Maryland Institute, Baltimore, Md. (123); Prof. J. H. C. Coffin, Messrs. W. B. Taylor and Chas. A. Schott, Washington, D. C. (123); Leander McCormick Observatory, University of Virginia (123); Prof. M. Schele De Vere, University of Virginia (123); Virginia Historical Society, Richmond, Va. (123); Elliott Society, Charleston, S. C. (123); Georgia Historical Society, Savannah (123); Cincinnati Observatory, Prof. J. M. Hart, Cincinnati, O. (123); Dennison University, Granville, O. (123); Rev. H. S. Osborn, Oxford, O. (123); Prof. Robt. Peter, Lexington, Ky. (123); State University Library, Prof. Daniel Kirkwood, Bloomington, Ind. (123); Chicago Historical Society, Illinois (123); Rantoul Literary Society, Illinois (123); Davenport Academy of Natural Sciences, Iowa (123); State Historical Society of Wisconsin, Madison (123); Kansas State Historical Society, Topeka (123); University of California, Profs. John and Joseph LeConte, Berkeley, Cal. (123); Prof. George Davidson, San Francisco, Cal. (123).

Letters of acknowledgment for the list of surviving members of the American Philosophical Society were received from New Hampshire Historical Society, Concord; Massachusetts Historical Society, Boston; Prof. H. A. Hagan, Mr. Robert N. Toppan, Cambridge, Mass.; Essex Institute, Salem, Mass.; American Antiquarian Society, Worcester, Mass.; Rhode Island Historical Society, Providence; Connecticut Historical Society, Hartford; New York Historical Society, Astor Library, New York; Buffalo Library, Buffalo, N. Y.; U. S. Military Academy, West Point, N. Y.; New Jersey Historical Society, Newark; Mr. Patterson DuBois, Dr. James W. Holland, Dr. Charles A. Oliver, Mr. Robert Patterson, Rev. J. W. Robins, Philadelphia; Prof. J. W. Moore, Easton, Pa.; Lackawanna Institute of History and Science, Scranton, Pa.; Wyoming Historical and Geological Society, Wilkes-Barrè, Pa.; Prof. M. Schele DeVere, University of Virginia; Georgia Historical Society, Savannah; Chicago Historical Society, Illinois; State Historical Society of Wisconsin, Madison; Kansas State Historical Society, Topeka; University of California, Berkeley, Cal.

Letters accepting membership in the Society were read from Prof. Merrill E. Gates (Rutgers' College, New Brunswick, New Jersey, September 27th, 1886); Prof. J. P. Postgate (Trinity College, Cambridge, England, September 4th, 1886).

La Société Littéraire Finnoise and the University of Illinois requested by letter to receive the Society's Proceedings. On motion, they were ordered to be placed on the list to receive Proceedings from No. 96.

The following societies were placed on the exchange list and ordered to receive Proceedings from No. 96:

Verein für Thüringische Geschichte und Alterthumskunde, Jena; Berliner Anthropologische Gesellschaft; Berliner Gesell. für Erdkunde; Maatschappij der Nederlandsche Letterkunde, Leiden.

Donations for the Library were reported from the following: Deutsche Gesellschaft für Anthropologie, Munich; Acadèmie Royale de Copenhagen; Prof. Giuseppi, Sergi-Rome; R. Osservatorio di Torino; La Société d' Histoire de France; d' Anthropologie de Paris; de Zoologie de France; Revue Internationale de L' Enseignement, Institut de France, Paris; Société d' Agriculture de Lyon; Acadèmie Nationale des Sciences, Belles-Lettres et Arts, Bordeaux; Royal Society, British Association for the Advancement of Science, Royal Geographical Society, London; Boston Society of Natural History, Boston Athenæum, American Academy of Arts and Sciences, Boston; Prof. Edward C. Pickering, Cambridge, Mass.; Essex Institute, Salem; Yale College, New Haven; New York Meteorological Observatory; Messrs. R. S. Culin, Philip H. Law, Henry Phillips, Jr., Philadelphia; Johns Hopkins University, "American Chemical Journal," "American Journal of Philology," Baltimore; U. S. National Museum, National Academy of Sciences, Entomological Society, Departments of the Interior, State and War Department, Hydrographic Office, Washington, D. C.; Rev. Stephen D. Peet, Chicago; California Academy of Sciences; Observatorio Nacionale Argentino, Buenos Ayres; Observatorio do Rio de Janeiro.

Photographs for the Society's Album were received from the following members: Charles A. Ashburner, Philadelphia; Thomas M. Drown, Boston; Thomas H. Dudley, Camden; Wm. W. Keen, Philadelphia; John M. Maisch, Philadelphia.

The following deaths of members at Philadelphia were announced: Dillwyn Parrish, September 18th, 1886, aged 77 years; James R. Ludlow, September 20th, 1886, aged 62 years; and, on motion, the President was authorized to appoint suitable persons to prepare the usual obituary notices.

Dr. Charles A. Oliver read a paper on "Subjective After-Color" (Complementary Color).

Dr. Daniel G. Brinton read a paper on "Ikonomatic Nomenclature."

Mr. Thomas H. Dudley read a paper, "Is there reciprocity in trade and the consumption of manufactured commodities?"

Prof. E. D. Cope presented a paper, "A systematic list of the North American species of Bufo and Rana, with descriptions of some new species of Batrachia from the specimens in the National Museum."

Pending nomination No. 1113 was read, and the Society was adjourned by the President.

Stated Meeting, October 15, 1886.

Present, 15 members.

President, Mr. Fraley, in the Chair.

Prof. Benjamin Sharp, M.D., a newly-elected member, was presented to the Chair and took his seat.

Letters of envoy were received from the Zoölogical Society of London; University of Illinois; U. S. Geological Survey, Washington, D. C.; Hamilton Association, Canada; Harvard College Observatory.

Letters of acknowledgment were received from the University of Illinois (96–123); Historical Society of Pennsylvania (123); Dr. William G. A. Bonwill and Mr. Samuel Dickson of Philadelphia (123); Mr. Richard Meade Bache (123).

The State Library of Massachusetts (Boston), the K. Sächs. Alterthumsverein, Dresden, and the Observatoire Astronomique et Physique of Tashkend, Turkestan, Russia, were placed on the list to receive the Proceedings of the Society, beginning with No. 96.

Donations to the Library were announced from the following: Mining Department, Melbourne; China Branch of the Royal Asiatic Society, Shanghai; Société de Littéraire Finnoise, Helsingfors; K. K. Sternwarte, Prag; Prof. G. vom Rath, Bonn; "Astronomische Nachrichten," Kiel; "Zoölogischer Anzeiger," Leipsic; Société Royale des Antiquaries du Nord, Copenhagen; K. Zoölogisch-Botanisch Genootschap, 'S-Gravenhage; Société de Géographie and Prof. Pedro A. Monteiro, Lisbon; Royal Society and "Nature," London; Natural History and Antiquarian Society, Penzance; Hamilton Association, Ontario, Canada; Boston Society of Natural History; Harvard College Observatory; "American Journal of Science," New Haven; Messrs. E. Steiger & Co., New York; New Jersey Historical Society; Franklin Institute, Hydrographic Office, College of Pharmacy, American Catholic Historical Society, Messrs. A. E. Foote, Isaac Myer, Philip H. Law, Henry Phillips, Jr., Gen. Russell Thayer and Dr. I. Minis Hays, of Philadelphia; Wyoming Historical and Geological Society, Wilkes-Barrè; Naval Observatory, Department of State, U. S. National Museum, Smithsonian Institution and Government Printing Office, Washington, D. C.; Illinois University, Champlain; University of California, Berkeley, Cal.

Mr. Alvan Clark, of Cambridgeport, Mass., presented his photograph for the Society's Album, and Mr. W. S. Baker, of Philadelphia, an etched likeness of himself.

Mr. William Harden, Savannah, Ga., presented a photograph of an Indian vase, lately exhumed in Georgia.

Action on proposition No. 1113 was postponed until December 17th.

Prof. Cope exhibited some crania of Tahitians and made remarks on human dentition, after which a discussion ensued, participated in by Drs. Horn and J. Cheston Morris.

The President reported he had received and paid over to the Treasurer the Michaux rentes for July, $133.07.

On motion, the Society subscribed to the "Journal of Morphology."

And the Society was adjourned by the President.

The Conception of Love in some American Languages.
By Daniel G. Brinton, M.D.

(Read before the American Philosophical Society, Nov. 5, 1886.)

"The words which denote love, describing a sentiment at once powerful and delicate, reveal the inmost heart of those who created them. The vital importance attached to this sentiment renders these beautiful words especially adapted to point out the exceeding value of language as a true autobiography of nations."

This quotation is from an essay by a thoughtful writer, Dr. Carl Abel, in which he has gathered from four languages, the Latin, English, Hebrew and Russian, their expressions for this sweet emotion, and subjected them to a careful analysis.* The perusal of his article has led me to make some similar examinations of American languages; but with this difference in method, that while Dr. Abel takes the languages named in the fullness of their development and does not occupy himself with the genesis of the terms of affection, I shall give more particular attention to their history and derivation as furnishing illustrations of the origin and growth of those altruistic sentiments which are revealed in their strongest expression in the emotions of friendship and love.

Upon these sentiments are based those acts which unite man

* *Linguistic Essays,* by Carl Abel, Ph.D. (London, 1882).

to man in amicable fellowship and mutual interchange of kindly offices, thus creating a nobler social compact than that which rests merely on increased power of defence or aggression. These sentiments are those which bind parent to child and child to parent, and thus supply the foundation upon which the family in the true significance of the term should rest. These are they which, directed toward the ruler or the state, find expression in personal loyalty and patriotic devotion. Surpassing all in fervor and potency, these sentiments, when exhibited in love between the sexes, direct the greater part of the activity of each individual life, mould the forms of the social relations, and control the perpetuation of the species. Finally, in their last and highest manifestations, these sentiments are those which have suggested to the purest and clearest intellects both the most exalted intellectual condition of man, and the most sublime definition of divinity.* These are good reasons, therefore, why we should scan with more than usual closeness the terms for the conception of love in the languages of nations.

Another purpose which I shall have in view will be to illustrate by these words the wonderful parallelism which everywhere presents itself in the operations of the human mind, and to show how it is governed by the same associations of ideas both in the new and old worlds.

As a preparation for the latter object, let us take a glance at the derivation of the principal words expressing love in the Aryan languages. The most prominent of them may be traced back to one of two ruling ideas, the one intimating a similarity or likeness between the persons loving, the other a wish or desire. The former conveys the notion that the feeling is mutual, the latter that it is stronger on one side than on the other.

These diverse origins are well illustrated by the French *aimer* and the English *love*. *Aimer*, from the Latin *amare*, brings us to the Greek *αμα*, *ομος*, both of which spring from the Sanscrit *sam;* from which in turn the Germans get their words *sammt*, along with, and *zusammen*, together; while we obtain from this root almost without change our words *similar* and *same*. Ety-

*I scarcely need say that I refer to the marvelous words of St. John: *ὁ μη αγαπων, ουκ εγνω τον Θεον, οτι ὁ Θεος αγαπη εστιν* (1 John iv, 8); and to the *amor intellectualis*, the golden crown of the philosophy of Spinoza as developed in the last book of his *Ethica*.

mologically, therefore, those who love are alike; they are the *same* in such respects that they are attracted to one another, on the proverbial principle that "birds of a feather flock together."

Now turning to the word *love*, German *Liebe*, Russian *lubov*, *lubity*, we find that it leads us quite a different road. It is traced back without any material change to the Sanscrit *lobha*, covetousness, the ancient Coptic λίβε, to want, to desire. In this origin we see the passion portrayed as a yearning to possess the loved object; and in the higher sense to enjoy the presence and sympathy of the beloved, to hold sweet communion with him or her.

A class of ideas closely akin to this are conveyed in such words as "attached to," "attraction," "affection," and the like, which make use of the figure of speech that the lover is fastened to, drawn toward, or bound up with the beloved object. We often express this metaphor in full in such phrases as "the bonds of friendship," etc.

This third class of words, although in the history of language they are frequently of later growth than the two former, probably express the sentiment which underlies both these, and that is a dim, unconscious sense of the unity which exists throughout all objective nature, a unity which is revealed to man most perfectly in the purest and highest love, which at its sublimest height does away with the antagonism of independent personality and blends the *I* and the *Thou* in a oneness of existence.

Although in this, its completest expression, we must seek examples solely between persons of opposite sex, it will be well to consider in an examination like the present, the love between men, which is called friendship, that between parents and children, and that toward the gods, the givers of all good things. The words conveying such sentiments will illustrate many features of the religious and social life of the nations using them.

I. The Algonkin.

I begin with this group of dialects, once widely spread throughout the St. Lawrence valley and the regions adjoining; and among them I select especially the Cree and the Chipeway, partly because we know more about them, and partly because they probably represent the common tongue in its oldest and purest type. They are closely allied, the same roots appearing in both with slight phonetic variations.

In both of them the ordinary words for love and friendship are derived from the same monosyllabic root, *sak*. On this, according to the inflectional laws of the dialects, are built up the terms for the love of man to woman, a lover, love in the abstract, a friend, friendship, and the like. It is also occasionally used by the missionaries for the love of man to God and of God to man.*

In the Chipeway this root has but one form, *sagi;* but in Cree it has two, a weak and a strong form, *saki* and *sakk*. The meaning of the latter is more particularly to fasten to, to attach to. From it are derived the words for string or cord, the verbs, "to tie," "to fasten," etc.; and also some of the coarsest words to express the sexual relation.† Both these roots are traced back to the primary element of the Algonkin language expressed by the letters *sak* or *s—k*. This conveys the generic notion of force or power exerted by one over another,‡ and is apparently precisely identical with the fundamental meaning of the Latin *afficio*, "to affect one in some manner by active agency,"§ from which word, I need hardly add, were derived *affectus* and *affectio* and our "affection;" thus we at once meet with an absolute parallelism in the working of the Aryan Italic and the American Algonkin mind.

The Cree has several words which are confined to parental and filial love and to that which the gods have for men. These are built up on the dissyllabic radical *espi* or *aspi*, which is an instrumental particle signifying "by means of, with the aid of."‖ Toward the gods, such words refer to those who aid us; toward children those whom their parents aid; and from children toward parents, again those from whom aid is received.

*Chipewa: *nin sagiiwe*, I love; *sagiiwewin*, love; *saiagiiwed*, a lover.

Cree: *sâkihituwin*, friendship; *manitowi sâkihewewin*, the love of God. The words from the Chipeway are from Baraga's *Otchipwe Dictionary*; those from the Cree from Lacombe's *Dictionnaire de la langue des Cris*, except when otherwise noted.

†Chipeway: *sagibidjigan*, a string or cord.

Cree: *sakkappitew*, he fastens, he ties; *sakkahigan*, a nail; *sakkistiwok*, coeunt, copulati sunt.

‡See Joseph Howse, *Grammar of the Cree Language*, p. 165.

§See the remarks in Andrews' *Latin Lexicon*, *s. v.*

‖Cree: *espiteyimit kije-manito*, for the love of God; *espiteyimatijk*, for the love of the children.

For love between men, friendship, the Cree employs some words from the radical *sâki;* but more frequently those compounded with the root *wit* or *witch*, which means "in company with,"* and is the precise analogue of the syllable *com* (Latin, *con*) in the English words companion, comrade, compeer, confederate, etc.; it conveys the idea of association in life and action, and that association a voluntary and pleasure-giving one.

In the Chipeway there is a series of expressions for family love and friendship which in their origin carry us back to the same psychological process which developed the Latin *amare* from the Sanscrit *'sam* (see above). They may be illustrated by the melodious term which in that dialect means both friendship and relationship, *inawendawin.* This is an abstract verbal noun from the theme *ni inawa*, I resemble him, which is built up from the radicle *in.* This particle denotes a certain prevailing way or manner, and appears both in Cree and Chipeway in a variety of words.† The principle of similarity is thus fully expressed as the basis of friendship. To see how apparent this is we have but to remember the English "I like him," *i. e.*, there is something in him *like* me.

The feebler sentiment of merely liking a person or thing is expressed in the Chipeway by a derivative from the adjective *mino*, good, well, and signifies that he or it seems good to me.‡

The highest form of love, however, that which embraces all men and all beings, that whose conception is conveyed in the Greek αγαπη, we find expressed in both the dialects by derivatives from a root different from any I have mentioned. It is in its dialectic forms *kis*, *keche*, or *kiji*, and in its origin it is an intensive interjectional expression of pleasure, indicative of what gives joy.§ Concretely it signifies what is completed, permanent, powerful, perfected, perfect. As friendship and love yield the most exalted pleasure, from this root the natives drew a fund of words to express fondness, attachment, hospitality, charity;

*Cree: *ni wiljiwâgan*, my friend; *witchettuwin*, a confraternity, or society.

†Chipeway: *inawema*, I am his relative, or, his friend.

Cree: *ijinâkusiw*, he has such an appearance. This particle of similarity is considered by Howse to be "one of the four primary generic nouns" of the Algonkin language. *Grammar of the Cree Language*, p. 135.

‡Chipeway: *nin minᵉnima*, I like (him, her, it).

§See Howse, *Grammar of the Cree Lang.*, p. 175. *Keche* (*kees*) as an interjection of pleasure, he considers in antithesis to *ak* (compare German *ach!*) as an interjection of pain, and cites abundant examples.

and from the same worthy source they selected that adjective which they applied to the greatest and most benevolent divinity.*

II. The Nahuatl.

The Nahuatl, Mexican or Aztec language was spoken extensively throughout Mexico and Central America, and every tribe who used it could boast of a degree of culture considerably above that of any of the Algonkin communities. Such being the case, it is rather surprising to note how extremely poor in comparison is the Nahuatl in independent radicals denoting love or affection. In fact, there is only one word in the language which positively has this signification, and it, with its derivatives, is called upon to express every variety of love, human and divine, carnal and chaste, between men and between the sexes.

This word is *tlazótla*, he loves. It is no easy matter to trace its history. By well known laws of Nahuatl etymology we know that the root is *zo*. We have from this same root several other words of curiously diverse meanings. Thus, *izo*, to bleed, to draw blood, either for health, or, as was the custom of those nations, as a sacrifice before the idols; *izoliui*, to grow old, to wear out, applied to garments; *tlazoti*, to offer for sale at a high price; and *zozo*, to string together, as the natives did flowers, peppers, beads, etc. Now, what idea served as the common starting-point of all these expressions? The answer is, that we find it in the word *zo* as applied to a sharp-pointed instrument, a thorn, or a bone or stone awl, used in the earliest times for puncturing or transfixing objects. From this came *zozo*, to transfix with such an instrument and string on a cord; *izoliui*, to be full of holes as if repeatedly punctured and thus worn out; and *izo*, to bleed, because that was done by puncturing the flesh with the thorns of the maguey or sharp obsidian points.†

*Chipeway: *nin kijewadis*, I am amicable, benevolent; *kijewadisiwin*, charity, benevolence, benignity, compassion; *kije manitowin*, Godhead, divine nature.

Cree: *kisatew*, he is devoted to (him, her); *kisew*, she loves (her children); *kisewatisiwin*, charity, the highest virtue; *kise manito*, "l'esprit charitable, Dieu," and numerous others.

†The following words and meanings are from Carochi's Grammar and Molina's Dictionary of this tongue:

ço, punzar, sangrar.

çoço, ensartar, como flores, cuentas, etc.

ço ica, estar ensartada la cuenta, etc.

tlaçotl, cosa ensartada.

The original meaning of *zo*, a pointed tool or awl, is not given by Molina, but is repeatedly expressed in the phonetic picture writing of the Aztecs.

But how do we bring these into connection with the sentiment of love and its verbal expression? We might indeed seek an illustration of the transfer from classical mythology, and adduce the keen-pointed arrows of Cupid, the darts of love, as pointing out the connection. But I fear this would be crediting the ancient Nahuas with finer feelings than they deserve. I gravely doubt that they felt the shafts of the tender passion with any such susceptibility as to employ this metaphor. Much more likely is it that *tlazótla*, to love, is derived directly from the noun *tlazôtl*, which means something strung with or fastened to another. This brings us directly back to the sense of "attached to" in English, and to that of the root *saki* in Algonkin, the idea of being bound to another by ties of emotion and affection.

But there is one feature in this derivation which tells seriously against the national psychology of the Nahuas: this their only word for love is not derived, as is the Algonkin, from the primary meaning of the root, but from a secondary and later signification. This hints ominously at the probability that the ancient tongue had for a long time no word at all to express this, the highest and noblest emotion of the human heart, and that consequently this emotion itself had not risen to consciousness in the national mind.

But the omissions of the fathers were more than atoned for by the efforts of their children. I know no more instructive instance in the history of language to illustrate how original defects are amended in periods of higher culture by the linguistic faculty than this precise point in the genesis of the Nahuatl tongue. The Nahuas, when they approached the upper levels of emotional development, found their tongue singularly poor in radicals conveying such conceptions. As the literal and material portions of their speech offered them such inadequate means of expression, they turned toward its tropical and formal portions, and in those realms reached a degree of development in this direction which far surpasses that in any other language known to me.

In the formal portion of the language they were not satisfied with one, but adopted a variety of devices to this end. Thus: all verbs expressing emotion may have an intensive termination suffixed, imparting to them additional force; again, certain prefixes indicating civility, respect and affection may be employed in the imperative and optative moods; again, a higher synthetic construction may be employed in the sentence, by which the idea expressed is emphasized, a device in constant use in their poetry; and especially the strength of emotion is indicated by suffixing a series of terminations expressing contempt, reverence or love. The latter are wonderfully characteristic of Nahuatl speech. They are not confined to verbs and nouns, but may be added to adjectives, pronouns, participles, and even to adverbs and postpositions. Thus every word in the sentence is made to carry its burden of affection to the ear of the beloved object!

Add to these facilities the remarkable power of the Nahuatl to impart tropical and figurative senses to words by the employment of rhetorical resources, and to present them as one idea by means of the peculiarities of its construction, and we shall not consider as overdrawn the expression of Professor De la Rosa when he writes: "There can be no question but that in the manifestation in words of the various emotions, the Nahuatl finds no rival, not only among the languages of modern Europe, but in the Greek itself." *

The Nahuatl word for friendship is *icniuhtli.* This is a compound of the preposition *ic*, with; the noun-ending *tli;* and the adverbial *yuh*, or *noyuh*, which means "of the same kind." The word, therefore, has the same fundamental conception as the Latin *amicus* and the Cree *inawema*, but it was not developed into a verbal to express the suffering of the passion itself.†

III. The Maya.

The whole peninsula of Yucatan was inhabited by the Mayas, and tribes speaking related dialects of their tongue lived in Guatemala, Chiapas, and on the Gulf Shore north of Vera Cruz. All these depended chiefly on agriculture for subsistence, were builders of stone houses and made use of a system of written records. Their tongue, therefore, deserves special consideration as that of a nation with strong natural tendencies to development.

In turning to the word for love in the Maya vocabulary we are

* *Estudio de la Filosofia y Riqueza de la Lengua Mexicana.* Par Agostin de la Rosa, p. 78 (Guadalajara, 1877).

† There is another word in Nahuatl of similar derivation. It is *pohui*, to make much of a person, to like one. The root is *po*, which carries with it the idea of sameness, similarity or equality; as *itelpocapo*, a boy like himself. (Paredes, *Promptuario Manual Mexicano*, p. 140.)

at once struck with the presence of a connected series of words expressing this emotion, while at the same time they, or others closely akin to them and from the same root, mean pain, injury, difficulty, suffering, wounds and misery. Both are formed by the usual rules from the monosyllable *ya*.* Were the ancient Mayas so sensitive to love's wounds and the pangs of passion as to derive their very words for suffering from the name of this sentiment?

No; that solution is too unlikely for our acceptance. More probable is it that we have here an illustration of the development of language from interjectional cries. In fact, we may be said to have the proof of it, for we discover that this monosyllable *ya* is still retained in the language as a verb, with the signification "to feel anything deeply, whether as a pain or as a pleasure."† Its derivatives were developed with both meanings, and as love and friendship are the highest forms of pleasure, the word *ya* in its happier senses became confined to them.

It seems to have sufficed to express the conception in all its forms, for the writers in the language apply it to the love of the sexes, to that between parents and children, that among friends, and also to that which men feel toward God, and that which He is asserted to feel toward men.‡

The Mayas, therefore, were superior to the Nahuas in possessing a radical word which expressed the joy of love; and they must be placed above even the early Aryans in that this radical was in significance purely psychical, referring strictly to a mental state, and neither to similarity nor desire.

It is noteworthy that this interjectional root, although belong-

* Thus:
ya or *yail*, love; pain, sickness, a wound; difficult, laborious,
yate, to love.
yacunah, to love.
yaili, painfully, laboriously.
yalal, to taste; to have relations with a woman.
yatzil, love, charity; something difficult or painful.

† "*ya*: sentir mucho una cosa.
yamab: sin sentir [the *ma* is the negative].
Diccionario Maya-Español del Convento de Motul. (MS. in my possession.)

‡ Thus:
yahletabal cah tumen Dios, we are loved by God.
u yacunah Dios toon, the love of God to us.
yacunahil Dios, the love with which God is loved.
mehenbil yacunah, filial love.
bakil yacunah, carnal love.
All from the *Diccionario de Motul* (MS.).

ing to the substructure of the language, does not appear with the meaning of love in the dialects of the Maya stock. In them the words for this sentiment are derived from other roots.

Thus among the Huastecas, residing on the Gulf of Mexico, north of Vera Cruz, the word for love is *canezal.* It is employed for both human and divine love, and also means anything precious and to be carefully guarded as of advantage to the possessor.* There is no difficulty in following its development when we turn to the Maya, which preserves the most numerous ancient forms and meanings of any dialect of this stock. In it we discover that the verb *can* means "to affect another in some way, to give another either by physical contact or example a virtue, vice, disease or attribute."† Here again we come upon the precise correlative of the Latin *afficio*, from which proceeds our "affection," etc.

The Guatemalan tribes, the principal of which were and are the Quiches and Cakchiquels, did not accept either *ya* or *can* as the root from which to build their expressions for the sentiment of love. In both these dialects the word for to love is *logoh.* It also means "to buy," and this has led a recent writer to hold up to ridicule the Spanish missionaries who chose this word to express both human and divine love. Dr. Stoll, the writer referred to, intimates that it had no other meaning than "to buy" in the pure original tongue, and that the only word for the passion is *ah*, to want, to desire.‡ In this he does not display his usual accuracy, for we find *logoh* used in the sense "to like," "to love," in the *Annals of the Cakchiquels*, written by a native who had grown to manhood before the Spaniards first entered his country.§

* Thus:

tatu canel ixallè, my beloved wife.

ma a canezal a Dios, dost thou love God?

Diccionario Huasteco Español, por Carlos de Tapia Zenteno (Mex., 1767).

† A number of examples are given in the *Diccionario de Motul* (MS.).

‡ "Der blosse Begriff derjenigen Liebe, welche das lateinische Zeitwort *amare* ausdrückt, dem Cakchiquel Indianer fremd ist" *Zur Ethnographie der Republik Guatemala.* Von Otto Stoll, M.D., p. 146 (Zurich, 1884).

§ *Xelogox ka chiri ruma Akahal vinak*, "they were loved by the Akahal men." *Annals of the Cakchiquels*, p. 126 (Vol. VI of Brinton's Library of Aboriginal American Literature). In the Quiche *Popol Vuh* the word has the same meaning as (page 102):

chi log u vach, their beloved face.

In fact, the word Dr. Stoll gives as that now usual among the Cakchiquels for "to love"=to desire, in the *Popol Vuh* is applied to the price paid for wives (p. 304):

rahil pu mial, the price of their daughters.

This word may be a derivative from the Maya *ya*, above mentioned.

That the verb *logoh* means, both in origin and later use, "to buy," as well as "to love," is undoubtedly true. Its root *logh* is identical with the Maya *loh*, which has the meanings "to exchange, to buy, to redeem, to emancipate." It was the word selected by the Franciscan missionaries to express the redemption of the world by Christ, and was applied to the redemption of captives and slaves. It might be suggested that it bears a reference to "marriage by purchase;" but I think that "to buy," and "to love," may be construed as developments of the same idea of *prizing highly*. When we say that a person is *appreciated*, we really say that he has had a proper price put upon him. The Latin *carus*, which Cicero calls *ipsum verbum amóris*,* means costly in price as well as beloved; and the tender English "dear" means quite as often that the object is expensive to buy, as that we dote very much upon it. Nor need we go outside of American languages for illustrations; in Nahuatl *tlazóti* means to offer for sale at a high price, and in Huasteca *canel*, from the same root as *canezal*, to love, means something precious in a pecuniary sense, as well as an object of the affections. Other instances will present themselves when we come to examine some of the South American tongues. But from what I have already given, it is evident that there is nothing contradictory in the double meaning of the verb *logoh*.

IV. The Qquichua.

The ancient Peruvians who spoke the Qquichua language had organized a system of government and a complex social fabric unsurpassed by any on the continent. The numerous specimens of their arts which have been preserved testify strongly to the licentiousness of their manners, standing in this respect in marked contrast to the Aztecs, whose art was singularly pure. It must be regarded as distinctly in connection with this that we find a similar contrast in their languages. We have seen that in the Nahuatl there appears to have been no word with a primary signification "to love," or any such conception. The Qquichua, on the contrary, is probably the richest language on the continent, not only in separate words denoting affection, but in modifications of these by imparting to them delicate shades

* *De Naturâ Deorum*, I, 44.

of meaning through the addition of particles. As an evidence of the latter, it is enough to cite the fact that Dr. Anchorena in his grammar of the tongue, sets forth nearly six hundred combinations of the verb *munay*, to love! *

The Qquichua is fortunate in other respects; it has some literature of its own, and its structure has been carefully studied by competent scholars. It is possible, therefore, to examine its locutions in a more satisfactory manner than is the case with most American languages. Its most celebrated literary monument is the drama of *Ollanta*, supposed to have been composed about the time of the conquest. It has been repeatedly edited and translated, most accurately by Pacheco Zegarra.† His text may be considered as the standard of the pure ancient tongue.

Of Qquichua words for the affections that in widest use is the one above quoted, *munay*. It is as universal in its application as its English equivalent, being applied to filial and parental love as well as to that of the sexes, to affection between persons of the same sex, and to the love of God. No other word of the class has such a wide significance. It ranges from an expression of the warmest emotion down to that faint announcement of a preference which is conveyed in the English "I should prefer."‡

On looking for its earlier and concrete sense we find that *munay* expressed merely a sense of want, an appetite and the accompanying desire of satisfying it, hence the will, or the wish, not subjectively, but in its objective manifestation. § Therefore it is in origin nearly equivalent to the earliest meaning of "love," as seen in the Sanscrit and the Coptic.

While *munay* is thus to love on reasonable grounds and with definite purpose, blind, unreasoning, absorbing passion is ex-

* *Gramática Quechua*, por Dr. J. D. Anchorena, pp. 163–177 (Lima, 1874).

† *Ollan'aï*: *Drame en vers Quechuas du Temps des Incas.* Traduit et commenté par Gavino Pacheco Zegarra, (Paris, 1878).

‡ Thus, from the *Ollanta*:

Ollantaytan munarccanqui, thou lovest Ollanta! (line 277).
munacusccallay, my well beloved! (the Inca to his daughter, line, 314).
munayman, I should prefer (line 1606).

Holguin, in his *Vocabulario de la Lengua Qquichua*, gives:

Dios munay, the love of God.
munaricuy, unchaste love.

§ Holguin (u. s.) gives the definitions:

munana, la voluntad que es potentia.
munay, voluntad, el querer, el gusto, appetito ó amor que es acto.

pressed by *huaylluni*. This is nearly always confined to sexual love, and conveys the idea of the sentiment showing itself in action by those sweet signs and marks of devotion which are so highly prized by the loving heart. The origin of this word indicates its sentient and spontaneous character. Its radical is the interjection *huay*, which among that people is an inarticulate cry of tenderness and affection.*

The verb *lluylluy* means literally to be tender or soft, as fruit, or the young of animals; and applied to the sentiments, to love with tenderness, to have as a darling, to caress lovingly. It has less of sexuality in it than the word last mentioned, and is applied by girls to each other, and as a term of family fondness. It is on a parallel with the English "dear," "to hold dear," etc.†

In the later compositions in Qquichua the favorite word for love is *ccuyay*. Originally this expression meant to pity, and in this sense it occurs in the drama of Ollanta; but also even there as a term signifying the passion of love apart from any idea of compassion.‡ In the later songs, those whose composition may be placed in this century, it is preferred to *munay* as the most appropriate term for the love between the sexes.§ From it also is derived the word for charity and benevolence.

As *munay* is considered to refer to natural affection felt within the mind, *mayhuay* is that ostentatious sentiment which displays itself in words of tenderness and acts of endearment, but leaves it an open question whether these are anything more than simulated signs of emotion.‖

This list is not exhaustive of the tender words in the Qquichua; but it will serve to show that the tongue was rich in them, and that the ancient Peruvians recognized many degrees and forms of this moving sentiment.

* From the *Ollanta:*

Huay ccoyallay, Huay mamallay,
Ay, huayllucusccay ccosallay.
Oh, my queen! Oh, my mother!
Oh, my husband so beloved! (305, 306).

These lines show both the word and its derivation.

†From the *Ollanta:*

ña llulluspa, caress thee, are fond of thee (931).

‡From the *Ollanta:*

ccuyaccuscallay, my beloved one (1758).
ccuyaska, compassionate (1765).

§See the Qquichua love songs, *harahui* and *huaynu*, as they are called, given by Anchorena in his *Gramática Quechua*, pp. 131–135.

‖See Holguin, *Vocabulario Qquichua*, s. v., *mayhuay* and *mayhuayccuni*.

What is also noteworthy is the presence in this language of the most philosophical term for friendship in its widest sense that can be quoted from any American language. It is *runaccuyay*, compounded of *ccuyani*, mentioned above, and *runa*, man — the love of mankind. This compound, however, does not occur in the Ollanta drama, and it may have been manufactured by the missionaries. The usual term is *maciy*, which means merely "associate," or *kochomaciy*, a table-companion or *convive*.

V. The Tupi-Guarani.

The linguistic stock which has the widest extension in South America is that which is represented in Southern Brazil by the Guarani, and in Central and Northern by the Tupi or Lingoa Geral. The latter is spoken along the Amazon and its tributaries for a distance of twenty-five hundred miles. It is by no means identical with the Guarani, but the near relationship of the two is unmistakable. The Guarani presents the simplest and more primitive forms, and may be held to present the more archaic type.

The word for love in the Guarani is *aihu*, in another form *haihu*, the initial *h* being dropped in composition. This expression is employed for all the varieties of the sentiment, between men, between the sexes, and for that which is regarded as divine.* For "a friend," they have no other term than one which means a visitor or guest; and from this their expression for "friendship" is derived which really means "hospitality."†

Verbal combinations in Guarani are usually simple, and I do not think we can be far wrong in looking upon *aihu* as a union of the two primary words *ai* and *hu*. The former, *ai*, means self or the same; and the latter, *hu*, is the verb to find, or, to be present.‡ "To love," in Guarani, therefore, would mean, "to find oneself in another," or, less metaphysically, "to discover in

*Thus:

Tupa nande raihu, God loves us.

Tupa nande haihu, the love which we have for God.

ahaihu, I love her, (him, it).

†*yecotiaha*, friend; compounded of *coti*, a dwelling, and *aha*, to go,=a goer to a dwelling, a visitor. This, and the other Guarani words given, are taken from Ruiz de Montoya's *Tesoro de la Lengua Guarani* (ed. Vienna, 1876).

‡Another possible derivation would be from *ahii*, desire, appetite (Spanish, *gana*); and *hu*, in the sense of being present. This would express a longing, a lust, like love (see above).

another a likeness to oneself." This again is precisely the primary signification of the Latin *amare;* and if the sentiment impressed in that way the barbarous ancient Aryans, there is no reason why it would not have struck the Guaranis in the same manner.

In the Tupi or Lingua Geral the word for love is evidently but a dialectic variation of that in the Guarani. It is given by some authors as *çaiçu*, plainly a form of *haihu;* and by others as *çauçu.* * These forms cannot be analyzed in the Tupi itself, which illustrates its more modern type.

There are other dialects of this wide-spread stem, but it would not be worth while to follow this expression further in its diverse forms. It is interesting, however, to note that which appears in the Arawack, spoken in Guiana. In that tongue to love is *kanisin*, in which the radical is *ani* or *ansi.* Now we find that *ani* means "of a kind," peculiar to, belonging to, etc. Once more it is the notion of similarity, of "birds of a feather," which underlies the expression for the conception of love. †

Conclusions.

If, now, we review the ground we have gone over, and classify the conceptions of love as revealed in the languages under discussion, we find that their original modes of expression were as follows:

1. Inarticulate cries of emotion (Cree, Maya, Qquichua).
2. Assertions of sameness or similarity (Cree, Nahuatl, Tupi, Arawack).
3. Assertions of conjunction or union (Cree, Nahuatl, Maya).
4. Assertions of a wish, desire or longing (Cree, Cakchiquel, Qquichua, Tupi).

These categories are not exhaustive of the words which I have brought forward, but they include most of them, and probably

* I find *çaiçu* given by Dr. Couto de Magelhaes in his *Curso da Lingua Geral segundo Ollendorf* (Rio de Janeiro, 1876); *saisu* by Dr. Amaro Cavalcanti in *The Brasilian Language and its Agglutination* (Rio Janeiro, 1883); *çauçub* by Dias, *Diccionario da Lingua Tupy* (Leipzig, 1858) and by Dr. E. F. França in his *Chrestomathia da Lingua Brasilica* (Leipzig, 1859).

† "*Ani*, es gehört, ist eigen; *ta ani*, nach seiner Art." *Arawackisch-Deutches Wörterbuch.* This dictionary, published anonymously at Paris, in 1882, in Tome viii, of the *Bibliotheque Linguistique Américaine*, is the production of the Moravian Missionary, Rev. T. S. Schuhmann. See *The Literary Works of the Foreign Missionaries of the Moravian Church.* By the Rev. G. H. Reichelt. Translated and annotated by Bishop Edmund de Schweinitz; p. 13 (Bethlehem, 1886).

were this investigation extended to embrace numerous other tongues, we should find that in them all the principal expressions for the sentiment of love are drawn from one or other of these fundamental notions. A most instructive fact is that these same notions are those which underlie the majority of the words for love in the great Aryan family of languages. They thus reveal the parallel paths which the human mind everywhere pursued in giving articulate expression to the passions and emotions of the soul. In this sense there is a oneness in all languages, which speaks conclusively for the oneness in the sentient and intellectual attributes of the species.

We may also investigate these categories, thus shown to be practically universal, from another point of view. We may inquire which of them comes the nearest to the correct expression of love in its highest philosophic meaning. Was this meaning apprehended, however dimly, by man in the very infancy of his speech-inventing faculty?

In another work, published some years ago, I have attempted a philosophic analysis of the sentiment of love. Quoting from some of the subtlest dissectors of human motive, I have shown that they pronounce love to be "the volition of the end," or "the resting in an object as an end." These rather obscure scholastic formulas I have attempted to explain by the definition: "Love is the mental impression of rational action whose end is in itself."* As every end or purpose of action implies the will or wish to obtain that end, those expressions for love are most truly philosophic which express the will, the desire, the yearning after the object. The fourth, therefore, of the above categories is that which presents the highest forms of expression of this conception. That it also expresses lower forms is true, but this merely illustrates the evolution of the human mind as expressed in language. Love is ever the wish; but while in lower races and coarser natures this wish is for an object which in turn is but a means to an end, for example, sensual gratification, in the higher, this object is the end itself, beyond which the soul does not seek to go, in which it rests, and with which both reason and emotion find the satisfaction of boundless activity without incurring the danger of satiety.

* *The Religious Sentiment, its Source and Aim; a Contribution to the Science and Philosophy of Religion*, p. 60, (New York, 1876).

Notices of New Fresh-Water Infusoria. By Alfred C. Stokes, M.D.

(Read before the American Philosophical Society, November 5, 1886.)

Mastigamœba longifilum, sp. nov. (Figs. 1, 2, 3, 4).

Animalcules repent, very soft and extremely changeable in shape, emitting from all parts of the surface simple lobate pseudopodia, or wave-like expansions of the sarcode; the single antero-terminal flagellum five times as long as the contracted body, about twice as long as the extended zoöid; contractile vesicle single, anteriorly placed; nucleus subspherical, small, situated near the anterior extremity. Length, when contracted, $\frac{1}{2250}$ inch; extended, $\frac{1}{900}$ inch. Habitat—Standing water, among decaying vegetation.

The figures (1, 2, 3, 4) show four forms of the same interesting little amœboid creature. The movements are usually slowly repent, while the flagellum is quite active. The zoöid not rarely glides forward without the protrusion of distinct pseudopodia, only changing the form of the body by irregular expansions and contractions, while on other occasions the unbranched obtuse pseudopodia extend from any or all points of the periphery.

Anisonema pusilla, sp. nov. (Fig. 5).

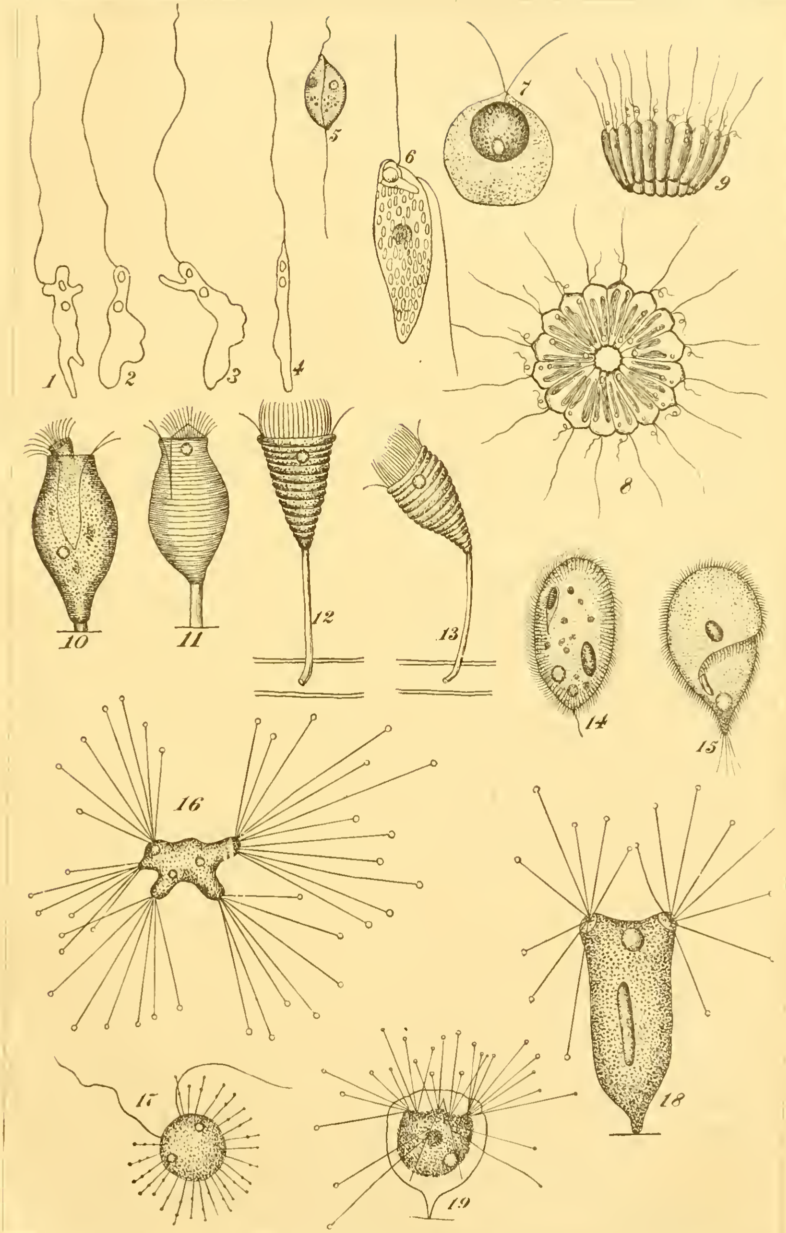
Body subelliptical, less than twice as long as broad, depressed, the two extremities narrowed and obtusely pointed, the ventral surface often slightly concave, the dorsal convex and longitudinally furrowed; anterior flagellum subequal to the body in length, the posterior or trailing appendage about three times as long as the zoöid, both originating near together on the ventral aspect a short distance back of the frontal apex; pharyngeal passage minute, but distinct; contractile vesicle apparently single, subcentrally located; nucleus not observed; endoplasm frequently enclosing small dark particles, probably food fragments. Length of body $\frac{1}{2250}$ inch. Habitat—Pond-water. Movements oscillating, not rapid.

Trentonia, gen. nov.

Animalcules free-swimming, soft and somewhat changeable in shape, biflagellate, one flagellum trailing, one vibratile; frontal border slightly bilabiate; trichocysts not observed; otherwise as in *Raphidomonas* Stein.

Trentonia flagellata, sp. nov. (Fig. 6).

Body obovate, less than three times as long as broad, the anterior border oblique and somewhat bilabiate, the posterior extremity obtusely pointed; flagella subequal to each other and to the body in length, one extending arcuately forward, often rapidly and spirally vibrating, apparently originating in the oral fossa; the other taking its origin on the ventral or lower surface a short distance behind the anterior extremity,



Fresh-water Infusoria. Stokes.

usually trailing; oral aperture conspicuous, communicating with a capacious subtriangular pharyngeal cavity; contractile vesicle single, spherical, near the anterior extremity; nucleus subspherical, situated near the body centre; endoplasm enclosing numerous small ovate chlorophyl corpuscles forming a bright-green layer near the cuticular surface. Length of body $\frac{1}{430}$ inch. Movements rotary on the longitudinal axis, but not rapid. Reproduction by encystment and subsequent binary fission. Habitat—Pond-water.

This is very similar to *Raphidomonas semen* (Ehr.) Stein, with two flagella and no apparent trichocysts. When first observed, more than a year ago, it was without hesitation identified with the above-mentioned European form; but some evenings later, while again examining the Infusorians, it became evident that the specimens possessed two flagella, while the Raphidomonas has but one; otherwise they were identical with the form just named, with the exception of the trichocysts. Recently the same Infusoria have been collected in a locality remote from the first, and the previous observations confirmed.

The trailing flagellum is ordinarily extremely difficult to see. When the Infusorium is rendered uncomfortable and sluggish by prolonged confinement beneath the cover-glass, or partially poisoned by iodine, then the vibratile flagellum, which is usually held stiffly in advance, the tip alone trembling, is flashed into sight as a rapidly undulating spiral, and the trailing appendage is also momentarily directed forward. At other times it also becomes visible when the Infusorian is in certain positions or has assumed certain changes of form. How the careful European investigators could have overlooked this trailing appendage is inexplicable, providing, of course, that the present form is *Raphidomonas semen*, with which two flagella are now for the first time observed. It is scarcely possible to believe that Stein would have failed to notice so important an appendage. Yet these two forms are so nearly identical, with the exception of the biflagellate character of the present Infusorian, that I confer the generic title *Trentonia* provisionally only. If, after re-examination, the European Raphidomonas should prove to be monoflagellate, then will *Trentonia flagellata* become the type of a new family group necessarily taking the name Trentonidæ.

Cryptoglena truncata, sp. nov. (Fig. 7).

Lorica subspherical, depressed posteriorly, the anterior border rounded, the oral aperture slightly eccentric and somewhat conically projecting; the posterior margin truncate, often slightly retuse; the lower or ventral aspect gently concave, the dorsal convex; enclosed zoöid subspherical; endoplasm green; contractile vesicle double, anteriorly situated; amylaceous corpuscle single, subspherical and subcentrally located; lorica minutely punctate, colorless when young. Length $\frac{1}{1287}$ inch or less. Habitat—Pond-water. Movements rotary on the long axis.

The enclosed body varies much in size. It is usually small, occupying but a very limited portion of the lorica cavity anteriorly, to which it is apparently in no way attached. Among the numerous individuals examined, none have been seen with the zoöid completely filling the cavity of the sheath, and but one in which the body even approached the posterior and lateral walls.

Cyclonexis, gen. nov. (κυκλος; νηζις).

Animalcules laterally joined to form free swimming annular colonies, the zoöids illoricate; flagella two, one long, the other short, both vibratile; endoplasm enclosing two laterally disposed color-bands; eye-like pigment specks absent. Habitat—Fresh water.

This differs from *Uvella*, which it most closely resembles, in the lateral instead of a posterior union of the constituent animalcules, in the annular rather than a spheroidal form of the colony, and in the very diverse length of the two flagella.

Cyclonexis annularis, sp. nov. (Figs. 8, 9).

Colony composed of from ten to twenty zoöids, the posterior extremities of the constituent animalcules in young and small clusters occasionally in contact, in older and larger colonies remote, leaving a central more or less circular space; bodies obovate, compressed, about twice as long as broad, obtusely pointed anteriorly, rounded and narrowed posteriorly; long flagellum equaling or exceeding the body in length, the short appendage about one-half as long, usually convoluted spirally; contractile vesicle double, small, spherical, located in the anterior body-half, near one lateral border; color-bands yellowish. Length of body $\frac{1}{1800}$ to $\frac{1}{2250}$ inch; diameter of the annular colony $\frac{1}{900}$ inch or less. Movements rotatory. Habitat—Marsh-water, with *Sphagnum*.

Pyxidium urceolatum, sp. nov. (Fig. 10).

Body vasiform, less than twice as long as broad, widest centrally, constricted anteriorly, the posterior extremity narrowed to form a short colorless prolongation somewhat broader than the pedicel; cuticular surface smooth; peristome border truncate; ciliary disk but slightly exserted, ciliary circles two, long and fine; vestibulum large, extending to near the centre of the body; contractile vesicle in close proximity to the posterior part of the vestibule and apparently emptying into it; pedicel extremely short; the contracted zoöid ovate, posteriorly invaginate. Length of body $\frac{1}{265}$ inch. Habitat—Pond-water; on rootlets of *Lemna*.

Rhabdostyla invaginata, sp. nov. (Fig. 11).

Body vasiform, often slightly gibbous, about one and one-half times as long as broad, widest centrally, tapering posteriorly to the pedicel, and anteriorly to the slight constriction beneath the peristome; surface transversely striate; peristome border not revolute; ciliary disk prominent, conical, ciliary circles two; pedicel short, about two-fifths as long as the body. Length of body $\frac{1}{750}$ inch. Habitat—Pond-water; attached to *Cypris*.

The contracted body is ovate, and the pedicel is then invaginate within the posterior extremity, this margin of the zoöid coming into actual contact with surface of the object supporting the pedicel.

The characteristic conical form of the ciliary disk, either alone or in connection with the invagination of the pedicel by the contracted body, renders the species readily distinguishable from all other members of the genus.

Opisthostyla, gen. nov. (*Οπισθε* ; *στυλος*).

Animalcules resembling those of *Rhabdostyla*, but the rigid pedicel curved near its point of attachment to the submerged object, this part acting, when the zoöid is contracted, like a spring, and throwing the animalcule and the otherwise inflexible foot-stalk backward through the water, the whole immediately becoming upright by the recoil of the curved extremity of the pedicel. Inhabiting fresh water.

Opisthostyla annulata, sp. nov. (Figs. 12, 13).

Body conical-campanulate, slightly changeable in form, somewhat gibbous or the lateral margins nearly straight, the zoöid obliquely or vertically placed on the pedicel, less than twice as long as broad, strongly striate or annulate transversely; obovate when contracted; peristome border revolute, ciliary circles two; pedicel as long as the body, the distal extremity suddenly and shortly curved. Body and pedicel each $\frac{1}{1125}$ inch long. Habitat—Pond-water; attached to Algæ.

The short curve at the end of the pedicel at its point of attachment to the supporting object seems to act as a spring, as already stated, to assist the zoöid in throwing itself backward when the body contracts, the entire Infusorian then describing rather more than a semicircle in the water, having the point of attachment of the foot-stalk as the centre. The movement is usually very quickly accomplished, the return of the animalcule to its normally erect position being almost as suddenly achieved.

In the "Annals and Magazine of Natural History" for February, 1886, the writer described an Infusorian under the name *Rhabdostyla pusilla*, which is certainly a member of the new generic group here formulated. The following is an amended diagnosis of the form referred to:

Opisthostyla pusilla Stokes (*Rhabdostyla pusilla* Stokes *).

Body campanulate, tapering posteriorly, less than twice as long as broad, the surface transversely striate; peristome slightly exceeding the body-centre in width, the border revolute; contracted zoöid ovate; pedicel scarcely longer than the body, the distal extremity shortly and suddenly curved. Length of body $\frac{1}{1125}$ inch. Habitat—Pond-water; attached to *Ceratophyllum*.

* Annals and Magazine of Natural History, S 5, Vol. xvii, p. 108, Pl. I, Fig. 17.

This differs from the preceding species of Opisthostyla in the more conical form and less strongly marked transverse furrows of the body, and in the greater proportionate length of the pedicel.

Colpoda depressa, sp. nov. (Fig. 14).

Body ovate, depressed, less than three times as long as broad, slightly widest anteriorly, the frontal border rounded, the right-hand side of the posterior margin slightly and obliquely truncate, the right-hand body-margin somewhat flattened, the left hand side convex; ventral surface flattened, slightly concave; cilia of the posterior border longest and most conspicuous, a single cilium occasionally longer than the others; oral aperture ventral, in the anterior body-half, on the right-hand side of the median line; the projecting ciliary tuft broad, the cilia fine and appearing like an undulating membrane; contractile vesicle single, spherical, in the posterior body-half on the right-hand side of the median line; the cuticular surface roughened by minute elevations arranged in longitudinal rows, except in the oral region, where a long obovate space is comparatively smooth; endoplasm colorless, granular; trichocysts numerous, arranged perpendicularly to the cuticular surface; nucleus ovate, subcentrally located; anal aperture ventral, on the right-hand side of the posterior extremity. Length of body $\frac{1}{300}$ to $\frac{1}{450}$ inch. Habitat—Standing water, with *Sphagnum*. Reproduction by transverse fission.

The most recently formulated generic diagnosis of *Colpoda* refers to the oral aperture as situated in a cleft like fissure, that orifice in the present form not being so placed but on the flattened ventral surface. It would therefore seem preferable to slightly modify the generic description so as to include the present Infusorian, rather than to form a new generic title upon a difference so slight, especially since the other essential characters are undoubtedly similar. In the previously known species trichocysts have not been observed, neither has the position of the anal aperture been recorded.

The form here referred to bears some affinity to *Anophrys*, but to admit it within that group a change would also be needed in the generic description:

Metopides acuminata, sp. nov. (Fig. 15).

Body obovate, about twice as long as broad, compressed, the frontal border rounded, the posterior extremity tapering from the body-centre and terminating in a conspicuous acuminate prolongation; the anterior body-half apparently folded obliquely across the ventral surface, the peristomal margin strongly ciliate and prolonged beyond the centre of the body to near the right-hand border; a tuft of long, fine setæ projecting from the posterior acumination; nucleus broadly ovate or subspherical, placed near the body-centre; contractile vesicle single, near the posterior extremity. Length of body, $\frac{1}{375}$ inch. Habitat—Standing pond-water, with decaying vegetation. Movements rotary on the longitudinal axis.

Trichophrya sinuosa, sp. nov. (Fig. 16).

Body flattened, irregular in shape, the margins undulate and lobulate; tentacles fascicled, long, distinctly capitate, protruded from the marginal lobes, the clusters seldom exceeding five in number; contractile vesicles multiple, marginal; nucleus not observed. Length $\frac{1}{460}$ inch. Habitat—Pond-water; attached by the entire lower surface to *Anacharis*. Movements slow.

This differs from *T. epistylidis* C. and L., in its much smaller size, and especially in the marginal arrangement of the tentacles. The latter are long, often three times the length of the body.

Acinetactis, gen. nov. (*Acineta*; ακτις).

Animalcules subspherical, soft and changeable in form, free-swimming or temporarily adherent, emitting from all parts of the surface capitate, ray-like pseudopodia; flagella two, vibratile, one temporarily adherent by its distal extremity. Inhabiting fresh water.

The single member of this previously undescribed genus differs from the *Actinomonas* of Saville Kent in the presence of two flagella and in the distinctly capitate character of the filamentous pseudopodia, the latter often being conspicuously pin-like in appearance. The existence of the temporarily adherent flagellum, in addition to the habitually vibratile appendage, necessitates not only the formation of a new generic title, but a new family group, for the reception of this singular creature, the name of the latter necessarily being *Acinetactidæ*.

Acinetactis mirabilis, sp. nov. (Fig. 17).

Body subspherical, soft and plastic, often emitting short lobate pseudopodia in addition to the fine, capitate rays projecting from all parts of the periphery, the last-named appendages usually bearing one or more minute supplementary protoplasmic globules in the course of the ray, in addition to the globule tipping the free extremity; rays occasionally exceeding the diameter of the body in length; flagella subequal, their length about twice the diameter of the zoöid, originating from the anterior border, but at some distance from each other; contractile vesicle double, situated on opposite sides of the anterior body-half; nucleus apparently subcentrally located and subspherical; endoplasm granular, especially posteriorly. Diameter of the body $\frac{1}{2250}$ inch. Habitat—Stagnant pond-water, among decaying vegetation. Movements rapid.

When in the free-swimming phase, the ray-like pseudopodia are usually confined to the posterior region of the body, or they may be entirely withdrawn, thus leaving the animalcule almost entirely smooth.

Acineta lacustris, sp. nov. (Fig. 18).

Lorica elongate-obovate or subvasiform, strongly compressed, less than three times as long as broad, widest anteriorly, the sides continuous across the frontal border, leaving a rounded lateral aperture at each angle for the exit of the tentacles; slightly constricted beneath the anterior border, and very moderately inflated near the posterior extremity, the frontal margin concave; pedicel very short and hollow; enclosed zoöid often entirely filling the entire cavity of the lorica; tentacles in two antero-lateral fascicles, distinctly capitate; contractile vesicle single, placed near the anterior border; nucleus elongate, vertical; endoplasm granular. Length of the lorica $\frac{1}{345}$ to $\frac{1}{140}$ inch. Habitat—Pond-water; attached to *Anacharis*.

Acineta stagnatilis, sp. nov. (Fig. 19).

Lorica subcircular in outline, rounded and inflated posteriorly, compressed anteriorly, the frontal border irregularly convex; pedicel short, hollow, from one-fourth to one-fifth as long as the lorica, widest at its junction with the sheath, tapering thence and terminating in a button-like point of attachment; frontal margin pierced by a slit-like fissure, and two anteriorly converging, narrow fissures on the front and rear walls, for the exit of the tentacles; the enclosed animalcule occupying the centre of the lorica, apparently not attached to the walls, subspheroidal, the anterior border truncate; tentacles more or less fascicled, capitate; contractile vesicle single, postero-lateral; endoplasm granular. Length of the lorica, including pedicel, $\frac{1}{450}$ inch. Habitat—Pond-water; on *Myriophyllum*.

EXPLANATION OF THE FIGURES.

Figs. 1–4. Mastigamœba longifilum; different forms of one individual.
Fig. 5. Anisonema pusilla, × 900.
Fig. 6. Trentonia flagellata, × 430; gen. et sp. nov.
Fig. 7. Cryptoglena truncata, × 772.
Figs. 8, 9. Cyclonexis annularis, × 630; front and side views; gen. et sp. nov.
Fig. 10. Pyxidium urceolatum, × 290.
Fig. 11. Rhabdostyla invaginata, × 750.
Figs. 12, 13. Opisthostyla annulata, × 730; gen. et sp. nov.
Fig. 14. Colpoda depressa, × 300.
Fig. 15. Metopides acuminata, × 375.
Fig. 16. Trichophrya sinuosa, × 255.
Fig. 17. Acinetactis mirabilis, × 900; gen. et sp. nov.
Fig. 18. Acineta lacustris, × 415.
Fig. 19. Acineta stagnatilis, × 135.

Stated Meeting, November 5, 1886.

Present, 16 members.

President, Mr. FRALEY, in the chair.

Mr. Samuel W. Pennypacker, a lately elected member, was presented to the Chair and took his seat.

Donations were announced from the following: Geological Survey of India, Calcutta; Geographische Gesellschaft, Wien; K. P. Academie der Wissenschaften and Deutsche Geologische Gesellschaft, Berlin; Naturwissenschaftliche Gesellschaft "Isis," Dresden; Senckenbergische Naturforschende Gesellschaft, Frankfurt A/M.; Physikalische Okonomische Gesellshaft, Königsberg; Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, München; Nassauische Verein für Naturkunde, Wiesbaden; Société Helvétique des Sciences Naturelles, Neufchatel; Archives Néerlandais, Harlem; Musée Royale d'Histoire Naturelle de Belgique, Bruxelles; Biblioteca Nazionale V. E., Firenze; R. Accademia dei Lincei and Biblioteca Nazionale Vittorio Emanuele, Rome; Société de Geographie and Revue Internationale de L'Enseignement, Paris; R. Academia de Ciencias and R. Academia de la Historia, Madrid; Royal Geographical and Zoölogical Societies, and the Society of Antiquaries, London; University Library, Cambridge; Radcliffe Observatory, Oxford; Royal Observatory, Edinburgh; Royal Society of Canada, Montreal; Geological Survey of Canada, Ottawa; Massachusetts Historical Society, Boston; Essex Institute, Salem; Dr. Samuel A. Green, Groton; Newport Historical Society; "American Journal of Science," New Haven; "Traveler's Record," Hartford; Meteorological Observatory, New York; New York State Library, Albany; Oneida Historical Society, Utica, N. Y.; Daniel Draper, New York, N. Y.; Franklin Institute, Historical Society of Pennsylvania, Spelling Reform Association, Messrs. Philip C. Garrett, Philip H. Law, Henry Phillips, Jr., and McCalla & Stavely, Philadelphia; Dr. Hugh Hamilton, Harrisburg; Johns Hopkins University and "American Journal of Archæology," Baltimore; U. S. National Museum, Washington; Leander McCormick University, University of Virginia; Mr. William Harden, Savannah; Prof. Henry S. Frieze, Ann Arbor; State Historical Society, Iowa; Mr. Adair Welcker, Sacramento.

Letters of envoy were read as follows: The K. Preussische Akademie der Wissenschaften; the Canadian Geological and Natural History Survey.

Letters of acknowledgment were received from K. K. Sternwarte. Prag (122); Iapetus Steenstrup, Copenhagen (122); State Library of Massachusetts, Boston (96–123); Oneida Historical Society, Utica, New York (123).

A letter was read from the Deutsche Morgenländische Gesellschaft (in answer to one addressed to it by the Secretaries to know why it had never sent its publications to this Society, although it had received for some years), stating that it had considered the proceedings to have been the gift of the Smithsonian Institution, and that it did not desire to exchange with this Society.

On motion, its name was ordered to be removed from the list of exchanges.

The "Revue Litteraire et Scientifique" replied to a similar query, and stated that the Redaction had ordered the exchange to be discontinued.

On motion, the exchange was ordered to be discontinued.

The death of John S. Haines, Philadelphia, was announced as having taken place on November 4, 1886, in the sixty-seventh year of his age.

The President announced the appointment of Mr. Richard Vaux to prepare the obituary of Judge Ludlow, and Prof. John M. Maisch that of Dillwyn Parrish.

Prof. Cope presented for the Transactions a paper on "Lemurine Reversion in Human Dentition."

The paper was referred to a Committee, consisting of Drs. Brinton, Oliver and Jayne.

Dr. D. G. Brinton read a paper on "The Conception of Love in some American Languages."

The Secretaries presented a paper on "The Facial Nerve of the Domestic Cat," by Prof. T. B. Stowell, of Cortlandt, N.Y.; also one from Dr. A.C. Stokes, of Trenton, N. J., on "Notices of New Fresh-water Infusoria."

Pending nomination No. 1113 and new nominations Nos. 1114–1150 were read.

The President reported that he had received and paid over to the Treasurer the interest on the Michaux *rentes* due October 1, 1886, amounting to $131.80.

And the Society was adjourned by the President.

Stated Meeting, November 19, 1886.

Present, 14 members.

President, Mr. FRALEY, in the Chair.

Acknowledgments were read from the K. Leopold-Carol. Akademie, Halle, a. S. (118, 122); Société Royale des Sciences, Upsal (117–122); New York State Library, Albany (121–123).

Letters of envoy were read from the Société Royale des Sciences, Upsal; Naturwissenschaft. Gesellschaft, Marburg; Meteorological Office and the Statistical Society, London; Col. Charles C. Jones, Jr., Augusta, Ga.

Additions to the Library were reported from Department of Mines, New South Wales; Societas pro Fauna et Flora Fennica, Helsingfors; Observatory at Tashkend, in Turkistan, Russia; K. P. Akademie der Wissenschaften, Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, R. Friedländer und Sohn, Berlin; Naturhistorischer Verein, Bonn; K. Leopoldino-Carolina Akademie der Deutschen Naturforscher, Halle, a. S.; "Astronomische Nachrichten," Kiel; Naturforschende Gesellschaft, Leipsic; Gesellschaft zur Beförderung der Gesammten Naturwissenschaften, Marburg; Editor of "Naturforscher," Tübingen; Société Royale des Sciences, Upsal; "Flora Batava," Leiden; Acadèmie Royale, Musée Royale D'Histoire Naturelle de Belgique, Bruxelles; R. Accademia dei Lincei, Rome; Biblioteca Nazionale Centrale di Firenze;

Royal Geographical and Astronomical Societies, Statistical Society, British Association for the Advancement of Science, Meteorological Office, "Nature," Mr. John Hampden, London; Natural History Society, Montreal; Institut Canadien-Français, Ottawa; Canadian Institute, Toronto; Prof. Thomas Sterry Hunt, Hon. Robert C. Winthrop, Boston; Museum of Comparative Zoölogy, Harvard University, Prof. Samuel H. Scudder, Cambridge; American Chemical Society, "The Critic," New York; Brooklyn Entomological Society; Academy of Natural Sciences, College of Pharmacy, Messrs. Henry C. Lea and Henry Phillips, Jr., Philadelphia; Johns Hopkins University, Prof. Ira Remsen, Baltimore; United States Civil Service Commission, Smithsonian Institution, Hydrographic Office, Washington; Col. Charles C. Jones, Jr., Augusta, Ga.; Cincinnati Society of Natural History; Rev. Stephen D. Peet, Chicago; Professors C. F. de Lendero and Raúl Prieto, Mexico.

Dr. J. T. Rothrock read by appointment an obituary notice of the late Hon. Eli K. Price, LL.D., Vice-President of the Society.

And, on motion, the Society was adjourned.

Biographical Memoir of the late Honorable Eli K. Price, LL.D., by J. T. Rothrock, Professor of Botany in the University of Pennsylvania.

(Read before the American Philosophical Society, Nov. 19, 1886.)

On the twentieth day of July, 1797, Eli Kirk Price was born in East Bradford township, County of Chester, and State of Pennsylvania. There was nothing in his surroundings, or in his opportunities, which indicated for him a life of more than the average success or usefulness. It is true that his home lay in the centre of what, for our young country, is classic soil. He must in later years have heard from those, who witnessed the battle of Brandywine, the tales and trials of that day which was so unfortunate to our arms. The field itself had doubtless often been trodden over by him. The very house in which on the first day of each week he was afterwards accustomed to worship still showed on its floors what were said to be the stains of blood from our wounded soldiers who were brought in for medical treatment. Whether this was so or not, there is no doubt that the building was used as a temporary hospital. The whole atmosphere of the region was then, and still is, full of the inspiration of patriotism. Up and down the valley, far as the eye could reach, lay a landscape of singular beauty. The very hills had an individual character, and there was no turn in the roads which wound between them, but brought some new surprise of beauty. To the south and west were "*The hills beyond the Brandywine*," which, once seen in the soft haze of Indian summer, could never be forgotten. What wonder then that an English officer, as he overlooked the region, said: "I am not astonished that these people fight for such a country." The temper of this fiery lad must often have been sorely tried when he learned how his "peace-loving" parents and neighbors had suffered from the depredations of the enemy. Perhaps the discipline of self-control, early enforced by his watchful parents, was one of the secrets of his future success. He never wearied in devotion to the memory of those under whose critical eyes he grew to manhood.

So far as these externals could go, it is true, they were all in his favor, but, as other boys who never came to fill his place in public esteem shared them with him, we must conclude there was in the lad himself a good measure of that holy ambition which goes so far in moulding higher individual destiny.

"Philip, father of Eli, was the fifth in lineal descent from that Philip Price who came into Pennsylvania with the Welsh settlers, and took up Merion, Haverford and Radnor townships in 1682. The name of Price was handed down through four generations from the first settler by a single male representative in each generation."

Rachel, his mother, was a daughter of William Kirk, of East Nantmeal, Chester county, the tenth child of Alphonsus Kirk, who came from the north of Ireland, landed first at Jamestown, Virginia, January 12th, 1689, and shortly after settled in Centre, New Castle county, Delaware.

William Kirk's second wife was Sibilla Davis (of Welsh descent), the mother of Rachel, and hence Eli Kirk Price's grandmother. Philip and Rachel were married October 20th, 1784. For generations Eli's ancestors had all been members of the religious society of Friends.

Though to all "Friends" human strife is a matter of the utmost concern and sadness, one must not infer that they were lacking in courage or in enterprise. On the contrary they have been among the very best of pioneers; often, indeed, they were the first, when principle or human life was at stake, to brave any danger, or to meet any hardship. Under a quiet exterior were often concealed memoiies of thrilling adventures with outward foes, as well as of desperate struggles with the powers of inborn sin tempting them away from the sober teachings of conscience and honest judgment. The life of no real Friend is uneventful. It may not strike the ear or eye of the world, but it is full of striving after perfect purity in thought, word and deed. It may lack the glamour of popular applause, but it is rich in the solid worth of conscious rectitude.

From a long line of such ancestors came the subject of this sketch. Integrity through all these generations had matured into an instinct in him It might be said that he despised and hated fraud simply because it was in him to do so, without conscious effort on his part.

Philip Price was among the leading farmers of his day. It was he who introduced the Washington Thorn into Chester county, where for half a century it has been not only a useful hedge, but one of the most characteristic features of the landscape. He was also among the earliest advocates of the use of mineral fertilizers in agriculture. Judge Peters wrote: "I have heard of none who have been more remarkably successful in the plaster system than Mr. West and Mr. Price." Philip Price was the first President of the Chester County Agricultural Society. He was furthermore one of the earliest to apply the vaccine crust in this community. With a firm faith in its efficacy, he vaccinated all his children at a time when there were more who doubted than believed in its power. Here he stood out, not only as a moral hero, but as a public benefactor. Moreover, it must be remembered, that in that early day there existed, if not open opposition to vaccination, at least a very strong popular prejudice against it.

Neither of the parents of the young Eli was wealthy. Their family was large; eleven in all, of whom he was the eighth. They were industrious and frugal, though unable to give their children what we should call a liberal education. But they did what was perhaps almost as well in encouraging such a thirst for useful knowledge that no ordinary obstacles could quench it. It is true that Eli entered Westtown school in 1812 (as number 772 of the first thousand pupils), but the course there was mainly what we should regard as the necessary, solid branches. Of one thing, however, we may be sure—what was taught was well taught. There was no more sham then than now in that most admirable school.

It may be worth the while to recall how much of our local history and of our advance in the civilized arts Mr. Price was a witness of.

West Chester was not made into a borough until two years after his birth. In the year 1800 the population was but 374. This was more than thirty years before the late Dr. William Darlington said he had hopes of the town because it had become so large that the inhabitants could live off each other. Mr. Price was thirty-five years old before the first railroad entered the town, and this was about three years before there was an

Episcopal church there. The Presbyterian church was perhaps a year earlier, but those vigilant workers, the Methodists, had reached the town about twenty-four years before the Episcopalians or Presbyterians were organized. So much for the now flourishing town of more than seven thousand inhabitants which stands almost within sight of his birthplace.

Even this great city in 1797 contained less than forty thousand inhabitants. All the region beyond Carlisle was the Great West, then, on the whole, perhaps less fully known than any spot of our national domain south of Alaska is to-day. As late as 1802 the inhabitants of the region west of the Alleghany mountains found it easier to send their flour from Pittsburgh to the Antilles by water than to send it to Philadelphia or Baltimore by land. Pittsburgh contained only four hundred houses. Neither anthracite coal nor gas, nor even lucifer matches, were then in use. The pumps stood by the side-walks, the corners were lighted by oil lamps, and the old market houses occupied the middle of the chief thoroughfare in your city. Indeed, the market places still adorn some of the less important streets.

In the year of Mr. Price's birth, every foreign coin, save the Spanish dollar, ceased to be a legal tender within our dominions. He was five years old when the mouth of the Columbia river was discovered by an American, Captain Gray, the same man who but two years earlier had been the first of our citizens to load an American ship with furs on our west coast, trade these in China for tea and bring his vessel back to Boston laden with this precious cargo. This event marked an era in our early commercial history. Mr. Price had heard our early troubles with France discussed in his home, and listened doubtless with a shudder to the details of Burr's atrocious conspiracy. He could remember the Napoleonic wars, and had heard the foolish protests of the Federal party against Jefferson's Louisiana purchase, which opened a magnificent domain for our growing population, and without which our national life would have been in continual jeopardy.

Those were primitive times, though not entirely simple or guileless. Party spirit ran high as now: there was as much crimination and recrimination, as much bribery, billingsgate and official corruption then as now. We look upon them as slow times because there were no railroad monopolies, no corners in grain, no great strikes and only signs of anything like the Wall street of today. Yet those times and those men were the forces which hastened our unprecedented material growth and cemented our national units into a larger, stronger and more productive whole. We may well say, too, that the subject of this sketch stood among the foremost of his contemporaries, for integrity, public spirit and far-sightedness. It is fairly a question whether this generation will leave as much to its credit, or whether we shall as well resist all tendencies toward national or social disintegration.

Of the successful men of this city a large proportion were country lads, many of them from the counties immediately adjacent. It is not improbable that much of Mr. Price's success came from the fact that his duties as a farmer's son had hardened his constitution and given him, along with great endurance, a great tenacity of purpose. There is nothing like regular duty, conscientiously done, to "crystallize vapory intentions." It is, then, to be regarded as a bit of good fortune that he was born in the country and early inured to toil. In one place he tells us, "In 1809, on my twelfth birthday, I reaped my dozen sheaves" [with a sickle].

Yet, with all this, farm life was not much to his liking, for he says he "was fond of reading and entered the counting-house to escape the farm." But the labor there had done its part. He was hardy, and "temperate in all things."

On May 15th, 1815, he entered the famous shipping-house of Thomas P. Cope. Previous to this, however, he had spent a year in the store and family of Mr. J. W. Townsend, in West Chester. This was a good preparation for his duties with the

Copes. He once stated to the writer that his fondness for reading had saved him many a temptation after he had left the farm.

This shipping-house was well known from its connection with the "Cope Liners," those justly celebrated packets between Philadelphia and Liverpool, which before the days of steam vessels were the pride of our city.

They were then the most important vessels which came to this port. In size they had but few superiors in either the American or foreign merchant service. Built as strong as iron and oak could make them, they well reflected the character of the house which owned them. But a few months since, one of these ancient liners (which is now engaged in the petroleum trade) appeared in the river and was tied up at her old Walnut street berth. Immediately she became the centre of attraction to those who could remember the part she had taken in making the commercial past of Philadelphia so glorious. Under Thomas P. Cope Mr. Price received a full mercantile education. Then he spent a year with J. C. Jones, Oakford & Co., to prepare especially for the China trade, for which he appears to have had a most intense longing. However, by the time he had become of age, that trade was so depressed that he felt justified in seeking a career in another field. Accordingly he became a student of law in the office of the Honorable John Sergeant. This change of plan was certainly as fortunate for Philadelphia as for Mr. Price. There is no question but that the time spent in acquiring the details of mercantile life was of great value to him in his subsequent career. John Sergeant could not help respecting a young man who had won the esteem of the Copes by his sobriety and persistent attention to duty, and the great lawyer became and continued to be a firm friend to his pupil. The field opened by the law afforded a wider career where his relations with his fellows were more intimate, and where, above all, he could, even as an attorney, often act as judge, thus greatly contributing to peace and justice in the conflicting claims between man and man.

On May 28th, 1822, Mr. Price was admitted to the bar. From this time forward his course in life was fixed. No shadow of doubt as to his vocation appeared. The people themselves seem to have made him a real estate lawyer, and no one in this city ever surpassed him in knowledge concerning its land titles. Probably very few ever equalled him. He was universally regarded as a safe adviser. What stronger testimony in his behalf could be given? It has been remarked, by one who knew him intimately at this period of his life, that his mental concentration and singleness of purpose became so intense that he seemed to have no time to think of anything but his profession, and that he wore the appearance of a man wholly engrossed by business. This, however, was from no loss of interest in others. When he was able to tear himself from the cares of an increasing practice, his sympathies were found to be warm. He loved and was loved by children. There is no truer index to a man's heart than this.

Mr. Price married Anna, the youngest child of James and Rebecca Embree, of West Bradford, Chester county, Pennsylvania. They lived together thirty-four years. His biographical sketch of her is most touching. It was written while his grief was yet fresh. Her loss was a great sorrow, following only too fast upon that which came with the death of his daughter Rebecca. He writes: "While her remains are yet with us, I take the pen briefly to perform towards her the duty I have endeavored to discharge toward our beloved, departed daughter. I say briefly, for such I know would be her wish. . . . . My busy retrospections must now be my only resource."

While with Thomas P. Cope, we are told, Mr. Price "familiarized himself with shipping and commercial law, and afterwards grappled with the harder law of real estate." It is well to give here a statement made by the late Judge Sharswood, on the occasion of that gentleman's retirement from the bench as Chief Justice of Pennsylvania: "Mr. Price has not been what we would term a conveyancer, but in England he would have stood high in that rank which is adorned with the names of Booth and Butler, Fearne and Preston." Mr. Price was chairman of the committee appointed to examine Judge Sharswood for admission to the bar more than half a century before the following remarks were made. "His examination," says the Judge, "was a thorough one, for then, as now, everything, which it was his duty to do, was done well. I have no doubt I made a great many mistakes, but he was kind and considerate enough not to correct them." "I doubt if he could tell us, even by approximation, how many titles in this large city (which he has seen grow almost from a village to its present proportions) have passed under his cautious and scrutinizing eyes."

He had no desire either to appear in court, or to have his clients appear there. No man was ever more anxious than he that they should settle their differences in a quieter, less expensive way; and, above all, that justice should be the basis of such settlement. Indeed, it is hardly too much to say that, if a client were plainly in the wrong, Mr. Price would rather decline than undertake the case. This at once explains why he was so often consulted, and his advice so generally acted upon, in the difficulties growing out of the unfortunate division in the Society of Friends, which involved titles to properties that were often very valuable. One of the leading citizens of Chester county inserted a clause in his will that, if certain contingencies arose in the settlement of his estate, the case should be laid before Mr. Price, and his decision should be final. These facts are inserted here because they show, more plainly than any eulogistic platitudes could, what his real standing with the bar and the community was. They are simply the illustrations which come first to mind. The number could be multiplied greatly.

As late as the year 1843 it was quite clear that the State was not receiving from its citizens the amount in taxes which it should, and that the earlier apportionments to the city of Philadelphia and the counties of the Commonwealth were unfair. To remedy this, a revenue commission was appointed according to an act of Assembly which was passed April 29th, 1844, and entitled, "An Act to reduce the State debt and to incorporate the Pennsylvania Canal and Railroad Company." In all, there were twenty-one members. Of these Messrs. Eli K. Price, James S. Craft, Maxwell McCaslin, John Krause and Owen Jones were constituted a committee to prepare a final report, which was, after many difficulties and discouragements, completed and presented to Governor Shunk in March, 1848. The value of the work done will be best appreciated by remembering that the entire increase of the returned valuations, after the action of this board, over that fixed by the revenue commissioners in 1845 was $43,477,255.

The work of these commissioners was evidently of a most delicate nature. They were empowered to measure practically the depth of Pennsylvania's patriotism and public spirit. The soundings were over tender spots in human character and possessions. It is not to be expected that there was no dissatisfaction over the report. But it is doubtful if any similar document could have produced less. One sentence in the report shows that the commissioners were conscious of no dishonorable or dishonest acts. "This work of revision we have intended to perform in the spirit of moderation, and for the proof of its equal and temperate justice, we confidently refer to the testimony adduced and to the record of our proceedings."

At the date of the report it was estimated that Luzerne county, now one of the richest in the State, had of property, subject to a tax of three mills on the dollar, $354,868 less than Huntingdon county. The present enormous coal trade of the Luzerne region was not even dreamed of. In Sullivan county, adjoining Luzerne, the tax on watches amounted to but one dollar and a half, as against $5000 paid in this city at the same time. A wilderness covered vast portions of the State.

In 1851 Mr. Price published a brief article upon that memorial of the county commissioners which asked for a repeal of the laws exempting churches, graveyards, colleges, schools, asylums, hospitals and other charitable institutions from taxation. After showing that such a repeal was against the spirit of all previous legislation here, that it was antagonistic to the very spirit under which the Commonwealth was founded, he continued: "The public squares, amounting to $1,670,400, yield no revenue to pay taxes with, and are especially of incalculable advantage to the health and enjoyment of the people of our city and county. There is something better than mammon, and more available for security and human happiness, and therefore within the scope of the considerations that must govern the wise statesman and legislator. It will not be forgotten what is due to a consideration of a pledged legislative faith, to objects and enterprises intended for the public good, for a small sacrifice is better than that the public faith be broken."

This evoked a spirited reply; but, as Mr. Price was evidently in the right, he may be said to have won an easy victory.

We now approach the period of Mr. Price's greatest activity as a public-spirited citizen. Fifty-six years of age; for thirty-eight years a resident of Philadelphia; for thirty-one years a member of the bar engaged in the transfer of property and advising in matters requiring care, judgment and fidelity: we may fairly assume that he was well known by his fellow-citizens. Honors, clients and emoluments came now without his seeking. In 1853 Governor Bigler requested him to prepare a bill for an act entitled, "An Act relating to the sale and conveyance of real estate." Here I quote in full the details of this important measure as given elsewhere by one well qualified to state the case.

This is the preamble: "Whereas the general welfare requires that real estate should be freely alienable, and be made productive to the owners thereof; and, whereas, in matters which the judiciary is competent to hear and decide, it is expedient that the courts should adjudicate them after a full hearing of all parties, rather than that they should be determined by special legislative acts upon an *ex parte* hearing." "The evils had been that real estate was extensively bound by trusts that made vacant ground and dilapidated buildings inalienable in title, which kept it out of the market and unproductive and unimprovable by the owners or purchasers, without a special act of Assembly, and in some instances such act would not avail. The courts for remedy were enabled to make decrees to sell, lease, mortgage, and convey on ground-rent, or to enable the trustees to build, and the reservation of rents and the purchase moneys were substituted, with security, for the land sold on the limitations of the original trusts. Thus the present generation got a better living without loss to the succeeding owners of the trust property; the dilapidations, like those that tell of long chancery suits in England, have disappeared; our city has been improved and beautified, and business accommodated; the public revenue by taxes is increased, and unfettered titles are carried into the world's commerce for the most profitable uses; purchasers holding titles already adjudicated are purged of legal questions. The Act has been in force since April 18th, 1853, and is popularly called the Price Act." "Its beneficence has been often judicially acknowledged."*

"In 1857 Mr. Price published his 'Law of the Limitation of Actions and of Liens against Real Estate.' In 1874 his treatise on 'The Act for the Sale of Real Estate' (containing 193 pages) appeared, as a reading thereon, embracing the reasons for and the decisions upon the Act."

The increase in population in and around what was originally Philadelphia, that is the two square miles contemplated by its

*The quotations which refer to the acts Mr. Price aided in having passed by our State Legislature are taken from the History of Chester County, by J. Smith Futhey and Gilbert Cope. They were compiled for that work "by Wm. E. Dubois, assisted by J. S. Price as to legal matters."

founder, had gradually brought in its train a host of evils, which in 1853 were felt by good citizens to be no longer endurable. The growth, prosperity, and even the safety of the city, to say nothing of its good name, appeared to be hopelessly compromised by its faulty organization. Without regard to political party, the friends of municipal reform, on the 30th day of July, nominated Mr. Price for the State Senate. He promptly replied, directing his letter to Stephen Colwell, chairman, and other conferees. It was a thoroughly characteristic letter, and contains much that is even more applicable to the present than to the past state of our political affairs. For example: "The exercise of the elective franchise has become almost valueless, since the citizens are under a compulsion to vote for those whom they do not approve, or not to vote at all." It was evident he had recognized that the machinery of our elections had practically placed the citizen voter where the constitution never contemplated that he should be placed, subservient to a party, or to parties, either or both of which might be good or bad, according to circumstances. It has become even plainer now than then, that the tendency of political organization is to bury the conscience of the individual beneath the crushing weight of what influential leaders consider expediency. There is no lesson so hard for a demagogue to learn as that what is morally reprehensible can never be politically justifiable or even safe for the party that advocates it. Such a truth is utterly beyond the comprehension, or acceptance, of one who, seeking only present good, can never take the view of a statesman anticipating the forces and results which may follow in the remoter future.

In a letter to his friend, the late Judge Haines, Mr. Price expresses his opinion very freely concerning methods used in pursuit of office. It bears the date of March 17th, 1854 (he was then a Senator). It deserves reproduction here:

"My Dear Sir:—Your letter of 16th Jan'y not being a business one, I laid it by for a leisure moment, and that moment I have not yet found. I must now write to get rid of my self-reproach. I did not then appreciate so fully, as I now do, these words: 'How contemptible appear the tricks and contrivances of party to secure or retain power!' You spoke thus from much ampler opportunities of observation than I have had, but I have verified the truth of your exclamation. When I went to the Senate, it was with a resolution to do what I should be myself convinced was right; not, it is true, expecting many others to be so transcendental in their views. I have a large confidence, too, in the goodness of human nature, and yet hold to my faith; and look upon those, who lose character, with a considerable degree of charity, as the victims of ignorance or accidental associations. But what is to be thought of Whig leaders and the best that the Senate claims, who have, some of them, high integrity in their ordinary transactions and in their duty to the State, yielding their expressed convictions to win capital to their own party and perhaps to their own support as candidates for governor?"

In accepting the nomination for the State Senate, Mr. Price did so with the express understanding that he was to give no pledges which would forestall discussion, and that he was to do nothing to ensure his own election. The special reasons for this union of his fellow-citizens upon him were: first, to secure the consolidation of the city; second, to substitute a paid for a volunteer fire department; and third, to have legislation which would suppress, or at least hold in check, the intemperance against which so many of Philadelphia's best citizens were then engaged in an active crusade. Horace Binney had said to his son, "I should think your battle would be half won if you could place Mr. Price's name, with his consent, at the head of your ticket." The history of the consolidation of this city will be alluded to later. We have now to consider the action of Mr. Price in regard to the temperance cause.

After Mr. Price's election a Rev. Mr. Rood wrote to ask him what he would attempt for the temperance cause, and what he thought he could accomplish. This called for a reply from Mr. Price of the same date (October 31st, 1853), in which he favored the passage of a bill to submit the question of prohibition to a vote of the people of the Commonwealth, and from the result to ascertain what legislation public opinion would sanction and support. He saw clearly enough that this was not what the extreme temperance people desired; but at the same time he recognized the folly of attempting to enforce a law which the people would not endorse. These are his words: "By taking care to be preceded by an authentic expression of public opinion we will act safely for a good cause, and more effectually promote the good of our fellow-citizens." "While you and your clerical brethren invoke the strong arm of the law and await its enactment, there is no occasion to cease your efforts to do good in the cause. You have in hand the work of persuasion, and conviction must still go on as the necessary preparative measure." "We have all our lives to do good, and we can do nothing better than to be always doing it; and what we leave unfinished, we will enjoin upon our children to finish." "I shall be *prepared to go for that which shall be most effective to suppress intemperance, that the people* can be persuaded and convinced to sustain."

Under date of January 30th, 1854, Mr. Rood wrote to Messrs. Price and Patterson, asking them to support the bill, "To prohibit the manufacture and sale of intoxicating drinks as a common beverage, and the sale of alcohol and ardent spirits, except to authorized agents for medicinal, mechanical and artistic purposes." It was desired that this should go into effect on March 1st, 1855, and be followed by an enactment authorizing a vote on its repeal by the people on the second Tuesday in September.

On February 8th, 1854, the Prohibitory Liquor Bill was in order at Harrisburg. When the eighth section, authorizing a warrant of search in case of a complaint of a violation of the law, was read, a motion was made to postpone. Mr. Price then rose and said he was not willing that this motion should prevail, and continued, "But I have been educated in certain sturdy notions of the rights and liberties of the people, inherited from the common law of our ancestors, and embodied in our State Constitution. It is therein declared that among the inherent and indefeasible rights of all men is that 'of acquiring, possessing and protecting property,' and also, 'that the people shall be secure in their persons, houses, and possessions from unreasonable searches and seizures.' Both of these above provisions, bulwarks of our rights and liberties, are invaded by this bill—unnecessarily and unwisely invaded by it." This of course provoked the bitter hostility of extreme temperance men. The *North American and United States Gazette*, in commenting upon Mr. Price's conduct, said: "Still there is an intrepidity of disinterestedness in his course, which is as unusual as it is heroic, and which must challenge the respect and confidence even of those who differ with him." Farther on the same article said of this eighth section: "For the usual rule is reversed and the accused must prove his innocence instead of standing guiltless till proved otherwise." What wonder then that a man of Mr. Price's loyalty to law and individual rights refused his sanction to so atrocious a measure.

The "Temperance Committee," on February 16th, 1854, sent a letter to Mr. Price. They felt aggrieved at his action concerning the eighth section, and also at the suggestion that he preferred to support a modified and more stringent license law, rather than their prohibition bill. The committee also reminded Mr. Price that but for the efforts of the temperance party he would have failed of his election "by more than two thousand votes." Rather an intemperate suggestion one might well admit on remembering that in so far from seeking or desiring election he was more than indifferent about it, and only consented to abandon his more congenial duties because the public, without regard to party, requested it.

Mr. Price's reply was written on the following day (February 17th, 1854). It was clear that he had "the courage of his convictions." He adhered absolutely to all that he had said and all that he had believed prior to his election, and closed with the "sincere hope that so much good feeling and zeal as I believe to actuate you may be made available in a tempered and practical result for the repression of intemperance." The letter should have been convincing as to his sincerity. Especially strong was one sentence in it: "When you nominated me, it is true you knew the 'antecedents' of my life, and when your committee entered my office, the first thing I told them was, that the only pledge I would give them was that which my life would afford."

On February 21st, "the intemperate resolutions of the extreme temperance men were adopted." The fact, however, that of fifteen Vice-Presidents named at the meeting, "it is believed not more than one or two were present, and six have no known residence among the constituency of Mr. Price," and that three wrote notes and one published a card that their names had been used without their knowledge or consent, should at once show how ill-judged and intemperate some of the proceedings had been. Mr. George H. Stuart's published card was a severe censure, which left these radical gentlemen in rather a sad plight before the public. The Philadelphia *Register*, of February 20th, summed up the whole thing in the statement that "Mr. Price has not changed, but a few of the temperance men have."

The friends of Mr. Price called a mass meeting on the evening of March 3d. The result was a triumphant vindication of his course by the most influential citizens of Philadelphia. The remarks of Mr. Frederic Fraley (may he long survive) were a heart-felt tribute to the courage and character of Mr. Price. The frequent applause which they elicited showed what entire confidence the community had in the Senator. In nothing did his character appear more admirable than in this unpleasant contest. He stood like a wall between extreme partisans and the constitution, which protected and guaranteed equal rights to all men.

On April 6th and 7th, 1855, Mr. Price spoke in the Senate on the bill to restrain the sale of intoxicating liquors. It is to be observed that those who had so recently upbraided him for his supposed want of zeal in the temperance cause, were now humbled and disheartened by their failure to induce extreme legislation. Mr. Price ought to have more than redeemed himself in their eyes by his generous forgiveness of the past and by his earnest efforts to ensure the passage of a bill which would be constitutional and efficient.

Aside from the great interests which he was chosen to represent, Mr. Price was also active in other directions in the Senate. "He drafted and had passed the Act of 1855, relating to charitable corporations" (P. L. 328); "and also the Act of April 27th, 1855, barring estates tail" (P. L. 368).

His sympathies were always in the direction of humanity. No one can point to an act of his which tended to increase the burden of any honest toiler. The legislative Act of May 4th, 1855, "relating to certain duties and rights of husband and wife, and parents and children," was one which brought relief to many an aching heart. It "enabled the wife to become a *femme sole* trader; to own her own earnings and dispose of her property while living, and when dying, without his interference; and, if she died intestate, it enabled her next of kin to take it. If by drunkenness, profligacy, or other cause, he shall neglect or refuse to provide for his child or children, the mother shall have all the rights of the father and perform his duties; may place the children at employment and receive their earnings, or bind them to apprenticeship, without the interference of such a husband, in the same manner as the father now can do by law; but if the mother also be of unsuitable character, the court is to appoint a guardian of such children with like powers. A husband guilty of such conduct for a year preceding his wife's death forfeits all right to her estate and also the right to appoint a testamentary guardian of his children" (P. L. 430; also History of Chester County, p. 698). This legislation in favor of humanity has well been said to be "an advance on the statute book of any civilized nation, and was necessary, as these protections were not covered by our Act of 1848, passed to secure to married women their own property."

In 1856 he "secured the passage of sections enabling a deserted or unsupported wife, or one divorced from bed and board, to protect her reputation by action of slander and libel, and to sue for her earnings and property, and to receipt for and give refunding bonds for legacies and shares of decedents' estates" (P. L. 315). He was the author and ardent advocate of an "Act for the greater security of title and more secure enjoyment of real estate." This became a law in 1856, and embraces so many important points that I quote in full what his son has said about it. It "cuts off all the exceptions to land limitations of twenty-one years after thirty years; requiring all ejectments for land and liens acquired by levies on real estate to be indexed, to give notice to purchasers and mortgagees; all trusts relating to land to be manifested by writing, except when they arise by implication; specific performance, etc., to be demanded within five years; wills duly proved to stand unless objected to within five years; surviving executors and administrators to exercise testamentary powers of sale; regulates subrogation to liens; and provides that, in partition, the highest bidder is to have the choice of shares (P. L. 532). He also drew up the Act of 1859, which requires action within a year after entry made on land to stop the running of the statute of limitations in favor of the possessor, and to bar the remainder after the tenant in tail is barred" (P. L. 603).

As a citizen his activity was always in a safe direction. To illustrate this, I quote again from his son. "He was also the author of many Acts of municipal legislation, passed with a view to the health, comfort and security of the citizens of Philadelphia; among others, that no street or alley is ever to be laid out of a less width than twenty-five feet. If any house now standing on a street narrower than that shall be taken down, the owner, in rebuilding, must set it back to that regulation. Every new house shall have a curtilage of at least 144 square feet of open space. There must be a parapet wall of brick or stone between the roofs of all houses, extending through the cornices, to prevent the spread of fire. A Board of Building Inspectors was also created, to see that all buildings are safely erected, and in accordance with the strict requirements of law. A Board of Revision of Taxes was established, to compel equality of valuation for taxation, and to supervise all assessments of property. A Survey Department to lay out plans for streets, culverts, etc., was also created, to which was attached a registry bureau, in which must be registered every deed or conveyance of real estate before it can be recorded, with a plan of the premises conveyed, so that no property shall escape taxation. And if there be conflict of claim of title, it can be promptly known, as no careful conveyancer passes any title without a certificate of search. He also prepared most of the sections of the Park Act of 1868."*

How active and efficient his exertions in behalf of our Centennial Exhibition were is within the memory of most here tonight.

In 1852 Mr. Price published a memorial sketch of the lives of his parents. It appears that he was the sole author, though the name of his brother Philip also appears on the title page, and he helped to print and to circulate the book. Though in this volume Mr. Eli K. Price states that he was not then a member of the "Society of Friends," it is very certain that their moderate and just principles were the directing power of his life. This little book (pp. 192) is a most tender tribute to the memory of

* These quotations, also, come from the valuable "History of Chester County," to which allusion has already been made. It is among the very best works of its class that our county has yet produced.

his revered parents. Probably better than any of his published writings does it reveal the profound religious convictions of the author.

In 1864 he read before this Society a brief paper upon the family as an element of government. Some of the ideas expressed in it were worthy of Herbert Spencer, and indeed one may almost say were prophetic of Spencer's views. The argument is at once a noble tribute to woman as the guardian of the race, and also a reflection of the innate purity of his own soul.

Love for, and pride in, his ancestry were strongly marked features in Mr. Price's character. Accordingly it does not surprise us to see him taking a conspicuous place in the "Centennial Family Meeting" of the descendants of Philip and Rachel Price, held at the old homestead, in East Bradford, in 1864. Friend that he was, at heart, there was one sentence in the account of the event (which he subsequently published) that must be quoted here. Our long civil war was drawing to a close. The agony of suspense was well-nigh spent, for it was clear that it was merely a question of time until the flag of the Union should float triumphantly over the entire land. He writes: "And what have the children of Philip and Rachel Price to say for those of their descendants who have been, or who are, absent from their homes, because fighting the battles of their country? On such an occasion, when met to commemorate our parents, we must bring all of ourselves and all that belongs to us into a comparison with these high exemplars and note the disparities. We have to say that, though it has not reached our sense of duty to do as these brave youths of our blood have done, we love them not the less, as our parents would have loved them not the less, for having obeyed *their own sense of duty* when their government and country were stricken by traitor hands."

Bound in the same volume with the last two papers, I find "A Discourse upon the Trial by Jury." It was read May 1st, 1863, before this Society. It shows how profoundly its author, Mr.

Price, had studied the subject. It is more than probable that, not only all juries, but many judges might read it with advantage to themselves and to those on trial.

In July, 1866, he read before the Numismatic and Antiquarian Society of Philadelphia a brief commentary upon some important but now obscure allusions to Revolutionary times, to which he added a short notice of the Pemberton family, which he says was ancient in England before the settlement of Pennsylvania.

In 1872 his busy mind was exercised in another direction. This time, upon the phases of modern philosophy, especially such as were attaining a rank luxuriance under the stimulus of the then latest ideas upon evolution. His published criticisms show remarkable acuteness in detection of the weak points in the new hypothesis. The facts were many of them strange, the relations of the facts were almost wholly strange: at least they assumed more scientific form and were under a more scientific presentation than ever before. What wonder then that Mr. Price failed, as most others did, to take in the whole subject at the first draught. It is well known that neither Mr. Darwin nor Mr. Spencer comprehended all that their doctrines taught, or even dreamed how widely their conclusions would reach and apply. Evolution itself was slowly evolved out of the best thoughts of the world's scientific leaders. Its propositions were then few, and its corollaries hardly more numerous. Already it has created a literature of its own, is as sure as the theory of gravitation and not less far-reaching. No man accepted more fully than Mr. Price did, in his later years, the abstract idea of evolution. The only question in his mind was, how far can it be considered operative? Here he was judiciously slow in deciding, and it would have been better for science if others had imitated his prudence. The largest task of the next century will be the sifting out and rejecting from the body of science such fancies as have been mistaken for facts and taught accordingly. Mr. Price intended to act, as a judge with conservative tendencies would do.

His paper on this subject, read March 1st, 1872, is one of intense common sense, with here and there passages, which are eloquent from earnest conviction. To the average thinking man his argument will always have great weight; for it is in sympathy with human longings which no philosophy can ever moderate or change.

Having himself been a most active participant in the measures which led to the consolidation of this city, Mr. Price was by unanimous vote of the Historical Society of Pennsylvania, on October 28th, 1872, requested to prepare "The History of the Consolidation of the City of Philadelphia." The dedication is to the venerable Horace Binney, and bears the date of December, 1872. It is a duodecimo of 140 pages. To give a clear idea of the increase in population around the original city, he investigates the early charters. The city, as contemplated by its founders, was to contain 1280 acres—exactly two square miles. The first city charter was not granted until October 25th, 1701, though its charter as a borough was about seventeen years older. On March 11th, 1789, a second city charter was obtained.

Step by step, *outside of the city proper*, the following districts were incorporated, and in the following order: Southwark, in 1762; Northern Liberties, in 1771; Moyamensing, in 1812; Spring Garden, in 1813; Kensington, in 1820; Penn, in 1844; Richmond, in 1847; West Philadelphia, in 1851; Belmont, in 1853.

It is enough to say that each district had its own police force, and that to escape arrest, for the time, it was simply necessary to step across an imaginary line from one district into another.

A meeting in behalf of consolidation of these disjointed members of the body politic into a compact city, whose government should be better and less expensive, and whose further expansion should be unlimited, was held on November 16th, 1849. It was attended by more than eighty of our then leading citizens. Nothing had done so much to prepare the public for the contemplated change, as the mobs of 1844.

They supplied all fair-minded men with ample evidence that in city politics, party lines must be abandoned and concert of action effected on this vital question. There could be neither peace nor progress without it.

Added to those riots which sprang out of creed or color, were others more serious (because more frequent) which grew out of the volunteer fire system. In the spring of 1853, another meeting was called to consider the latter cause of trouble, and, if possible, to devise means for its suppression. It was a foregone conclusion, this need of consolidation. The only question was, on what basis should it be effected. To accomplish it, legislative action was requisite. Public sentiment settled upon Mr. Price as the man to represent this part of the city's interest in the State capital. He was not offered the office as an honor, for it was felt he would honor the office, but it was tendered as a sacrifice of inclination and of interest, which he must make for the public good. And as such he accepted the nomination for the office of State Senator. To say that for the mere honor of office, which so possesses some small minds, he cared nothing, is to make a very mild statement of the fact. In so far from spending time or money to gain a seat in our legislative halls, Mr. Price would have given freely to be allowed to remain a private citizen. His letter of acceptance, read by his friend, Mr. Joseph B. Townsend, before the nominating convention, is in all respects a remarkable one. The expressions, brief and sharp, in which he pointed out the dangers from what has since culminated in that greatest of political curses known as the *Boss System*, are now recognized as prophetic.

Mr. Price (as already stated) was elected "by independent voters who left their party attachment and discipline" in the interest of the greatest good of this city.

We can go no further into details here, than to say in the words of the memorial presented to the State Senate on January 3d, 1854, that among other things, consolidation "dispenses with a multitude of treasurers, solicitors, clerks, superintendents, or their equivalents, besides a host of subordinates. It dispenses with 168 tax collectors, and will cause a saving in this one item alone of $100,000 per year."

Of course any bill which promised to make such sweeping reductions in the number of office-holders would be opposed by that disinterested fraternity; and at once the specious argument was advanced before its passage by the Lower House, that the consolidation would endanger the city trusts. It is creditable to the men of all parties in the city, and to their representatives at the State capital, that the argument was estimated at its true worth, and the bill passed by an almost unanimous vote.

The select committee of the Senators of the City and County of Philadelphia, of which Mr. Price was chairman, in its report to the Senate compressed the whole truth into the single statement that, "while nearly all the cities of our continent have been allowed freedom of expansion, and have bounded forward in population and wealth, the City of Philadelphia had fallen, in 1850, from the first to the second in wealth, and the fourth in population." There was no resisting such an argument.

It was a great day for Philadelphia when the Consolidation bill passed. One can hardly imagine how dark a day it would have been had the bill been rejected, or even essentially modified.

Mr. Price's friend and companion, the venerable and revered Frederic Fraley, had much to do with giving shape to the ideas of the sub-committee and committee appointed to prepare the bill for presentation to the Legislature. His large business capacity and intimate knowledge of the details of city government were freely offered in the public interest. He may well rejoice now in the beneficent results of his labor. It was a master stroke which made the office of City Controller an elective one, in which the people decided who should oversee public expenditures. Maladministration thus lay largely at the doors of the voters. Did space permit, this portion of Mr. Price's useful life might well receive more extended notice.

In November, 1873, he published in some of our leading State papers eight brief articles, giving his objections to our proposed new State Constitution. It is needless to say that his points were well chosen and ably defended. After a lapse of thirteen years, some of the evils he then foresaw have proved gigantic enough to threaten our whole social fabric. It is proper that these objections be here briefly recorded.

The first was that, as compared with the rest of the State, Philadelphia was inadequately represented in our Legislature.

The second was, that it prescribed limits to the powers of the Legislature, stated rules to be observed, prohibited bribery and corruption, showed how even a clerical mistake might become a law (as it has done); but gave no method of enforcing right or punishing wrong in certain important contingencies.

The third showed that the election of judges was practically placed in the hands of a self-elected caucus.

The fourth was, that the proposed equality of taxation was not only a hardship in Philadelphia, but an express violation of assurances properly given prior to the passage of the Act of Consolidation, and also that the proposition to tax charitable and educational institutions and churches was in violation of traditional policy so old, and so often expressed, that it had become sacred as unwritten law, even if not actually on the statute books.

The fifth point was, that in apportionment of the State revenues under the proposed new Constitution, "no moneys of the State could be applied to any purpose of charity, education, or benevolence, or to develop our resources, or to gratify or instruct the people;" and that even after payment of the State debt these prohibitions would remain the same.

The sixth exception was mainly in regard to corporations. Mr. Price contended that justice had not been done them in the way of protection. On the other hand this Constitution left room for *unjust* discrimination, for cutting rates, for bribes in the way of free passes, and yet prescribed no penalty. It is probable Mr. Price recognized that even discrimination in freights might prove in one way a benefit to the masses, however hard it bore upon producers near the points where the products were consumed. It can hardly be supposed, however, that even he saw then the disastrous extent to which discrimination could be carried by our own corporations against our own citizens. Loyalty to his State, in him, reached the measure of devotion; and he would have spared no corporation that struck unjustly by discrimination at any legitimate business of his fellow-citizens.

The seventh objection was an echo of the first on the inadequate representation for Philadelphia.

The eighth, and last, objection concerned, mainly, the methods of administering justice in the city. The manner of electing magistrates placed the franchise practically in the hands of ward politicians. While the State was amply protected, "the citizens of no city have any protection from the evils of bribery, corruption and fraud." Though warned in advance of the needs of the cities, the constitutional convention "left us helpless of remedy, as before, and thus virtually deferred to and perpetuated the municipal rings, and permitted plunder to flourish."

These strictures were made before the new Constitution was voted upon by the people. Can any fair-minded man now deny how just they were, or how much needed? Mr. Price was warned by certain persons that he was acting to his own injury. His dignified defiance of all threats was simply characteristic of the man. The peaceful son of a peaceful sect, how often had he proved a very lion in the path of public plunderers. It is no exaggeration to say that he would have endured martyrdom for his principles. His appearance, conduct and mode of expression told plainly enough that he had a courage beyond intimidation. In pursuit of wrong-doers, he was simply merciless and unrelenting. Yet his admiration for industry and honesty were just as marked.

The Pennsylvania Colonization Society requested Mr. Price to prepare a biographical sketch of its former Vice-President, Dr. Edward F. Rivinus, who was also his personal friend. This sketch was an affectionate tribute to the memory of one who was an associate in a congenial cause.

Early in 1876 he prepared and read before this body a paper upon "The Glacial Epochs."

It is a review of the opinions held by the leading advocates of glacial action. How far time modified Mr. Price's objections to the hypothesis I have no means of knowing. It is certain, however, that he was more favorably inclined to it during his later years. The paper itself is a marvel of cross-questioning. Hardly any other than a legal mind could have produced it.

Prior to 1867 the question arose as to what were the legal uses of the so-called Penn Squares, which were in the older part of the city. Several citizens, who were joint-committee men of the Academy of Natural Sciences, the Library Company of Philadelphia, the American Philosophical Society, the Academy of the Fine Arts, and the Franklin Institute, asked Mr. Price's opinion upon the subject. This was subsequently published. It is well enough that the conclusions reached be given here; for they cannot be too well known, or too widely circulated among our citizens. Mr. Price held that the Central Square could and should, in justice to Penn's wishes and without any betrayal of public trust, be used as a building site for such educational institutions as were represented by the above committeemen; because these five Penn Squares were laid down by the first surveyor-general (Thomas Holmes), and it was specified, by implication, if not directly, in the "advertisement annexed to the List of First Purchasers," that, whereas the four others were to be kept open, the central one was to have upon it "houses for public affairs—as a meeting house, assembly or State house, market house, school house, and several other buildings for public concerns." That pamphlet should least of all be forgotten by this Society, as it declares our legal status in times of either peace or war.

Prior to 1876 the legacy of André Francois Michaux became available to this Society. It is worthy of note that our honored chief in botany, Prof. Asa Gray, was present at the preparation of that will, and it is more than possible made suggestions which should be kindly esteemed here. This, however, is conjecture. Mr. Price was made chairman of the committee having in charge the execution of the Michaux trust. In 1876 he read his report here, showing that the income had been judiciously expended, and, almost as enthusiastically as if he had been half a century younger, he stated his plans and the hopes which grew out of the fund. It can hardly be said that this legacy from France started Mr. Price upon the agitation of the timber question and the necessity of a national and state system of forestry. His fondness for trees was an inherited one, and all his life he had been a tree-planter. For a score of years he had witnessed with sadness the wholesale destruction and waste of our forest growth. It was thus a happy chance which associated his name with that of Michaux. No man could have had a stronger or more practical leaning toward the execution of such a trust, and no man would have been more certain to see that the testator's wishes were religiously carried out.

I thus desire here to record the fact that of all those who, in this State, agitated the timber question before it had commended itself to the public judgment, the most efficient was *Eli Kirk Price*. He has had his share of sympathy for having gone so wide of the mark (it was thought by some) as to predict that there ever could be a dearth of timber in this land. Now that the whole country is awakening to a recognition of the truth of what he taught, let him have the credit of a prophet and a public benefactor.

In this connection it is but just that I also mention the name of another Pennsylvanian, the Honorable Washington Townsend, who, when a member of Congress, was chairman of the Committee on Public Lands, which started the late Franklin Hough on his productive career as a compiler of forest law and literature for our national use.

It is a matter of regret that Mr. Price did not live to witness the observance of Arbor Day, when the school-children all over the State were engaged in planting the trees under whose shade future generations might rejoice. Those who see what the day has done in Nebraska will recognize something more than sentiment in its observance.

In November and December, 1877, Mr. Price read before the American Philosophical Society a paper on Sylviculture. This apparently was suggested by the duty of utilizing the income from the Michaux legacy. It is, however, important as being among the first studied papers upon that subject published in this city. Considering how much we were then in the dark, as to the precise facts and statistics of American forestry, it is a wonderfully clear statement of wants and remedies as applied to our own soil. A year later he supplemented it by a briefer one.

On March 20th, 1879, the Numismatic and Antiquarian Society of Philadelphia presented him, its President, with a silver medal in commemoration of the twenty-first anniversary of the foundation of that organization. Dr. Daniel G. Brinton, who has earned so distinguished a place in anthropological science, made the presentation address, after Mr. Henry Phillips, Jr., had delivered and explained the medal itself. On its obverse this medal bore the name and portrait of Mr. Price, and on the reverse were the seal and date of the foundation of the Society. Mr. Price made a brief and felicitous response.

Greatly as Mr. Price valued such a tribute of respect and veneration, the moderation evinced in his reply was thoroughly characteristic.

His active interest in the Numismatic and Antiquarian Society appears in his contributions made from time to time.

On January 15th, 1884, the friends of Mr. James J. Barclay gathered at the Philadelphia House of Refuge to celebrate his ninetieth birthday. Mr. Price spoke effectively and affectionately on the occasion. Listening to what was said of Mr. Barclay, Mr. Price could hardly avoid recognizing that much of it was also applicable to himself. Age, fidelity, exemplary private life, recognition by the best citizens as Philadelphia's most respected men, came in equal measure to them both.

Of those who began life with Mr. Price, but few survive. Among them Dr. Ezra Michener stands pre-eminent as a public-spirited citizen and as a scientist. The tribute paid by this venerable gentleman to Mr. Price, who was once his room-mate and always his friend, is of the warmest character.

For many years Mr. Price was an active member of the Board of Trustees of the University of Pennsylvania. He gave no stinted measure of care and interest to that great institution, and more than once aided it from his own financial resources. It is not too much to say that his legal knowledge was of the greatest importance in the administration of its real estate. He was also President of the Preston Retreat, one of our noblest charitable institutions. He was also one of the original members of the Park Commission, and, as chairman of its committee on land damages and purchases, passed under his personal supervision all the titles to the large area now occupied by the people's pleasure ground, which aggregates in value nearly eight millions of dollars, this, too, without any charge whatever for his services.

In concluding what is here said of Mr. Price as a public character, it appears proper to quote from a letter written by him to a relative twenty years ago. There was no suspicion in his mind that any part of the letter would ever be published. Hence a peculiar value attaches to the following extract as indicating his own real integrity of character.

"Having said so much, I am now going to offer thee some cautions; but these are also for thy encouragement. But whatever thee may do I wish to see it over thy own name, or initials, or none. In discussing sacred truths no unusual name should be assumed. For myself, I write nothing that I would not put my name or initials to; first because they give authenticity to what is written and help the effort that should be kept uppermost to tell the best truth we know in the best manner we can. The writing thus authenticated will have a greater weight with our contemporaries, and if read yet later will be our testimony, borne from one generation to the next. If we write with sincerity of purpose under a sense of duty, we need not be disturbed by the apprehension of criticism; for, if others can do better, let them try it, and for one I shall be thankful to them."

His love for this commonwealth was only exceeded by his love of truth. It would be difficult to write a history of this State or City without reference to the services which he has rendered directly or indirectly. No movement of public policy which he inaugurated or actively aided was other than a benefit to those in whose times he lived.

We can hardly tell when he began to grow old. The erect, commanding frame gradually became a little bent, and the vigorous step a little more slow; but up to the evening of November 14th, 1884, when he was in his eighty-eighth year, his mind was active and his interest in human affairs warm.

He lay down in usual health, and just before the dawn of November 15th, passed quietly to his eternal reward. He saw the sun rise out of a cloudless horizon from near the throne. Anticipating the change, he had written:

"I hear celestial billows roll,
Before I've reached the parting strand:
I listen with transported soul
To music from the better land."

He had lived so simply, and cared for himself so systematically, that there was no real disease. The machinery of life quietly stopped when the full measure of work was done, and the world was left the poorer because a great, good man had gone.

Admirable as he was in his public relations, he was no less admirable in his family life. He carried to his home all the charm of a gentle, affectionate, thoughtful man.

The children of Mr. Price were:

I. Rebecca E., married to Hanson L. Withers.

II. John Sergeant.

III. Sibyl E., married to Starr H. Nicholls.

Of these, the son, an eminent lawyer of this city, alone survived him.

Whatever we may think of ourselves, the fact is, the example of such a man as the subject of this sketch may be studied with advantage by all. There was not in his early life anything which placed him in a conspicuous light before the world. He entered upon his career with simply honest ancestry and personal rectitude and good health to favor him. Yet without self-seeking, without fawning to powerful patronage, without sacrifice of self-respect, without ceasing to condemn wrong, he became one of the most conspicuous men in this city, which claims a population of a million inhabitants. Why was it?

I. Because his fidelity to trust was absolutely unassailable. No man ever lived in whom this was stronger. A trust was as sacred to him and as binding upon him as though the exact case had been specified in the volume of revelation.

II. Because, when called upon to express an opinion, he did so from his honest conviction, without the slightest regard to what friend or foe might think of it; and his actions were always as positive as his opinions. But with all this, he was singularly tolerant of the honest opinions of others.

III. Because he was usually in advance of his times, and often very far in advance. It is only requisite here to specify his relations to the park, to the timber, colonization and abolition questions in illustration of the above statement.

IV. Because he held to the plan of work which he had laid out for himself with undeviating steadiness through a long, active life.

These may be called modest qualifications with which to win the universal esteem in which Mr. Price was held. True, yet it appears they were sufficient. He was not a great genius, nor a man of destiny, but he was something better than either—an honest worker. His intuitions never did duty instead of his convictions, for the latter maintained their supremacy throughout, and were only trusted when fully weighed. This explains why during so long a life Mr. Price was seldom obliged to reverse an opinion once formed.

His virtues were of the Spartan kind. The style of literature may change from century to century. The science of to-day may be rejected as insufficient in the next score of years. Habits of thought, dress, social usage, all these are ephemeral; but simple, perennial honesty can never become antiquated. The more corrupt a nation may become, the more will it be needed, and the longer will it be respected. A life moulded by conscience and warmed by love can never be other than a benefaction to those living under its influence. It is not claimed that the subject of this sketch was perfect. What mortal can be? Nor was he without enemies. High integrity and moral convictions must always clash with less noble elements. But with all this, no better advice can be given to those who follow than to be as much like him as possible. Eli Kirk Price may well be taken as an ideal worthy of imitation.

Obituary notice of Dr. Albert H. Smith, by Dr. Harrison Allen.

(Read before the American Philosophical Society, Dec. 3, 1886.)

Albert Holmes Smith was born in Philadelphia, July 19th, 1835. He was the seventh child of Dr. Moses B. and Rachel D. Smith. His ancestors emigrated from England about 1685, soon after the grant by Charles II to William Penn. Dr. Moses B. Smith was a noted practitioner of medicine at Bustleton, Pa., from 1814 to 1829. From the date last named to that of his death he was well known in Philadelphia as a practicing physician. He died in 1855 in the sixty-eighth year of his age. He was a man who stood high in the estimation of his fellow-citizens. He was an associate of Physick, the elder Hartshorne, J. K. Mitchell, and other eminent medical men. He was one of the founders of the American Medical Association.

The education of Albert H. Smith was conducted in accordance with the views of the Society of Friends. After passing through the Academy at Westown and the private schools of James Lippincott and Henry D. Gregory, he entered the Collegiate Department of the University of Pennsylvania, whence he graduated with honor in 1853. Immediately after graduation he matriculated in the Medical Department of the same institution, and obtained his diploma in 1856. He was fortunate in receiving the position of resident physician at the Friends' Asylum for the Insane at Frankford, and subsequently the more important office of resident physician to the Pennsylvania Hospital. He was thus in every way thoroughly prepared for the duties of practice which soon devolved upon him. At an early period of his career he became identified with the Nurses' Home and Lying-in Charity. He served as one of its physicians and lecturers for the long period of twenty years. This unassuming charity is a centre from which has always emanated authoritative teaching on the subject of obstetrics. Hundreds of physicians scattered over the face of our wide country have received their instruction in this all-important branch of medical art from Dr. Smith. The Nurses' Home was the scene of much of Dr. Smith's professional labors. He here laid the foundation of that career which in many respects was remarkable.

For a short time Dr. Smith was one of the obstetricians to the Philadelphia Hospital, and in 1868 he became one of the consulting physicians to the Woman's Hospital. Dr. Smith was twice elected president of the Philadelphia Obstetrical Society, and of the Philadelphia County Medical Society. He presided over the American Gynecological Association at its eighth annual meeting. He visited Europe in 1880, when he was received with distinction by the leading physicians both in England and on the continent. In 1885 he was elected an honorary member of the Gynecological Society of Great Britain.

Dr. Smith enjoyed robust health until the fall of 1883, when the symptoms of an incurable malady announced themselves. With but slight abatement the disease advanced until it compelled its victim to seek absolute repose. After a prolonged illness, accompanied with great suffering, he died, December 14th, 1885.

Dr. Smith married Miss Emily Kaighn, daughter of Charles Kaighn, of Kaighn's Point, N. J. He was the father of seven children, five of whom survive him.

To attain to a commanding position in a difficult art, to become a popular practitioner in a city where professional competition is keen, demands qualities of unusual order. By steady, untiring persistence Dr. Smith conquered a position of eminence among his brethren and a place in the hearts of hosts of patients. In the last mentioned relation his rank among the physicians of Philadelphia was, perhaps, unique.

Dr. Smith was *facile princeps* the leading obstetrician of his time in America. He developed a skill in the management of cases requiring instrumental aid which in the opinion of his colleagues has probably never been exceled. In the language of an associate: "He held advanced positions both as a practitioner and a teacher of obstetrics. He used the forceps with unsurpassed skill."

The excessive toil which is inseparable from the life of an obstetrician in full practice—the irregular hours, the exacting vigils—demand an iron constitution and a determined will. Dr. Smith possessed these qualifications. In common with many men of exceptional endowment, he enjoyed the faculty of sleeping at times which did not interfere with the exactments of long-continued toil. Forty-eight hours have been passed without sleep on his part and yet without impairment either of physical or mental vigor. Nothing ever came to him as an interruption. The demands of the most unreasonable patient never annoyed him. When at his prime he was indifferent to fatigue and hardship. I recall on one occasion meeting him at the house of a patient when the cold was extreme, and the streets were all but impassable from the accumulations of ice and snow, congratulating myself that I was free from the labor which was before him that day. Yet he failed to comprehend that anything unusual existed, and did not appear to regard in the slightest degree conditions which are generally held to be distasteful and simply to be endured.

It has been frequently observed that men of the cast of mind of Dr. Smith are rarely literary in their inclinations. The lives of intense responsibility lead by them; the fatigue to which they are habitually committed; the weariness and disposition to repose which is so well known to follow upon long periods of exposure to the open air, no doubt suffice to explain this disinclination. It is a noteworthy circumstance that in spite of this disinclination Dr. Smith was a literary worker. Soon after leaving the Pennsylvania Hospital he is found editing "Ellis' Formulary," a work requiring great patience and care. He contributed a number of papers—eighteen in all—to the medical journals. As an evidence of the cast of Dr. Smith's mind it may be noted that of this number ten were on practical subjects. In the main they were in illustration of improvements of instruments and of apparatus. An important modification by himself of a uterine pessary is favorably known over the entire medical world. He was the first to introduce into practice the intra-uterine applications of hot water in arresting hemorrhage. At a time when his practice was at the largest he undertook the study of the German language, and at a later period he enjoyed an easy command of the medical literature of Germany. As a writer Dr. Smith was clear and forcible. In a sketch of Dr. Emeline H. Cleveland he attained a truly eloquent strain. This fact is worthy of mention since he was always self-depreciatory of his literary abilities and disclaimed every intention to authorship. He was often heard to regret that with him the act of composition was difficult.

These are the chief facts, as the world esteems facts, in the life of Albert H. Smith. Much remains to be said, much that at my hands I keenly feel must remain imperfectly said. The elements of character which made Dr. Smith while he was among us an honored object, remain now that he is dead an undying memory.

Dr. Smith was a man of chivalrous type, and his life was consecrated in the best sense of the term to the service of the Highest. It was more to him to right a wrong and to defend the weak than to make scientific discoveries. The impression made upon his mind from being brought in contact with disease was the suffering that appealed to him for relief rather than the nature or the results of morbid processes. As a consequence he is found less active in the investigation of the anatomy and the pathology of those diseases with the study of which he was identified than with the means of assuaging the pain and distress attending their presence in the economy. He was not heard to express any exalted conception of the duties of the physician ; he made no pretension to any special consecration to good works ; he was, indeed, too busy a man to systematically attend to the rites of a society so simple in organization as is that of the Friends. The attitude assumed by him toward the suffering was not that of one who from generous impulse was occasionally induced to offer relief, but as one impelled by an incentive which was constantly present. It actuated the performance of the smallest duty as well as the greatest, and was the same in the dwellings of the rich as in those of the poor.

Many instances are told in which Dr. Smith undertook the task of seeking out the helpless and rescuing the fallen. Dr. Christopher Cleborne, of the U. S. Navy, is my authority for the following incident : Dr. Smith, while a resident at the Pennsylvania Hospital, had in some way learned that a poor country girl had been enticed from her home into a brothel. She was sick, in debt, and unable in consequence to escape from her surroundings. Finding that she was penitent, he opened a correspondence with her friends, paid her indebtedness, enabled her to get away from the den in which she was lodged, and to be restored to her parents. On another occasion Dr. Smith was called upon by an agent for a benevolent society who informed him that an abandoned woman was about to be tried for the murder of her child. The poor creature had taken the life of the infant soon after its birth. She had been arrested and at the time that Dr. Smith was notified she was on trial for the crime. It appears that the mother had applied to the Nurses' Home for assistance, but in vain. Dr. Smith needed but a simple narration of the facts to have his sympathies aroused. He relinquished all his engagements and repairing to the court-room undertook to defend the woman. He endeavored to show by statements made on the witness-stand by himself and his medical friends, whom he had summoned, that a homicidal tendency is not infrequently developed in the mother while in the parturient state, that the woman had sought relief and protection at the Nurses' Home, which, had it been granted, would have shielded her from her own maniacal disposition, and that no premeditation to the murder could be proved. The plea was successful and the woman was acquitted.

The zeal which always characterized Dr. Smith's efforts to save and defend women doubtless accounted for the line of practice he accepted. While a resident at the Pennsylvania Hospital he was noted for the delicacy with which he treated the women patients. In his practice he gave evidence of a thorough acquaintance with the peculiar organization of women. He studied not only her physical but her psychical nature. Women returned this appreciation with an esteem and affection that was unbounded.

A lady whose knowledge of Dr. Smith was gained almost entirely in the course of his professional visits to herself, has recorded some of the impressions which she derived from him. His influence, she thought, was due in great part to his sympathy. It had no limits. He took the trials and griefs of others to himself. He was never known to be impatient even when he was weary and sad at heart. As his health failed he disguised his sufferings and listened with interest to the most trifling ailments. "I saw him," said she, "on the very day that he finally gave up work, yet he was so bright and cheerful that I felt completely reassured that he was restored to health."

Dr. Smith had a high conception of womanhood. He accepted woman as man's help-mate in the most exalted sense. He held her to be man's guide and controller. In his judgment, while her moral instincts were truer than his, her mental powers were equal, and that on the encouragement given her depended the moral regeneration of the world. He was as urgent in calling her to a true sense of the immense importance of her mission as he was strenuous in his endeavors that society at large should acknowledge her claims. "Woman," said he on the occasion of a memorial meeting held in honor of Professor Cleveland, "must expect to exalt herself to her true position in which she can perform the proper function in the intellectual and social economy."*

* Papers read at the Memorial Hour in Commemoration of the late Professor Emeline H. Cleveland, M.D., Phila., 1879, p. 28.

From the foregoing it can be easily understood that Dr. Smith became an early and consistent advocate of the medical education of women. He urged upon the profession and the community the justice of admitting women to the practice of medicine, and to all the privileges of membership in the representative medical bodies. To use the words of an eulogist,* "he bent his broad shoulders to shield professional women from roughness and unjust depreciation, and to remove from their path the stumbling block of scornful indifference." He was undaunted by opposition and unwavering in his adherence to his convictions. That ostracism followed such a course mattered not; that he was openly assailed as a man who was defiant of public opinion did not move him. Defeats of women candidates to election to membership in the Philadelphia County Medical Society did not deter him from repeatedly renewing the attempt.

At a meeting of the Pennsylvania State Medical Society, held in Pittsburgh, in May, 1878, Dr. Hiram Corson presented a resolution to the effect that every Hospital for the Insane in the State be administered by two medical attendants, one a man and the other a woman. The resolution met with great opposition, and at the ensuing meeting at Chester it was actively discussed. In the course of the debate Dr. Smith spoke stoutly in favor of the resolution, and throughout the struggle which agitated the society defended the position taken by Dr. Corson. The resolution was lost by a close vote of 40 to 35.

Dr. Smith lived to see the opposition to the medical advancement of women in great part overcome and to enjoy the gratitude of those whose cause he had so valiantly espoused. When the warning of failing health compelled him to relinquish his practice and to seek relief abroad, he was the recipient of the most touching expressions of regard from the physicians and the students of the Woman's Hospital. On the occasion of his death a meeting of the Alumni of the Woman's Medical College was called and largely responded to. Messages of sympathy were received from graduates from distant cities. In commemoration of his self-appointed service in their behalf and the interests which they represented, a portrait in oil was ordered to be painted and presented to the Hospital. In pursuance of this intent a portrait now adorns the parlor of this institution.

The prolonged illness of Dr. Smith called out as much sympathy from his friends and patients as he had extended to others. It may be here related that when it was found desirable to remove him from his city residence to his cottage at Beach Haven, the equipment of the city ambulance service became available and the interest taken by the mayor of the city, by the police surgeon, Dr. Morris Stroud French, and by the police corps in seeing that the beloved physician was painlessly and expeditely taken from his sick-room to the cars—the streets being cleared for the purpose —made the occasion in a degree a public one.

His attitude to children was all but reverential. It was beautiful to see

* Public Ledger, Dec. 15, 1886.

his countenance lighten up even in midst of pain to hear of the welfare of some little friend. Tokens of affection showered themselves upon him during his illness. A lady narrates the incident that a fortnight before he died she took her little niece, of whom he was extremely fond, to see him. He gave her some flowers, and, though suffering greatly at the time, insisted upon carefully fastening them to her dress himself.

Such is the brief chronicle of an important life. Not that much has been left in literature or science in evidence of what he accomplished. In the best sense of the term his career was imperfectly developed. He was at the point of attaining a position in life where many converging lines were meeting. A fairly lengthened span would doubtless have given opportunity for complete application of his powers. It is well known that he was on the threshold of a preferment which would have greatly increased his influence and widened and strengthened his position, when the last summons came with no uncertain sound. The spear fell from his nerveless grasp and the fight was over.

Stated Meeting, December 3, 1886.

Present, 13 members.

President, Mr. FRALEY, in the Chair.

Professor F. A. Genth, Jr., a lately elected member, was presented to the Chair and took his seat.

Correspondence was submitted as follows, viz: A letter of envoy with request for exchange from R. Istituto di Studi Superiori practici e di perfezionamento in Firenze, Italy; a letter of envoy from the Foreign Office at the Hague; a letter announcing change of address from Dr. F. L. Otto Roehrig, Los Angeles, Cal.

On motion, the R. Istituto di Studi Superiori was placed on the Society's exchange list, to receive from No. 121.

College of Physicians (Philadelphia) requested the loan of portraits belonging to the Society, of such persons as were founders or fellows, to be shown at its approaching Centennial exhibition, December 28, 1886–January 6, 1887. The application was on motion referred to Curators with instructions to report thereon at the next meeting of the Society.

Accessions to the Library were received from the Department of Mines, Melbourne; Comité Géologique, Académie Impériale des Sciences, St. Petersburg; Imperial Society of Friends of Natural Sciences, Anthropology and Ethnology, Société Impériale des Naturalistes, Moscow; Society of Naturalists of New Russia, Odessa; Mr. Emile Schwœrer, Colmar, Alsace; Foreign Office at the Hague; R. Istituto di Studi Supériori, Biblioteca Nazionale Centrale V. E., Firenze; R. Accademia dei Lincei, Rome; Ecole des Mines, Société de L'Enseignement Superieur, Muséum d'Histoire Naturelle, Paris; Sociedade de Geographia de Lisboa; R. Meteorological Society, Zoölogical Society, "Nature," Mr. John Hampden, London; Essex Institute, Salem; Rhode Island Historical Society, Providence; Professor John S. Newberry, New York; The Buffalo Library; Engineers' Club, Franklin Institute, Henry Phillips, Jr., Philadelphia; Bureau of Education, The Public Opinion Co., Washington; University of California, Berkeley; Observatorio Astronomico Nacional de Tacubaya, Mexico; Imperial Observatorio do Rio de Janeiro.

A photograph of Mr. Carlier, of Paris, was received for the Society's Album.

Dr. Harrison Allen read, by appointment, an obituary notice of the late Dr. Albert H. Smith. The decease of Charles Francis Adams (Boston, Nov. 21, æt. 80) was announced, and after remarks by Messrs. Dudley and McKean on the services rendered to the United States by him during the Civil War, the President was authorized, on motion, to appoint a proper person to prepare the usual obituary notice.

The Committee on Publication reported that as the paper offered for the Transactions, November 5, by Professor Cope, had already appeared in a magazine for November its publication by the Society was not desirable, and that it should be returned to the writer. Which, on motion, was so ordered.

Nominations 1113–1150 were read.

The proceedings of the Officers and Council, of which the reading was postponed at the last meeting, were submitted.

The Treasurer's Report was presented.

And the Society was adjourned by the President.

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Verbal Communications.

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VOL. XXIII. JANUARY, 1886. NO. 121.

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BY

McCALLA & STAVELY,

NOS. 237-9 DOCK STREET, PHILADELPHIA.

EXTRACT FROM THE BY-LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with

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Extract from the By-Laws.

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