PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1877.

PUBLICATION COMMITTEE.

JOSEPH LEIDY, M.D., W. S. W. RUSCHENBERGER, M.D.,
WM. S. VAUX, GEO. H. HORN, M.D.,
J. H. REDFIELD.

EDITOR: EDWARD J. NOLAN, M.D.

PHILADELPHIA:
ACADEMY OF NATURAL SCIENCES,
S. W. Corner Nineteenth and Race Streets.
1877.

Academy of Natural Sciences of Philadelphia,
February 15, 1878.

I hereby certify that printed copies of the Proceedings for 1877 have been presented at the meetings of the Academy, as follows:—

Pages 9 to 24	March	13, 1877.
" 25 to 120	April	17, 1877.
" 121 to 136	May	22, 1877.
" 137 to 168	June	26, 1877.
" 169 to 184	July	10, 1877.
" 185 to 216	"	17, 1877.
" 217 to 264	"	24, 1877.
" 265 to 280	October	9, 1877.
" 281 to 296	January	1, 1878.
" 297 to 312	"	15, 1878.
" 313 to 360	February	12, 1878.

EDWARD J. NOLAN,
Recording Secretary.

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LIST OF CONTRIBUTORS,

With reference to the several articles contributed by each.

For Verbal Communications see General Index.

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JANUARY 2, 1877.

Mr. VAUX, Vice-President, in the chair.

Thirty members present.

The deaths of Dr. Jos. Carson and of Mr. F. B. Meek were announced.

The Academy unanimously voted a presentation of thanks to Wm. P. Jenks, Esq., for a portrait of Dr. W. S. W. Ruschenberger, painted in oil by Mr. Wm. K. Hewitt.

JANUARY 9.

Mr. VAUX, Vice-President, in the chair.

Thirty-nine members present.

The resignation of C. H. Howell as a member was accepted.

The following papers were presented for publication:—

"Unionidæ of Ohio and Alabama." By James Lewis, M.D.

"On Certain Generic Names proposed by Zittel, Stoliczka, and Zekeli." By T. A. Conrad.

On Astrophyllite, Arfvedsonite, and Zircon.—Dr. GEO. AUG. KŒNIG spoke of the co-occurrence of *astrophyllite*, *arfvedsonite* and *zircon* in El Paso Co., Colorado. The minerals are imbedded in quartz, which is massive and of a gray color, occasionally stained with iron ochre, especially in specimens taken from the surfaee. Astrophyllite was only known to occur in the syenite of Brevig in Norway, being associated there likewise with arfvedsonite and zircon. This assoeiation of the three species on points of the globe nearly opposite to each other is very interesting. The matrix, however, is flesh-colored orthoclase at Brevig and gray quartz in Colorado.

1. *Astrophyllite.*—In elongated prismatic forms, with a nearly rectangular cross-section, no terminal faces developed. Measurements made on a crystal of a more complicated form lead to a *monosymmetric* interpretation, while Scheerer determined the astrophyllite from Brevig to be orthorhombic. Cleavage perfect, parallel to the basal plane, producing micaceous habitus. Hardness = 3. Specific gravity at 15° C. = 3.375.

B. B. fuses easily to a black globule. With microcosmic salt gives reactions of silica, iron, manganese, titanium. Decomposed by hydrochloric and sulphuric acids.

Composition—

SiO_2	= 34.68
TiO_2	= 13.58
ZrO_2	= 2.20
Fe_2O_3	= 6.56
Al_2O_3	= 0.70
FeO	= 26.10
MnO	= 3.48
K_2O	= 5.01
Na_2O	= 2.51
MgO	= 0.30
CuO	= 0.42
TaO_2	= 0.80
H_2O	= 3.54
	99.91

This leads to the atomistic symbol—

$$\left.\begin{matrix} \overset{IV}{Si}_{13} & \overset{IV}{Ti}_4 & \\ \overset{II}{Fe}_8 & \overset{VI}{Fe} & \overset{II}{Mn} \\ K_2 & Na_2 & H_8 \end{matrix}\right\} \overset{II}{O}_{52}$$

Note.—Care was taken to eliminate mechanically admixed zircon. The separation of aluminium, titanium, zirconium, was effected by a new colorimetric method (Proceedings American Phil. Soc. Jan. 19, 1876), devised by the speaker.

2. *Arfvedsonite.*—Elongated prisms of the form $\infty P. \infty P\infty$. Angle of prism 124° 30′, of cleavage pieces 124° 5′. Color raven black, lustre submetallic, streak lavender blue, H = 6. Specific gravity at 12° C. = 3.433.

B. B. fuses easily. Reaction with the fluxes of silica, iron, manganese, and titanium with difficulty. Not decomposed by acids at ordinary pressure, and very slowly in sealed tube. Composition—

SiO_2	= 49.83
TiO_2	= 1.43
ZrO_2	= 0.75
Al_2O_3	= trace
Fe_2O_3	= 15.88
FeO	= 17.95
MnO	= 1.75
Na_2O } LiO }	= 8.33
K_2O	= 1.44
MgO	= 0.41
Ignition	= 0.20
	97.97

Atomistic symbol—

$$\left.\begin{matrix} & \overset{IV}{Si_8} \\ \overset{II}{Fe_3} & \overset{VI}{Fe}\ Na_3 \end{matrix}\right\} \overset{II}{O_{24}}$$

3. *Zircon* occurs in tetragonal forms of the combination P. ∞P. 0 P. Basal plane noticed on all crystals. Color, iron-gray; after treating with hydrochloric acid, of a yellowish flesh-color.

Specific gravity at 12° C. = 4.538.

Composition—

SiO_2	= 29.70
ZrO_2	= 60.98
Fe_2O_3	= 9.20
MgO	= 0.30
	100.18

The material for analysis was boiled as powder with hydrochloric acid, until no iron was dissolved. This zircon is, therefore, characterized by an exceptionally high percentage of iron.

The material for examination was furnished by Dr. Foote.

January 16.

The President, Dr. Ruschenberger, in the chair.

Forty-one members present.

Fertilization of Browallia elata.—The following communication from Dr. Asa Gray was read at his request by Mr. Thos. Meehan:—

In a paper communicated to the Academy of Natural Sciences, and printed in the "Proceedings" under date of Feb. 8, 1876, Mr. Meehan, upon exhibiting specimens of *Browallia elata* which had flowered in a green house, and set seed in winter, added the following among other remarks:—

"Not only was it a fact that this plant, with such an attractive blue color, perfected every seed-vessel without insect aid, but the *structure of the flower was such that should any insect endeavor to collect the pollen it would only aid, if that were necessary, in self-fertilization.* The stigma was nearly the length of the corolla-tube; and the anthers, a trifle longer, were arranged closely around it. Two of these were inverted just over the stigma, their backs being densely bearded, and appearing to the naked eye like petaloid processes, effectually closing the mouth of the throat. *No insect could thrust its proboscis into the tube except through this dense bearded mass, and if it had foreign pollen, would be thoroughly cleaned by the beard; but the very act of penetration would thrust these anthers forward on to the pistil, and thus aid in rupturing the pollen-sacs, and of course the self-fertilization of the flower.*"

I have italicized the passages which attracted my attention when I first read this paper in August, and which led me to make some observations for myself. In consequence, when I afterward read a reproduction of this statement in *Nature*, I was constrained to address a note to that paper, in which I expressed the opinion that, as to this matter, Mr. Meehan's observation was incomplete and his inference hasty, or some word to that effect. I have not the printed note before me. In it I stated, simply and substantially, that the throat of the corolla was found by me to be pervious by an orifice or chink directly in front of each of these bearded anthers; that a hog's bristle thrust down these passages, after being slightly moistened, had the inserted portion well supplied with adherent pollen when withdrawn, and that this could be reinserted into another corolla (removed from the plant) without being cleaned off by the beard. I also explained that the structure and collocation of the stigma and upper anthers were such that, in my opinion, the action of an insect would not tend to thrust any pollen of the former upon the actual stigma. I added that the flowers in question were freely visited by Hymenoptera and Lepidoptera of various sorts.

In *Nature* for Dec. 14, I find a rejoinder from Mr. Meehan, which makes (so far as I am concerned) the following points:—

1. Prof. Gray should have noticed that the original observation was made upon a green-house plant in winter, and should have understood the phrase, "*Browallia* is not visited by insects, yet seeds abundantly," to refer only to this condition.

2. "That even though an insect were as careful in finding the chink as Dr. Gray was in his manipulations with the hog's bristle, the obstruction of the mouth in the way it is cannot surely be claimed as an arrangement in favor of cross-fertilization."

We need not trouble *Nature* any further with this little discussion, and any amends that may be due to Mr. Meehan may be made here; wherefore let me say that I never presumed to question Mr. Meehan's *fact*, viz., that his plant of *Browallia* seeded in winter without insect aid, but only his *inference*, viz., that *Browallia* flowers, on account of their structure, could not or would not in the natural course of things be cross-fertilized by insects. This being understood, it will be apparent:—

1. That I had no occasion to refer to the season in which Mr. Meehan's observation was made and his paper read. That is relevant to the matter I had in hand only as confirming my remark that the observation was incomplete and inference hasty, as the ensuing summer showed.

2. The "obstruction" referred to "surely" was not "claimed as an arrangement in favor of cross-fertilization." The point made was that no obstruction to cross-fertilization exists.

Mr. Thomas Meehan said he was quite willing to grant the correctness of Dr. Gray's point that it was not absolutely impossible that *Browallia* should be once in a while fertilized by an insect in the way suggested. The great object he had had in view in all his papers and remarks on this subject, was anything but to argue against the possibilities of these occasional acts. At the outset of his course on this question, he found Mr. Darwin saying that clover would not fertilize without the aid of the humble bee; and we know the row of consequences built on this supposed fact, that if cats no longer existed, clover would disappear from England. Dr. Gray, himself, in playful earnestness, had suggested as a further disaster, that if there were no old maids to care for the cats, it would be bad for the clover. He had found the whole subject formulated in this wise: all plants with inconspicuous, odorless flowers, are fertilized by the wind; all flowers with color, fragrance, or sweet secretions, are fertilized by insects. Sir John Lubbock expressly declares that "to the unconscious agency of insects, plants owe their color and fragrance." Professor Gray, himself, before the Mount Holyoke Seminary, the year before last, is reported in the Scientific Farmer to have said, "Nature abhors in-and-in breeding; and, like a wise teacher, shuns the practice." It is also on record in the Proceedings, that when he had shown that many composites, *Staphylea* and others, did fertilize themselves, Dr. Gray objected to the whole argument. His (Mr. M.'s) point had been, that Nature did not shun the practice of self-fertilization in flowers; and not by any means that cross-fertilization by insect agency under no circumstances occurred. Professor Gray, in a recent paper, had modified these views. He there stated his position to be now, that plants abhor *perpetual* in-and-in breeding; that Nature says to the plant, "Get cross-fertilized if you can, but anyhow get fertilized;" and admits that cross-fertilization is the great exception to the rule. Of course, this destroys all the practical sequences, from old maids to fertile clover, for at that time it was thought clover had no choice but to wait the pleasure of the humble bee. There was now nothing left to him to object to, except the interpretation of these exceptional cases of cross-fertilization. He really thought that "exceptional crossing," as a factor in the development of species, involved more difficulties than the "general" theory did; but that was a question for the future. For the present, he was willing to admit that if there was anything in the whole context of his *Browallia* communication indicating that it was impossible under any circumstances that an insect should cross-fertilize it, his friend, Dr. Gray, had the best of that argument.

On the Hudson River and Utica Slates of Pennsylvania.—Prof. PERSIFOR FRAZER, Jr., remarked that it always must be one of the principal objects of a geological survey to restrain people from investing their capital where there is a practical certitude that they will have no return. Probably till the end of our race the investment in pyrites for gold and quartz for diamonds will continue, in spite of the diffusion of knowledge. In Pennsylvania the most fatal delusion is found in the black slate beds of No. 3, (or the Hudson River Slates and Utica Slates, called also Matinal by Rogers). This is because these slates occur frequently at no great geographical distance from the true coal measures, because the slates are unusually black and really somewhat carbonaceous, and because their slickensides frequently impart to certain surfaces a lustre not unlike that of some Schuylkill County anthracite. Rogers (vol. i. p. 239), in speaking of these slates, says: "I regard the thin bed of brownish carbonaceous slate" (the equivalent of the Utica Slate of New York) . . . . "as probably representing the" (lower) "margin of the formation."

Again (Ibid. p. 260), in speaking of the Matinal Slates of the Kittatinny Valley near Dublin Gap, he says: "Some bands of the slate, particularly those lying adjacent to the limestone, are highly carbonaceous and of a dark color, somewhat resembling the slates of the coal measures. This analogy in their appearance, notwithstanding the conclusiveness of all geological evidence to the contrary, induces many persons not familiar with the geology of the country" (sic.) "to suppose that the formation may actually contain *coal*. For the last fifty years" (1858) "excavations have from time to time been made at various places in the valley, in the confident belief that coal will be discovered, and though in every instance unsuccessful, they are still occasionally renewed." The same work (p 472) reaffirms the same view with regard to the place in the series of this black belt.

On p. 480 Mr. Rogers says: "At Copeland's Mill" (Kishacoquillas Valley) "the lower beds of the slate are so black as to have seduced proprietors into an unavailing search for coal. It is the matinal black slate, and of course cannot indicate coal."

Nevertheless these attempts continue to succeed each other in spite of the advice of experts. Indeed the projector of such an enterprise frequently regards as impertinent intrusion the well-meant warning which might save him from pecuniary loss.

A recent instance of the effect of these delusions is to be found in a tunnel driven by Mr. Gosherd, of Franklin County, into the hard slates which form a terrace along the side of the North Mountain close by Franklin Furnace. Mr. Gosherd first became aware of the existence of "*a treasure*" on his property through a dream, in which he seemed to be standing in a certain field of his farm and at a point which he was afterwards able to find without difficulty. On awaking he told his dream to the members of his family, and lost no time in repairing to the spot indicated. As he says, "at the first stroke of the spade black dirt was turned up, and at a short distance below the surface, coal was found equal, in the opinion of a coal operator from Harrisburg, to the best Lykens Valley coal." It occurred to Mr. Gosherd that as the point of this discovery was on the sharply-sloping flank of the mountain, it would be advisable to drive a tunnel across the rocks from the base of the terrace. He has thus executed a very creditably-cut tunnel, some 330 feet long, partly by hired labor, but principally by his own, at a cost of about $1500. The heading of this tunnel was in the black stratum which was wrought by the first preliminary excavation. The rocks which were passed through were hard, not very fissile bands of one or more inches in thickness, except the last stratum, which was a band of pulverulent argillaceous matter inclosing a hard mass of slate.

Various specimens were selected and submitted to approximate analysis:—

A 1. A hard dark slate, much intersected by quartz veins, both large and small, from the heading of Gosherd's tunnel, half a mile N. E. of Franklin Furnace.

A 2. The same brayed in the iron mortar and panned to separate the finer quartz particles and concentrate the carbonaceous matter.

B. Black argillaceous slate or "horse" in the middle of the soft stratum in which Mr. Gosherd's tunnel heads.

D. Soft pulverulent stuff called "coal" by Mr. Gosherd, ten feet from heading of tunnel

The coarse powder was first heated three hours to 120° Cent. and weighed, then successively reheated to the same temperature till no loss of weight occurred. The covered crucibles were gradually raised to full redness and then kept for three minutes at a white heat, to ascertain the amount of volatile organic matter. The carbon was ascertained by difference after the calcination of the residue. The following is the result:—

	Per Cent. A 1.	A 2.	B.	D.
Hygroscopic moisture, .	0.05	0.55	2.33	1.58
Volatile organic matter,	5.76	8.89	4.40	3.99
Ash, ...	91.40 Brick-red.	62.52 Brick-red.	90.87 Light cream-pink.	90.35 Light cream-pink.
Carbon (by loss), .	2.79	28.04	2.40	4.08
Sulphur, . .	3.46	——	——	——
Metallic iron, .	7.84	——	——	——

Supposing all the sulphur united to the iron to form pyrites, we would have—

	Per Cent.
Iron pyrites, ...	6.49
Iron as free oxide and as basic constituent of ash, .	4.81

In the above results several things are worthy of remark. First, the amount of carbon which these slates contain is inconsiderable. Even when concentrated by pulverizing and panning, the amount of combustible matter does not reach one-third of the total weight. It may be added that much of this fixed carbon is in the form of graphite.

Another point is the comparatively large amount of volatile organic substances, which, in view of the last statement, is quite unexpected, for in those carbonaceous strata in which the carbon is chiefly graphite, the volatile organic substances are generally reduced nearly to zero.

The amount of hygroscopic moisture is low in all of the specimens, and in the case of A 1 is, of course, without signification, owing to the mode of preparation of the analysis.

Anthracite from "Third-Hill Mountain," West Virginia.—Prof. Persifor Frazer, Jr., stated that some specimens of coal from this locality had been subjected by him to proximate analysis two years ago. The locality was eighteen miles east of Berkeley Springs or Bath, West Virginia. At that time the exposures were few, shallow, and much washed in, and the specimens consequently not fair representatives of the coal. Since then, last summer, he obtained from Mr. Pendleton, of Bath, specimens of a much better coal collected by that gentleman from the same vicinity. There are some reasons for ascribing to this coal a horizon below the carboniferous series, and this lends to its constitution additional interest. The following is an analysis of it:—

	p. c.
Hygroscopic moisture	0.21
Volatile hydrocarbons	7.66
Ash (light gray)	5.35
Free carbon (by difference)	86.78
Sulphur (probably trace)	not determined
Iron (under 1 p. c.)	not determined

The lustre resembles that of some Schuylkill County anthracite.

JANUARY 23.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-eight members present.

JANUARY 30.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-one members present.

The resignation of F. W. J. Wylie as a member was read and accepted.

The following papers were presented for publication:—

"On Certain Excrementitious Deposits from the West." By H. W. Henshaw.

"The Valsei of the United States." By M. C. Cooke.

In conformity with Art. III, Chap. V, of the By-Laws, Jos. Willcox, Wm. S. Vaux, Rev. E. R. Beadle, Jos. Leidy, Chas. F. Parker, W. S. W. Ruschenberger, E. Goldsmith, Persifor Frazer, Jr., Wm. H. Dougherty, Theo. D. Rand, Clarence S. Bement, and Chas. C. Phillips were constituted the Mineralogical Section of the Academy of Natural Sciences of Philadelphia.

On Copper-bearing Rocks of the Mesozoic Formation.—Prof. PERSIFOR FRAZER, Jr., remarked that the existence of copper in the shales and sandstones of the Mesozoic era has long been known, and many of the copper industries derive their material from such sources. The whole of the band of micaceous and specular iron ores which lies along the northwestern border of the New Red Sandstone is saturated with copper salts, and cupriferous strata are frequently found among the rocks of the central portions of the basin.

One of the latter recently discovered lies about five miles east of the town of Gettysburg, at the hamlet of Bonnaughton or "Bunnytown," as it is pronounced.

About 300 yards south of Mr. Liver's house, in a field, is an excavation made in Sept. 1876. While cutting off the corn, numbers of outcrop specimens of malachite were observed strewed over the surface of the ground. The rocks here are very much broken. The most homogeneous of them consist of a red sandstone, which is hard and compact, regarded in large blocks, but the latter are intersected by innumerable cleavage planes.

The general dip is about N.W. 30°. The cupriferous strata are about one foot thick, while the clay and rocks both above and below this are much impregnated with copper. Some of the accompanying rock appears to be calcareous, with small prisms of perfectly transparent quartz.

In the sandstone are pits showing the section of cubes of pyrite more or less hydroxidized.

The strike of these cupriferous measures seems to extend at least a mile on either side.

The portion which might be called a bed vein of copper ore was, as is said, about 1 foot thick. That is to say, that the decayed argillaceous material composing this foot was sufficiently green to render it worthy of being called an ore.

This seam was selected and averaged, and submitted to three determinations of the contained copper.

The following is the record :—

	p. c.
Insoluble silicious residue	79.73
Sesquioxide of iron present (over 5 p. c.)	not determined
Copper by electrolysis	2.65

While on this subject, it may not be inappropriate to say one word as to the readiest methods of determining copper.

Of the various methods of *indirect* determination, but one was selected (viz., that of Rose) for comparison with the results obtained by precipitation of metallic copper on a tared platinum dish.

The results follow :—

		p. c.	mean.
Cu	by Rose's method[1]	2.55	2.53
	by Pfaf's method[2]	2.40	
	by Luckow's method[3]	2.65	

The difficulties experienced in the practical use of the second of these methods, when a large number of analyses are to be undertaken in a limited time, are very great. The solution of the zinc in a liquor strongly saturated with salts is slow and irregular; towards the close of the operation, small pieces of

[1] Precipitating in acid solution by sulphydric acid, and igniting with excess of sulphur.

[2] Precipitating in acid solution by zinc. There was a slight loss of copper in this analysis.

[3] Precipitating by the battery in acid solution.

undissolved zinc are likely to be commingled with the granular copper, and not to be separable therefrom; if the solution be kept in contact with the deposited copper until the analyst is assured that the zinc is all dissolved, part of the copper is sure to go into solution.

For these reasons, one of the worst processes for rapid copper determination is the production of metallic copper by means of reduction by zinc. A modification, or rather a suite, to this process is that by Steinbeck, which, with another, took the prize offered by the Mansfield Copper Works.

It consists in dissolving the copper precipitated by zinc in nitric acid, and titring with cyanide of potassium.

For practical purposes, and whenever a battery is to be had, the electrolytic method seems more rapid and exact.

To recapitulate:—

	1st.	2d.
Insoluble residue	79.73	78.11
Iron sesquioxide	over 5 p. c.	

Metallic copper (Rose's), 2.55; (Pfaf's), 2.40; (Luckow's), 2.65.

Contamination of Drinking Water.—In connection with the contamination of potable water and the manner in which such contamination may manifest itself, Prof. PERSIFOR FRAZER, Jr., presented the following partial examination of the well-water used at the parsonage of St. James the Less. The priest of this church, Rev. Robert Ritchie, having noticed that the water from the well was at times fetid and nauseating, brought about three gallons for inspection. The water was collected, according to advice, in a demijohn previously well washed out with the same water. It was collected early in the morning of a day in April, 1874. It was fairly clear. Upon examination it yielded:—

	Grammes per litre.	Grains per gallon.
Mechanically suspended matter	0.006	0.42
Precipitate after evaporation to one-third of its original volume	0.062	4.34
Total dissolved matter dried at 120° Cent., 11.344 grammes[1]	0.997	69.93
Volatilized at a red heat	0.024	1.68

The water emitted an offensive odor after standing in a warm place twenty-four hours. It assumed a yellow tint and gave an acid reaction when reduced by evaporation to one-half its volume, shortly after which a bulky yellow precipitate was thrown down. When reduced to 30 or 40 c.c. bunches of acicular white crystals began to be deposited. On ignition, an intensely foul odor was given off. Residue chiefly iron sesquioxide.

[1] The determination of the total dissolved matter here given must be regarded as somewhat in excess of the amount actually present in the water.

The well is situated about one hundred yards from the grave-yard of the church, and between it and the river. Between the burial-ground and the river the ground slopes gradually. Since the fall of 1874, the water has been purer, but many cases of diphtheria have occurred at various times in the rectory.

Dr. Leidy remarked that his attention had been repeatedly directed to an impurity in our drinking-water differing from that usually mentioned. It often conspicuously appeared in the other-wise clear water when first drawn from the hydrant into a white basin or a tumbler, as diffused brownish or yellowish flakes. Though comparatively light, they soon settle to the bottom of the vessel. When first noticed he supposed that they were fragments of decaying woody fibres. On microscopic examination, he thought that he had recognized them to be largely composed of the cast-ings of worms mingled with remains of confervæ and animalcules. The source of these he suspected to be the soft mud at the bottom of our reservoirs. This mud rapidly accumulates in the latter from the sediment of the Schuylkill water, and is a favorable nidus for the development of worms, various animalcules, and the growth of algous plants. He had often observed such mud colored bright red from the multitude of worms partially buried in it with the tail ends protruded and vibrating. The mucus secretions of the worms mingled with mud particles form tubes, and it is these which he thought he had recognized as forming most of the flakes in the drinking-water. The more frequent cleansing of the reservoirs from the accumulating sedimentary mud, Dr. L. thought, would promote the purity and healthfulness of the water.

On Eozoon.—Dr. Leidy directed attention to the large and characteristic specimen of *Eozoon Canadense*, presented this evening by the Geological Survey of Canada.

For the information of those not familiar with the object, Dr. L. stated that it was regarded by many of the best zoologists as of animal origin, and as such had excited much interest from its being the oldest known fossil. It was found in the Laurentian rocks of Canada, and is considered to be the remains of a coral-like Rhizopod. Dr. L. was himself not fully convinced of its animal nature.

On the Diaphragm.—Dr. Leidy remarked that the elevation of the dome of the human diaphragm was usually as high as the fifth rib, but that in the subject, used during his present anatomical course at the University, a well-formed muscular male, the dia-phragm on the right side was elevated to a level with the anterior extremity of the third rib.

The following were elected members: C. W. Cross, J. T. Montgomery, Jos. M. Stoddart, Dr. H. Ernest Goodman, Dr. Thomas Biddle, Jr., Wm. G. Audenried, Dr. Jos. Thomas, Dr. I. S. Moyer, and Clarence C. De Lannoy.

Dr. J. M. Da Silva Coutinho, of Rio Janeiro, Dr. Wm. A. Mintzer, U. S. N., Prof. L. Nicholsky, of St. Petersburg, Gen. A. Gadolin, of St. Petersburg, Nikolai v. Kokscharow, of St. Petersburg, and Prof. L. de Koninck, of Bruxelles, were elected Correspondents.

The following papers were ordered to be printed:—

ON CERTAIN GENERIC NAMES PROPOSED BY ZITTEL, STOLICZKA, AND ZEKELI.

BY T. A. CONRAD.

I propose the following rectification of generic names published by Zittel in his description of Gosau-Fossils:—

Table	1.	Fig.	1.	Diploconcha, Con.	= Fistulana tubulosa, Zit.
"	"	"	3.	Leptosolen, Con.	= Siliqua Petersi, Reus.
"	"	"	5.	Liopistha, Meek,	= Panopæa frequens, Zit.
"	2.	"	3.	Liopistha,	= Pholadomya granulosa, Z.
"	"	"	10.	Baroda, Stolic.	= Tapes eximia, Zit.
"	3.	"	2.	Baroda,	= Tapes Martiniana, Math.
"	"	"	3.	Baroda,	= Tapes fragilis.
"	"	"	7.	Cyprimeria, Con.	= Circe discus, Math.
"	4.	"	1.	Cyprimeria,	= Circe concentrica, Zit.
"	"	"	8.	Venilia, Morton,	= Cypricardia testacea, Zit.
"	7.	"	7.	Vetericardia, Con.	= Cardita granigera, Gümp.
"	10.	"	1.	Trigonoarca, Con.	= Cucullæa Austriaca, Zit.
"	"	"	2.	Trigonoarca,	= Cucullæa crossetesta, Zit.
"	"	"	3.	Idonearca,	= Cucullæa Chiemiensis, Gümp.
"	"	"	4.	Trigonoarca,	= Cucullæa gosauviensis, Zit.
"	"	"	5.	Trigonoarca,	= Cucullæa bifasculata, Zit.
"	"	"	6.	Trigonoarca,	= Cucullæa semisulcata, Math.
"	"	"	7.	Trigonoarca,	= Arca Swabeani, Zit.

After an examination of Stoliczka's "Palæontology of Southern India," I would suggest the following rectification of generic names contained therein:—

	Vol. II.			
Plate	II.	2–4.	Anchura, Con.	= Aporrhais securifera, Forbes.
"	"	5–8.	Anchura,	= Alaria Parkinsoni, Mant.
"	"	9–10.	Anchura,	= Alaria papilionacea, Goldf.
"	"	11–13.	Anchura,	= Alaria tegulata, Stol.
"	"	14–15.	Anchura,	= Alaria glandina, Stol.
"	"	16–17.	Anchura,	= Alaria acicularis, Stol.
"	VIII.	4–7.	Ptychoris, Gabb,	= Athleta purpuriformis, Forbes.
"	"	8.	Ptychoris,	= Athleta scrobiculata, Stol.
"	XII.	2.	Pyropsis, Con.	= Rapa Andoorensis, Stol.
"	"	5–8.	Pyropsis,	= Tudicla eximia, Stol.
"	"	10–11.	Pyrifusus, Con.	= Rapa nodifera, Stol.
"	"	12–16.	Pyropsis,	= Rapa cancellata, Sow.
"	XIII.	1–4.	Pyropsis,	= Rapa cancellata, Sow.
"	"	5.	Pyropsis,	= Rapa corallina, Stol.

Vol. III.

Plate	I.	12–13.	Leptosolen, Con.	= Siliqua limata, Stol.
"	II.	8-9.	Liopistha,	= Poromya lata, Forbes.
"	"	10–11.	Liopistha,	= Pholadomya caudata, Röm.
"	"	8.	Liopistha,	= Poromya globulosa, Forbes.
"	III.	2–4.	Liopistha, Meek,	= Poromya superba, Stol.
"	IV.	3.	Legumen, Con.	= Tagelus Albertinus, d'Orb.
"	VI.	1-5.	Cyclothyris, Con.	= Cyprimeria Oldhamiana, Stol.
"	"	17-19.	Aphrodina, Con.	= Cytherea Garudana, Stol.
"	VII.	7-9.	Aphrodina,	= Cytherea (Callista) laciniata, Stol.
"	"	10-17.	Aphrodina,	= Cytherea lascula, Stol.
"	"	18–20.	Aphrodina,	= Cyth. (Callista) minutula, Stol.
"	"	21-23.	Aphrodina,	= Cyth. (Callista) vagrans, Stol.
"	"	30-31.	Aphrodina,	= Cyth. (Callista) discoidalis, Stol.

VENIELLA, Stol.

As Stoliczka has without sufficient reason given this name in preference to that of *Venilia*, Morton, and as his first reference is to that of another genus, it may stand as the type of *Veniella*.

Plate	VIII.	4–9.	Veniella (Venilicardia) obtruncata, Stol.	
"	IX.	1.	Venilia, Morton.	=Cyprina cristata, Stol.
"	"	2–8.	Venilia,	=Cyprina Forbesiana, Stol.
"	X.	1–2.	Venilia,	=Cyprina (Cicatrea) cordialis, Stol.
"	"	15–21.	Cretocardia, Con.	=Cardita Jaquenoti, d'Orb.
"	XVI.	16.	Liopistha, Meek,	=Poromya globulosa, Forbes.
"	"	17.	Liopistha,	=Poromya lata, Forbes.
"	XVII.	1–2.	?	Cyprimeria obesa, d'Orb.
"	XVIII.	6-11.	Idonearca, Con.	=Macrodon (Grammatodon) Japeticum, Forbes.
"	XXIV.	2.	Inoperna, Con.	=Modiola flagellifera, Forbes.

Regarding the generic names in Dr. Zekeli's paper on the Gasteropoda of the Gosau strata, I would propose the following:—

Plate	XII.	4.	Anchura Con.	= Rostellaria calcarata, Sow.
"	XIII.	1.	Anchura,	= Rostellaria Partschi, Zk.
"	XIV.	5.	Rostellites, Con.	= Voluta prolonga, Zk.

NOTES ON SHELLS.

BY T. A. CONRAD.

CRYPTODON, Con.

C. Nuttallii, Con.

Lutraria maxima, Midd.
Schizothærus Nuttallii, Con.
Tresus maximus, Gray.

This shell, described in 1837, should retain the generic name of *Cryptodon*, as Gray has published it, because the *Cryptodon* of Turton, 1822, was superseded by *Thyasira*, Leach, 1818. The latter genus was established by the quotation of Lamarck of *Thyasira* under the head of *Tellina flexuosa*, the type of *Cryptodon*, Turton. Gray afterwards names the *Lutraria maxima* of Middendorf *Tresus;* but Carpenter and others unite the latter with *Cryptodon Nuttallii* by means of great numbers of specimens of both varieties. The synonymy will therefore be as above.

GLYCIMERIS, Klein.

Panopæa, Menard de la Groye, is a synonym of this genus, as stated by Adams, but some conchologists have supposed that Klein's figure represented *Cyrtodaria*, Daudin. The figure is larger than *Cyrtodaria*, of the *Glycimeris* outline, and especially the habitat, according to Bonani in "Iberico mari," is not that of the arctic *Cyrtodaria*. The second species of Klein is *Chama glycimeris*, Aldrovandi, "ex mari Hispanico" (*Panopæa Aldrovandi*, *Lam.*).

Panomya, Gray, is the generic name for *Panopœa*.

CYMBOPHORA, Gabb.

This genus appears to characterize the upper Cretaceous strata in California, New Jersey, and North Carolina, leaving no successor in the Eocene. I had supposed it differed in some respects from *Veleda*, Conrad, but I am now convinced that it is essentially the same genus. I may add to Gabb's description that the palleal line has a small rounded sinus.

Cymbophora lintea, Conrad.

Veleda lintea, Conrad.

SCAMBULA, Conrad.

Mr. Gabb has referred this singular genus, of the family *Crassatellidæ*, to his *Anthonya*, in which opinion I do not agree. *Anthonya* is a bent shell, the other is not; while the former has no lateral teeth, the other has two long linear lateral teeth.

UNIONIDÆ OF OHIO AND ALABAMA.

BY JAMES LEWIS, M.D.

In the Ohio River and its tributaries are found a very considerable number of species of Unionidæ, a large proportion of which are regarded as types by means of which similar shells of other regions are identified. In Central Alabama occur about thirty species of Unionidæ that are identical with or equivalent to a similar number of species of the Ohio drainage. Possibly an exhaustive study of the species of Tennessee would increase this list to forty or more species. The occurrence of identical and equivalent species in the two systems of drainage suggests the probability that a careful scrutiny of some of the *equivalent* species may afford some assistance in simplifying the study of these things by indicating synonymy hitherto unsuspected. The identical species of the two regions, so far as have been compiled, are embraced in the following list:—

Unio Anodontoides, Lea.
U. camptodon, Say.
U. cornutus, Barnes.
U. crassidens. Lam.
U. ebenus, Lea.
U. elegans, Lea.
U. metanever, Raf.
U. obliquus, Lam.
U. plenus, Lea.
U. pyramidatus, Lea.
U. rectus, Lam.
U. securis, Lea.
U. tuberculatus, Barnes.
Margaritana complanata, Barnes.

Of the shells common to the Ohio and Alabama drainage it may be unnecessary to speak at length of more than one species, *U. crassidens*, Lam., which may be considered the type of a somewhat numerous group of species of shells of solid structure, dark epidermis, dark purple nacre, and having folds more or less strongly indicated on the posterior slope. The following are some of the more prominent members of the group:—

U. pliciferus, Lea. Mexico.
U. incrassatus, Lea. Chattahoochee River, Ga.
U. fraternus, Lea. Chattahoochee River, Ga.
U. Anthonyi, Lea. Florida.
U. Monroensis, Lea. Lake Monroe, Florida.
U. Forbesianus, Lea. Savannah River, Ga.
etc. etc. etc.

The distribution of *crassidens* seems to extend to many of the more conspicuous rivers of the Gulf States west of Florida; to all the principal tributaries of the Ohio. Most of the other recognized species of this group are quite local, and do not occupy an extensive area. There are in this group indications that the future student of synonymy may find much to interest him.

Unio fraternus, Lea, appears to be simply a variety of *incrassatus*, as intermediate specimens of every degree seem to be abundant in the Chattahoochee River.

Among the most conspicuously *equivalent* species are the following:—

Ohio System.	Alabama System.
U. alatus, Lea.	U. purpuratus, Lamarck.
U. brevidens, Lea.	U. penitus, Con.
U. circulus, Lea.	U. castaneus, Lea.
U. clavus, Lamarck.	U. decisus, Lea.
	U. interventus, Lea.
	U. consanguineus, Lea.
	U. crebrivittatus, Lea.
	U. Chattanoogaënsis, Lea.
U. Conradianus, Lea.	U. acutissimus, Lea.
	U. parvulus, Lea.
	U. rubellinus, Lea.
U. Cooperianus, Lea.	U. asperatus, Lea.
U. gibbosus, Barnes.	U. subgibbosus, Lea.
	U. sublatus, Lea.
U. glans, Lea.	U. Cromwellii, Lea.
	U. corvunculus, Lea.
U. Kirtlandianus, Lea.	U. glandaceus, Lea.
	U. verus, Lea.
	U. instructus, Lea.
U. lachrymosus, Lea.	U. asper, Lea.
U. lævissimus, Lea.	U. inflatus, Lea.
U. lenoir, Lea.	U. metastriatus, Con.
	U. compactus, Lea.
U. luteolus, Lam.	U. stramineus, Con.
	U. Claibornensis, Lea.
	U. pallescens, Lea.
	U. Gouldii, Lea.
U. multiplicatus, Lea.	U. Boykinianus, Lea.
U. ovatus, Say.	U. excavatus, Lea.
U. parvus, Barnes.	U. granulatus, Lea.
	U. germanus, Lea.

Ohio System.	Alabama System.
U. phaseolus, Hildreth.	U. Greenii, Lea.
	U. flavescens, Lea.
	U. simplex, Lea.
	U. trinacrus, Lea.
	U. Foremanianus, Lea.
	U. Woodwardianus, Lea.[1]
U. plicatus, Barnes.	U. atro-costatus, Lea.
	U. Elliottii, Lea.
U. rubiginosus, Lea.	U. negatus, Lea.
U. undulatus, Barnes.	U. late-costatus, Lea.

On comparing the shells of the two regions indicated, it will be found generally true that the shells of the Ohio system, especially of that portion north of the Ohio River, attain a more luxuriant development and have a more brilliant epidermis, in which the rays are more numerous and more persistent, than in the shells of Alabama. There are also conspicuous differences in form, even in some of the species that are acknowledged to be identical in the two regions.

Some of the species that are here presented as equivalents of species of the Ohio system are represented by other analogous forms or equivalents in contiguous territory in the same latitude with Central Alabama.

Unio purpuratus extends westward into Texas and Arkansas. So far as known *U. penitus* has been reliably quoted only as found in the Alabama River, possibly also in the Coosa River, which is practically the same thing. *Unio decisus* is said to occur in Mississippi as well as in Alabama. *Unio consanguineus*, *U. crebrivittatus* and *U. Chattanoogaensis* are quoted as found in Georgia and Alabama. The equivalents of *U. Conradianus* have been quoted as occurring in several streams in Alabama. One, *U. rubellinus*, also occurs in Georgia. Another, not included in the above list (*U. penicillatus*), is found in the Chattahoochee River.

A shell of this type also occurs in the Black Warrior River, in which stream also occur other Uniones, whose geographical distribution is nearly the same. The range of the shells of this type in Alabama and Georgia reaches fully across the State of Alabama. Whether similar shells are also found in the rivers of Mississippi does not appear in any records that have been consulted

[1] Georgia.

in the preparation of this paper. Through correspondence and records the distribution of *U. Conradianus* is found to reach the northern portions of Georgia and Alabama, a considerable portion of East Tennessee, and a few streams in Kentucky.

Unio Cooperianus, Lea, besides finding an equivalent in *U. asperatus*, seems also to be represented elsewhere in the same or a similar manner by *U. pernodosus*. *U. asperatus* occurs in the Coosa, Alabama, and Black Warrior Rivers, in each of which streams it exhibits local peculiarities, more marked, perhaps, in the Black Warrior River than in the other two streams named.

Unio gibbosus, Barnes, is very fairly represented in the Coosa River by shells having white nacre to which Mr. C. M. Wheatley, of Phœnixville, Pa., gives the name *U. subgibbosus*, Lea. Whether this nomenclature has the sanction of Mr. Lea has not been stated. The typical *U. sublatus* is found in Uchee Creek, in southeastern Alabama, and also on Uchee Bar in the Chattahoochee River. Specimens identified by records and types have been found in Shoal Creek at Montevallo, Ala. The beaks of the Shoal Creek specimen have undulations such as are found on the perfect beaks of young *gibbosus*. In another stream near Montevallo (Buck Creek) is found another variety more slender in form, with darker epidermis and nacre, and more decided undulations in the beaks. In the series of specimens that have been examined as recorded above, the near relation of *U. sublatus* to *gibbosus* is very clearly shown. Of *Unio glans*, *Cromwellii* and *corvunculus* little can be said at this time for the reason that but few specimens from any one locality have been examined in this connection. The two species last named occur at Montevallo and in Northern Georgia.

The shells quoted as the equivalents of *U. Kirtlandianus* occur in the Cahawba River and in Buck Creek. Mr. Lea quotes only the Cahawba River. The shells are very much alike, the chief differences seeming to be due to age and local influences. They have much the same flattened form as *Kirtlandianus*, and the undulations on the beaks of the young shells are such as occur in *Kirtlandianus;* in outline there are conspicuous differences, though the Alabama shells agree very closely with each other in form character of the epidermis, muscular and palleal impressions, teeth and nacre.

In the relation of *U. asper* to *U. lachrymosus* differences may be observed which are, in many respects, such as might be pointed out in some of the species of Alabama identical with Ohio species. Many of the Alabama Uniones that are identical with Ohio species exhibit peculiarities that one readily and intuitively ascribes to local influences. Some of them are of smaller *size;* those species which in Ohio are beautifully and conspicuously marked with rays, in Alabama are found without rays, or the rays appear only on the umbo and are lost by erosion as the shell matures. In other instances the rays appear only as a periodical phenomenon, a row of distant spots down the posterior angle, disappearing before they reach the margin of the adult shell. This phenomenon is faintly hinted in many of the shells of Tennessee, and makes its full appearance only in Georgia, Alabama, and other States in the same latitude. Local influences must affect every species in a greater or less degree.

In quoting *asper* as an equivalent of *lachrymosus* the parallelism is suggested and verified by specimens of *lachrymosus* from the Illinois River. In these specimens the forms and colors, and other peculiarities of *asper*, are approximated in a very suggestive manner. The Illinois shells, however, though smaller than Ohio River shells, are larger than the typical *asper*. *U. asper* itself varies in different localities, and among its most prominently variable features are its *size* and roughness of surface. The relations of *asperrimus* to these shells seem to require that it be *mentioned* here. *Unio lævissimus* and *U. inflatus* are obviously nearly related. The chief and most conspicuous difference is in the relative diameter of the two shells.

Unio lenior, quoted by Mr. Lea as a Tennessee shell, seems to be represented in the Black Warrior River by the female of a small species belonging to the same group with *U. penitus*, Con. Shells recently received from the Black Warrior fully corroborate Mr. Lea's remark on *U. metastriatus*, Con., at the bottom of page 40 in his Synopsis of 1870, and make its identification complete.[1] This is the female of the same species to the male of which Mr. Lea gave the name *U. compactus*. It has been found in the Black Warrior, Cahawba, and other rivers and creeks in Alabama. Mr. Lea's type of *compactus* was from Georgia. The shells vary from each other in different streams, as is the universal habit of this class of mollusks.

[1] Conrad's *metastriatus* is a Black Warrior River shell.

Unio luteolus, Lam., does not seem to have been recorded as occurring in any stream much south of the latitude of the Ohio River.[1] It may possibly occur in some of the rivers of Kentucky; it is regarded as one of the most variable species occurring in water north of the Ohio. A lacustrine variety described by Mr. Anthony received the name *U. distans*, Anth.

Mr. Lea in his Synopsis (1870) has put *distans* in the synonymy of *radiatus*. The error was probably accidental. In southern latitudes the typical *luteolus* is unknown,[2] and in its place are found equivalents to which the following names and local references have been assigned:—

Unio obtusus, Lea. Chattahoochee River, Ga.
U. Claibornensis, Lea. Alabama River, Ala.
U. stramineus, Con. Various small streams in Alabama, etc.
U. pallescens, Lea. Black Warrior River, Ala.
U. Gouldii, Lea. Tuscaloosa, Ala.
U. approximus, Lea. Red River, La.
U. Reeveianus, Lea. Alexandria, La.
U. Hydianus, Lea. Bayou Teche, La.

In the progress of the investigations made in this behalf, specimens of this group of shells have been carefully compared, and a liberal interpretation has been given to records of species.

It has been suggested that *Unio callosus*, Lea, may find a fitting place in the above list of equivalents of *luteolus*. Of the value of *callosus* as a species, nothing is known beyond the record. The relations conjectured between *U. multiplicatus* and *U. Boykinianus* may not be confirmed. Between *U. multiplicatus* and *U. Eightsii* from Texas, relations are more apparent. *U. Boykinianus* has a somewhat wide distribution, being known to occur in the Alabama and Tombigbee Rivers as well as in the Chattahoochee. Possibly specimens may yet be found in Louisiana and Texas, to make its relation with *multiplicatus* more apparent.

Unio ovatus, Say, has probably more intimate relations with southern shells of the same type than the differences in names would imply. *U. excavatus*, Lea, found in Mississippi, Alabama, and Georgia, is represented in the Chattahoochee River by a diminutive form of the same type. The typical *ovatus* is a triangularly ovate shell, posteriorly truncate, with epidermis nearly devoid of

[1] *U. luteolus* is quoted from Texas, Obs. XI. 31.
[2] See Obs. XI. 31.

rays. A slightly more rotund form having rays and often pink nacre is Mr. Barnes's *U. ventricosus.* A form still more rotund is Mr. Lea's *U. occidens*, the male of which many intelligent collectors believe to be his *subovatus;* while *U. capax*, Green, is a very globose shell, scarcely marked with rays, and having the cardinal teeth very much compressed and directed obliquely forward, nearly parallel with the anterior dorsal margin of the shell. *Unio satur*, Lea, seems to be very nearly related to *capax*. *Unio Canadensis*, Lea, is apparently very nearly related to *occidens*. It differs by being quite as much compressed as *U. cariosus*, and nearly of the same form. The beaks are more coarsely undulate than in any other shell of this group. *U. Canadensis* is probably a northern equivalent of *occidens*. It occurs in Wisconsin as well as in the river St. Lawrence.

Uniones of the type of U. parvus, Barnes. There are on record nineteen species of Uniones which have relations to each other seeming to warrant their association in this group. In geographical distribution they extend over a large area north and south in the United States and both sides of the Mississippi River. The typical *parvus* is known to exhibit considerable diversity of appearance, form, and size. One variety of this species found in Indiana is so remarkable for its luxuriant development as to have acquired the familiar designation of "The big parvus of the Wabash." This variety differs also from the type by having the nacre sometimes tinted of a salmon color, the nacre of the type being white. Most of the species of this group also have white nacre. Two, however (possibly having more intimate relations with *U. glans*, Lea), have purple nacre. These are the species *Cromwellii* and *corvunculus*. Another species has been characterized as having salmon-colored nacre, namely, *U. Bealei*. Two other species, clearly members of this group, have been described as having "purplish" nacre; these are *granulatus* and *germanus*. The soft parts of three species have been found to exhibit, near the branchial opening, a black, spongy, fleshy mass that Mr. Lea calls "caruncle." This has been observed only in females of *parvus*, *granulatus*, and *paulus*. The differences of form usually observed in the sexes are less conspicuously observable in *parvus* (as found in the Ohio system of drainage) than in some of the other species of this group. *Unio pygmæus* is probably figured from a male specimen; the female may possibly have the form of *granulatus*. Shells from North Carolina distributed by Mr. C. M. Wheatley to his correspondents under the name of *granulatus* seem to warrant this conjecture.

That Mr. Lea regards some of the forms included in this group as being possibly synonyms of others, is indicated in his Synopsis, 1870, p. 49, foot note 3; and also in his remarks on species in "Observations" VIII., 41 and 43.

Two species, members of this group (*paulus* and *corvinus*), are credited to the Chattahoochee and Flint Rivers in Georgia. It should be remembered that these two streams are parts of one system of drainage, and that they have many species of Uniones in common.

The species *Johannis* and *flavidulus* may ultimately prove not to be legitimate members of this group, as they exhibit peculiarities of form in which they resemble each other, while they are in some respects quite different from all the other species with which they are here provisionally associated.

In compiling notes on a group of species, it might by some persons be thought excusable to suggest synonymy in those instances in which strong resemblances are apparent. But synonymy is not to be hastily inferred, as there are also *differences*, some of which are too important to be ignored. The most that can be done at present is to call attention to *groups of species* in a manner to encourage a thorough study of them. It seems also necessary that inquiries should be directed particularly to geographical distribution and the local association of species; also to the local influences that modify species, and to the extent to which a species may be susceptible to modifying influences. Synonymy and the hypothesis of evolution may contend for the result in the final treatment of this and other groups of Uniones. To aid the student who may desire to know what has been recorded of the group of species now under consideration, the following table of references is appended:—

Unio parvus, *Barnes*. Ohio, etc.[1] American Jour. Sci. 1823. Lea's Observations—(soft parts) VII. 39; (Embryos) VII. 39; (Miscellaneous References) I. 23, 26, 27, 34, 54, 97, 213; II. 55, 128; III. 52, 69, 70, 85; IV. 35; V. 18, 25; VI. 20; VIII. 44, 101; IX. 27; XI. 24, 31, 54; XII. 15, 19, 69, 71, 75, 87; XIII. 42.

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[1] Besides having been found in the Ohio River and its tributaries, Mr. Lea in his "Observations" quotes *parvus* as occurring in Mississippi (VII. 39) and in Texas (XI. 31).

U. granulatus, Lea. Big Prairie Creek, Ala. Jour. Acad. Nat. Sci. VI. 48; Obs. XI. 52: Synopsis, 1870, p. 49, foot note 2.

U. germanus, Lea. Coosa River, Ala. Jour. A. N. S. VI. 49; Obs. XI. 53; (soft parts) XI. 54; (Miscell. Ref.) XII. 45.

U. paulus, Lea. Chattahoochee River, Ga. Trans. Am. Phil. Soc. VIII. pl. 15, f. 29; Obs. III. 51; (soft parts) X. 38; (Embryo) VII. 40; X. 39; (Miscell. Ref.) VIII. 26; XII. 19, 71, 75.

U. corvinus Lea. Flint River, Ga. Jour. A. N. S. VI. 310; Obs. XII. 70.

U. Johannis, Lea. Connasauga River, Ga.; Etowah River, Ga.; Alabama River, Ala. Jour. A. N. S. IV. 343; Obs. VIII. 25.

U. flavidulus, Lea. Columbus, Miss. Jour. A. N. S. V. 97; Obs. VIII. 101.

U. Texasensis, Lea. DeWitt Co., Texas. Jour. A. N. S, IV. 359; Obs. VIII. 41.

U. Bairdianus, Lea. Devil's River, Texas. Jour. A. N. S. VI. 361; Obs. VIII. 43.

U. Bealei, Lea. Leon Co., Texas. Jour. A. N. S. V. 204; Obs. IX. 26.

U. corvunculus, Lea. Swamp Creek, Whitfield Co., Ga. Jour. A. N. S. VI. 315; Obs. XII. 74.

U. Cromwellii, Lea. Kiokee Creek, Dougherty Co., Ga. Jour. A. N. S. VI. 258; Obs. XII. 18.

U. marginis, Lea. Blue Springs, Dougherty Co., Ga. Jour. A. N. S. VI. 255; Obs. XII. 15.

U. apicinus, Lea. Othcalooga Creek, Gordon Co., Ga. Jour. A. N. S. IV. 76; Obs. VI. 76.

U. ineptus, Lea. Abbeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 12, Obs. V. 17; XI. 25.

U. pygmæus, Lea. Abeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 14; Obs. V. 18.

U. vesicularis, Lea. Lake Ocheechobee, Florida. Jour. A. N. S. VIII.; Obs. XIII. 41.

U. minor, Lea. Lakes Monroe and George, Florida. Trans. Am. Phil. Soc. IX. pl. 39, f. 3; Obs. IV. 34.

U. trossulus, Lea. Lake Monroe, Florida. Trans. Am. Phil. Soc. IX. pl. 40, f. 6; Obs. IV. 36.

Unio phaseolus, Hildreth, as found in northern waters, presents considerable diversity of form and appearance, but nowhere loses its identity north of the Ohio. In the Indian Territory varieties are found which exhibit peculiarities which might puzzle an inexperienced student. Something similar has been found in some of the streams near the southwestern part of Tennessee. In these divergent specimens the characteristic form of the species becomes somewhat obscured, and the rays are capillary. They diverge, indeed, from the typical *phaseolus* in the direction of its southern equivalents, as exhibited in the rivers of Alabama.

Unio velatus, Conrad, which Mr. Lea puts in the synonymy of *Foremanianus*, is quoted from "the river St. Fois." Mr. Conrad makes *U. simplex*, Lea, a synonym of *U. Greenii*, Con. Mr. Lea, in his Synopsis (1870), foot note 1, page 43, is evidently of the opinion that *U. Greenii* and *U. flavescens* are varieties of one species; an opinion that is clearly entitled to the highest consideration. It is possible that some future writer may be able to show that *all* the Alabama equivalents of *phaseolus* are entitled to be placed in the same category with *Greenii* and *flavescens*.

Unio plicatus, Barnes,[1] has a considerable number of southern equivalents, besides the two quoted for Alabama.

Southern equivalents of *U. plicatus*, Barnes, and original localities.

U. perplicatus, Con. Jackson, La.
U. atro-costatus, Lea. Claiborne, Ala.
U. Elliottii, Lea. Othcalooga Creek, Geo.
U. Lincecumii, Lea. Dallas Co., Texas, and Brazos River, Texas.
U. Brazosensis, Lea. Dallas Co., Texas.
U. pauciplicatus, Lea. Austin, Texas.

Unio hippopæus, Lea, Lake Erie, seems to be a northern lacustrine form, entitled to a place as a member of the group.

U. perplicatus, Con., has a somewhat extensive geographical distribution, and is a very well-known shell. *U. atro-costatus*, Lea, which is sometimes confounded with *perplicatus*, occurs in the Coosa River. Specimens referable to this species have been taken in the Cahawba.

U. Elliottii, Lea, seems to be represented in the Cahawba River by shells of the characteristic *form*, but of less size than the type. Shells that would be quite readily identified as *U. pauciplicatus*, Lea, occur in the Upper Black Warrior River.

Of *U. negatus*, Lea, not much needs to be remarked. The species is set apart from *rubiginosus*, Lea, out of regard to the peculiar undulations of the beaks. The beaks of different varieties of *rubiginosus* exhibit considerable diversity of appearance. The species is very widely distributed, and assumes a wonderful variety of forms.

U. undulatus, Barnes, is represented in Alabama by *U. latecostatus*, Lea, which is credited by Mr. Lea to Tuscaloosa. Shells

[1] Mr. Barnes was the first person to describe *U. plicatus*, though it had been on record, without description, earlier.

of this type occur in various streams in the vicinity of Selma and Montevallo. Cahawba River, Buck Creek, and Bogue Chitto Creek, are among those remembered. One adult specimen from Bogue Chitto Creek has the characteristic folds, but not the form of a smaller shell of this group (*U. Neislerii*, Lea) found in Flint River, Georgia. While the subject is yet fresh, it may not be out of place to inquire whether *U. undulatus* is other than an equivalent of *plicatus?* Do the two forms maintain their integrity? And is there any well-attested instance of their occurring in one locality together, each preserving its identity?

Referring back to *U. plicatus* and its equivalents, more especially to those in which the folds have become nearly or quite obsolete, it may not be out of place to remark that there is a specimen of unmistakable *plicatus* from the Ohio River, in the National Museum at Washington (Smithsonian Institution), *entirely destitute of folds.*

February 6.

The President, Dr. Ruschenberger, in the chair.

Thirty-seven members present.

February 13.

The President, Dr. Ruschenberger, in the chair.

Twenty-nine members present.

The following papers were presented for publication:—

"On the Fishes of Northern Indiana." By D. S. Jordan.

"On the Genera of North American Fishes" By D. S. Jordan and Charles H. Gilbert.

"List of Plants recently collected on Ship's Ballast in the Neighborhood of Philadelphia." By Isaac Burk.

In conformity with Art. III. Chap. V. of the By-laws, W. S. W. Ruschenberger, E. Goldsmith, Persifor Frazer, Jr., Jos. Leidy, Geo. A. Koenig, H. C. Humphrey, C. P. Krauth, Wm. H. Dougherty, R. S. Kenderdine, Henry C. Chapman, Alexander Willcocks, and W. G. Platt were constituted the Physics and Chemistry Section of the Academy of Natural Sciences of Philadelphia.

February 20.

The President, Dr. Ruschenberger, in the chair.

Forty-six members present.

The deaths of Mr. William Struthers, Dr. Elisha J. Lewis, and Dr. Wm. Byrd Page were announced.

Art. 8, Chap. I. of the By-laws was amended by adding the words, " Provided that no professor or assistant-professor in the Academy shall occupy the position of councillor—those who are ex-officio members of council excepted."

On the Giraffe.—Dr. H. C. Chapman remarked that, in a verbal communication on the post-mortem examination of a Giraffe, in the Proceedings for 1875, page 401, he described and figured the mode of origin of the great bloodvessels from the arch of the aorta. Having lately had the opportunity of dissecting another specimen which died in the Zoological Gardens of this city, he called attention to a slightly different disposition of these vessels. In this case an innominate gave off the right subclavian, right vertebral, the left subclavian, and left vertebral separately, and then terminated in the two common carotids. This arrangement also differs from that described by Prof. Owen, thus illustrating the variability in the origin of the bloodvessels in these animals. The recurrent laryngeal nerve was found as described by the eminent anatomist just mentioned, that is, the lower two-thirds almost completely atrophied, while the upper third came from the pneumogastric just below the superior laryngeal.

On the Habits of Quiscalus purpureus.—JOSEPH WILLCOX spoke of the custom of some crow blackbirds (*Quiscalus purpureus*) of eating fish, and their method of catching them through the intervention of another animal.

Last winter when on the shore of the St. John's River, near Lake Jessup, in Florida, he observed an unusual commotion among the crow blackbirds, which were congregating near the water, and anxiously looking into it. Soon a loud splash and noise were made in the vicinity by a large bass in making a charge upon his favorite food, the small fry, which, in their frantic efforts to escape, jumped out of the water, and many of them fell upon the land.

The blackbirds, which were evidently experts at the game, immediately pounced upon the small fish and swallowed them before they had time to hop back into the water. This performance was repeated many times.

On one occasion he examined the stomach of a bass in order to ascertain what it had taken for dinner. In it he found a rat that had evidently been imprisoned only a short time.

FEBRUARY 27.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-two members present.

Frank L. Scribner and Mrs. Mary Wagner were elected members.

Prof. Alphonse Favre of Geneva, Prof. Paul De Loriol of Geneva, Baron Ferdinand Freiherrn Von Richthofen of Berlin, Dr. Ferd. Von Hochstetter of Vienna, Prof. Edouard Desor of Neuchatel, Prof. Ludwig Rütimeyer of Basel, Prof. Valerien De Mueller of St. Petersburg, H. Trautschold of Moscow, and Lieut. A. W. Vodges, U. S. A., were elected correspondents.

The following papers were ordered to be printed:—

ON CERTAIN EXCREMENTITIOUS DEPOSITS FOUND IN THE WEST.

BY H. W. HENSHAW.

In the volume on Zoology, forming one of Lt. Wheeler's reports to the chief of engineers, several pages are devoted to a discussion of the origin of certain resinous-like substances, found in the crevices and on the walls of many of the rocky cañons of the far west, and the conclusion arrived at that these were the excrementitious products of a species of lizard, *Euphryne obesa*. This opinion chiefly resulted from the fact, ascertained by chemical analysis, that these products were composed wholly of vegetable matter; in view of which fact the original supposition that they had been made by bats was abandoned, the diet of these animals being, as is well known, insectivorous. Hence their origin was attributed to the herbivorous lizard above mentioned, the inaccessibility of many of the spots where the substance was noticed being deemed sufficient proof to negative the possibility of its originating from any other mammal. In a note following, however, it is stated that Prof. Cope believes this excrement to have been produced by some small mammals, as the *Neotoma*.

As a matter of interest to some, and inasmuch as I learn that the subject has again been brought to notice by the receipt of similar specimens by the Academy of Natural Sciences of Philadelphia, which were made the subject of remarks at one of the Society's meetings, I propose offering a few suggestions regarding these deposits, especially since I believe I can speak with some degree of positiveness as to their origin.

During the past season, while in the neighborhood of Lake Tahoe, Cal., I had an opportunity of examining deposits of an exactly similar character, and under circumstances which admit of no doubt in my own mind that their originators are the big-eared rats (*Neotoma*), as believed by Prof. Cope.

My attention was directed to these deposits by Mr. H. G. Parker, of Carson City, Nevada, who stated, that, when visiting Cave Rock, on the borders of Tahoe, some ten years before, he had found the depressions and crevices of the rock to be inhabited by large numbers of a rat, which he described as having large ears and a bushy tail. These characteristics point with certainty to a *Neotoma*, probably *N. cinerea*.

Incidentally he mentioned the "bituminous-like" deposits, the origin of which he was at a complete loss to understand, but which he finally satisfied himself were the product of these rats. Visiting the place myself, I found the deposits as described, but was unable to obtain any proof of the presence of the rats. It is possible they were still there, but, it being daytime, had hidden away in the remote crevices; or, as is quite probable, that their former haunt is now deserted. In either case the fact of their former occupation of the place in numbers, as attested by Mr. Parker, is sufficient.

The deposits here vary much in character, and, as any attempt to describe them in detail would occupy too much space, I will mention them briefly.

Specimens gathered from different parts of the rock showed all the differences between the hard, rounded, pill-like excrements, which no one could mistake the nature of, and the hardened bituminous substances, in mass, which bears no resemblance at all to excrement. The former is found on the flat shelves of rock, where, however, it is often partially dissolved by action of the urine, and perhaps too by water. In this form it is not readily recognizable, but a careful examination will show the rounded excrements through the whole mass, especially if it be broken.

In one case I found a crevice which had been filled up to the depth of at least two feet, with the stalks of weeds, small twigs, and even with a considerable amount of bird's feathers interspersed. This mass was evidently the accumulation of years, and had served as a nest. Throughout was a large amount of dry hard droppings, from which the urine had passed, and which was unmistakable. The urine charged with a certain amount of excrementitious matters had filtered through, to form below the singular deposits.

The "conglomerate masses" then are simply the excrement dissolved by urine, and carried from the original place of deposit in crevices or on shelves by water, or possibly by urine itself, if in sufficient quantity, and deposited on the faces of the walls, where it is perfectly true no animal without wings could reach; and in many cases, it might be added with equal truth, could not deposit the masses if they could reach the spot, inasmuch as they are sometimes found on the *roof* of a hollow rock where they trickle from above.

This will account for the presence of the substance many feet away from the place where first deposited.

Finally, all the regions in which these masses of excrement are found are known to be inhabited by the *Neotoma*. The chemical analysis of these deposits made by Dr. Loew is also entirely in accordance with such an origin, as the *Neotoma* is eminently a vegetarian. Some of the deposits are unquestionably of great age, and the particular localities may or may not be inhabited at the present time by the rats. In many cases they certainly are not, as the erosion and breaking away of masses of the cliffs has in many instances rendered inaccessible points which formerly permitted free access.

ON THE FISHES OF NORTHERN INDIANA.

BY DAVID S. JORDAN, M.D.

The material on which the present paper is based was collected, in the summer of 1875, in the streams and clear, deep lakes of the northern part of Indiana, by Mr. Caleb Cooke, in the interest of the Peabody Museum of Science, and Dr. G. M. Levette, in the interest of the Indiana Geological Survey.

The collection consists chiefly of small fishes—darters, sunfish, and minnows—with the young of some larger species. About 60 species in all are represented.

The following are the localities:—

I. Lakes without outlet to the sea.
- *a.* Clear Lake, La Porte Co.
- *b.* Pine Lake, La Porte Co.

II. Waters tributary to Lake Michigan through St. Joseph's River and its branch, the Elkhart.
- *a.* South Fork of the Elkhart, Rome City, Noble Co.
- *b.* Tamarack Run, two miles south of Rome City.
- *c.* Adams Lake, La Grange Co.
- *d.* Stream at Syracuse, in Kosciusko Co.

III. Waters tributary to Lake Erie through the Maumee River and its branch, "St. Joseph's of the Maumee."
- *a.* Henderson Lake and Creek, Kendallville, Noble Co.
- *b.* Sawyer Creek, outlet of Long Lake, Kendallville.
- *c.* Outlet of Bixel's Lake, Kendallville.

IV. Waters tributary to the Illinois River through Kankakee River.
- *a.* Mill-pond and Creek, Union Mills, La Porte Co.

V. Waters tributary to the Upper Wabash through Tippecanoe River.
- *a.* Lake Manitou, Rochester, Fulton Co.
- *b.* Centre Lake, Warsaw, Kosciusko Co.
- *c.* Lake Tippecanoe, Kosciusko Co.

VI. The Lower Wabash (Coll. F. W. Putnam, 1871).
- *a.* Wabash River, Hutsonville, Crawford Co., Illinois.
- *b.* Wabash River, Merom, Sullivan Co., Ind.
- *c.* Turman's Creek, Sullivan Co.
- *d.* A few specimens in my own collections from Terre Haute, Vigo Co.

For purposes of comparison I add:—

VII. White River and its tributaries—Fall Creek, Eagle Creek, Pleasant Run, and Pogue's Run—in the neighborhood of Indianapolis, in Marion Co.; and Hurricane Creek, in Johnson Co. (Collections of Prof. H. E. Copeland and myself in 1874–77).

It will be noticed that, excepting Nos. VI. and VII., the above-mentioned localities are near together, all within a radius of 50 miles, but on five different sides of the water-shed of northern Indiana. A glance at the table below will show, however, that, in all these upland streams and lakes, the fish-fauna is essentially the same, although in some cases the waters flow to the Gulf of Mexico, in others to the Gulf of St. Lawrence. On the other hand, between the faunæ of the upper course of the Wabash River and that of the lower, and between both and the fauna of White River, there will be noticed certain striking differences.

These facts may be formulated as follows: More species of fishes are common to the head-waters of streams rising on different sides of a water-shed than are common to the upland and lowland courses of the same stream. This subject is ably discussed by Prof. Cope (Journ. Acad. Nat. Sci., Phil., 1868, 242–246).

In the following table are given, opposite the name of each fish, the number of specimens thereof in the collection from each of the different water-basins:—

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
PERCIDÆ.							
Microperca punctulata, Putn.	15	16	1	..	..	..	3
Boleichthys eos, Jor. & Copeland	20	1	1	..	10		
Nothonotus niger (Raf.), Jor.	..	..	..	..	..	..	3
Etheostoma flabellare (Raf.), Jor.	..	..	..	..	..	..	3
Pœcilichthys variatus (Kirt.), Ag.	..	3	..	..	..	..	Common
Pœcilichthys spectabilis. Ag.	..	1	.	2	..	..	75
Boleosoma brevipinne, Cope	..	34	11	42	25	..	Common
Diplesium blennioides, Raf.	..	..	..	..	..	1	Common
Imostoma shumardii (Grd.), Jordan	..	..	..	..	..	6	50
Alvordius aspro, Cope & Jordan	..	..	..	..	..	..	

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
PERCIDÆ.							
Alvordius phoxocephalus (Nelson), C. & J.	..	..	..	..	..	1	
Alvordius evides, J. & C.	..	3	..	..	..	..	3
Percina caprodes (Raf.), Grd.	..	..	..	..	..	1	Common
Percina manitou, Jordan	..	3	..	..	..		
Pleurolepis pellucidus (Baird), Ag.	..	..	..	..	..	..	150
Perca flavescens (Mit.), C. & V.	15	4	..	..	30		
Pomoxys annularis, Raf.	..	..	..	..	..	1	5
Pomoxys hexacanthus (C. & V.), Ag.	..	..	..	..	8	..	1
Micropterus floridanus (LeS.), Gill	13	8	7	6	19	12	Common
Micropterus salmoides (Lac.), Gill	..	1	..	..	..	2	Common
Chænobryttus gulosus (C. & V.), Cope	1	..	..	..	7		
Ambloplites rupestris (Raf.), Gill	..	1	..	..	1	4	Common
Apomotis cyanellus, Raf.	1	..	..	1	..	..	Common
Lepomis nephelus, Cope	..	..	..	..	..	..	25
Lepomis incisor (C. & V.), Cope	25	18	27	..	95	23	Common
Xenotis inscriptus (Ag.), Jor.	..	..	..	..	..	..	25
Lepomis peltastes, Cope	..	..	..	4			
Xenotis megalotis (Raf.), Jor.	..	..	..	..	..	..	20
Xenotis nitidus (Kirt.), Jor.	..	..	..	..	..	..	Common
Pomotis aureus (Walb.), Gill	2	1	1	6	5		
APHREDODERIDÆ.							
Aphredoderus cookianus, Jordan	..	..	1				
SCIÆNIDÆ.							
Haploidonotus grunniens (Raf.), Gill	..	..	..	..	..	..	Scarce
COTTIDÆ.							
Potamocottus wilsoni (Grd.), Gill	..	..	..	..	..	..	3
ATHERINIDÆ.							
Labidesthes sicculus, Cope	19	..	5	..	53	171	Common
CYPRINODONTIDÆ.							
Zygonectes notatus (Raf.), J. & C.	..	8	9	..	..	61	Common
Zygonectes dispar, Ag.	..	7	..	..	16		
Fundulus diaphanus (LeS.), Ag.	13	25					
UMBRIDÆ.							
Umbra limi (Kirt.), Gthr.	3	14	15	..	1	..	10
ESOCIDÆ.							
Esox lucius, L.	..	2					
Esox salmoneus, Raf.	11	1	2	..	1	..	Common

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
SALMONIDÆ.							
Argyrosomus clupeiformis sisco, Jor.	..	..	..	..	15		
CLUPEIDÆ.							
Dorosoma cepedianum (LeS.), Gill	..	..	..	..	..	1	
CYPRINIDÆ.							
Campostoma anomalum (Raf.), Ag.	..	..	5	..	1	..	Common
Hyborhynchus notatus (Raf.), Ag.	2	41	..	30	3	24	Common
Hybognathus argyritis, Grd.	..	..	..	..	..	7	3
Ericymba buccata, Cope	..	..	..	..	..	..	Common
Semotilus corporalis (Mit.), Put.	..	4	1	2	2	..	Common
Nocomis biguttatus (Kirt.), C. & J.	3	3	..	1	3	..	Common
Nocomis amblops (Raf.), C. & J.	..	..	..	..	..	..	Common
Nocomis dissimilis (Kirt.), C. & J.	..	..	..	..	..	..	25
Rhinichthys obtusus, Ag.	..	..	..	7			
Rhinichthys atronasus (Mit.), Ag.	..	..	..	..	..	..	Common
Hybopsis stramineus, Cope	..	..	..	7	..	..	100
Hybopsis plumbeolus, Cope	..	..	..	..	3		
Hybopsis storerianus (Kirt.), Ag.	2						
Hemitremia heterodon, Cope (?)	..	..	..	..	5		
Luxilus cornutus (Mit.), Jor.	4	34	..	4	16	..	Common
Episema scabriceps, Cope	..	..	..	..	..	..	25
Minnilus spilopterus, Cope	..	..	3	..	10	..	75
Minnilus analostanus (Grd.), C. & J.	..	..	..	..	..	48	Common
Minnilus ariommus, Cope	..	..	..	..	..	..	50
Minnilus dinemus, Raf.	..	..	..	..	..	..	25
Minnilus rubellus (Ag.), Jor.	..	..	..	..	..	2	Common
Minnilus rubrifrons (Cope), Jor.	..	..	..	..	7	..	Common
Notemigonus americanus (Lac.), Jor.	12	..	16	5	24	10	Common
CATOSTOMIDÆ.							
Catostomus teres (Mit.), LeS.	..	6	..	9	..	1	Common
Catostomus nigricans, LeS.	..	..	..	..	..	..	Common
Erimyzon oblongus (Mit.), C. & J.	1	1	27	1	4	..	Common
Erimyzon melanops (Raf.), C. & J.	..	..	..	..	..	3	Common
Moxostoma anisurum, Raf.	..	..	..	..	..	6	
Moxostoma duquesnii (LeS.), Jor.	..	..	..	..	..	5	Common
Placopharynx carinatus, Cope	..	..	..	..	..	1	
Carpiodes difformis, Cope	..	..	..	..	..	1	
Carpiodes carpio, Raf.	..	..	..	..	..	1	5
Ichthyobus bubalus, Raf.	..	..	..	..	..	1	
SILURIDÆ.							
Ictalurus punctatus (Raf.), Jor.	..	..	..	..	..	1	5
Amiurus cupreus, Raf.	1	1	..	..	1	4	5

	I. Lakes of La Porte Co.	II. St. Joseph's R.	III. Maumee R.	IV. Kankakee R.	V. Tippecanoe R.	VI. Lower Wabash R.	VII. White R.
SILURIDÆ.							
Amiurus nebulosus (LeS.), Gill	..	..	..	..	1	..	Common
Amiurus atrarius (Dek.), Gill	1	5	19				
Hopladelus olivaris (Raf.), Gill	..	..	..	..	..	1	
Noturus flavus, Raf.	13	2	..	..	..	..	35
Noturus miurus, Jor. Mss.	..	..	1	..	..	8	60
AMIIDÆ.							
Amia calva, L.	..	..	1				
LEPIDOSTEIDÆ.							
Lepidosteus "huronensis, Rich."	..	..	..	..	..	..	5
POLYODONTIDÆ.							
Polyodon folium, Lac.	..	..	..	..	..	..	5
PETROMYZONTIDÆ.							
Petromyzon niger, Raf.	..	..	..	..	..	..	25
Petromyzon argenteus, Kirt.	..	..	..	..	..	..	1

Notes and Descriptions.

I give here notes on some of the foregoing species, with descriptions of those less known, as well as of a few new species which have come to my notice from Indiana, Wisconsin, and Illinois.

1. **Boleichthys eos,** Jordan and Copeland, n. s.

Boleichthys exilis, Jordan Man. Vert., 1876 (in part—probably not of Girard Proc. Acad. Nat. Sci., Phila., 1859).

Boleichthys eos, Jordan Mss. Nelson Bull. Ills. Museum Nat. Hist. Soc., 1876, 34 (partial diagnosis, Wis. and N. Ills.)

? *Boleichthys exilis*, Nelson Bull. Ills. Mus. Nat. Hist., 34 (the small species or variety noted below).

Body elongated, slender, somewhat compressed, especially behind, rather heavy forwards, with long caudal peduncle. Head rather long, rounded in front, $3\frac{7}{8}$ in length, without caudal. Greatest depth of body $5\frac{1}{3}$ in length. Mouth small, little oblique, the upper jaw a very little longest. Eye large, $3\frac{1}{3}$ in head, rather high up, longer than snout.

Dorsal fins high, about equal, the second highest, rather shortest, the two well separated. Anal moderate, smaller than second dorsal, caudal truncate. Pectorals rather short, reaching about as far as tip of ventrals, not $\frac{2}{3}$ the distance to vent. Cheeks, opercles, neck, and ventral region with small scales. Thoracic region naked. Vent a trifle nearer snout than tip of caudal. Lateral line to end of first dorsal on 22 to 26 scales, the total number being 57 to 59.

Color (in alcohol) dark olive, with darker markings, *i.e.*, 10 or 12 blackish dorsal spots or bars, and as many short bars across the lateral line nearly opposite the dorsal bars but not continuous with them. Various sharply defined but irregular black markings on lower parts of sides and on cheeks, etc. Second dorsal, caudal, and pectorals strongly marked with wavy black bands as in *Catonotus*. In females the first dorsal is similarly specked. In males dark terminal and basal bars are present (blue in life). Top of head dark. A black streak forward from eye, and another downward.

The life colors are very brilliant. The interspaces between the lateral bars as well as most of the ventral region are of a brilliant vermilion. The first dorsal is bright blue, with a broad median band of crimson.

Fin rays D. ix—11 (rarely x—10 or x—11) A ii—7.

Length $2\frac{1}{2}$ to 3 inches. *Habitat:* Rock River, Wisconsin, Wisconsin River, Fox River, Illinois, and streams of North Indiana.

In Fox River (Wis.) Suamico River, and other tributaries of Lake Michigan, there occurs in abundance another *Boleichthys;* but whether specifically distinct from *B. eos* or not I am unable to say. My numerous specimens are all smaller, shorter, with large scales. Their coloration is different—plain brown with several large round red spots. This form is the *B. exilis* of Nelson's paper, and partly that of the Man. Vert., but it is very doubtful whether it is Girard's species which was described from the Upper Missouri.

The genus *Boleichthys* is very close to *Pœcilichthys.* I know of no character on which to separate the eastern species as *Hololepis.* The short-arched lateral line and distinct, sub-equal dorsal fins as well as the general form seem to be common to all.

2. **Nothonotus niger** (Raf.), Jor.

This beautiful and rare species has been noticed by few authors, and has been properly described by still fewer. The following seems to be its synonymy:—

Etheostoma nigra, Raf. Ich. Oh. 1820, 37 (Kentucky; a superficial description).
Nothonotus niger, Jordan Bull. Buff. Nat. Hist. Soc., 1876, 93, 134 (name only). Man. Vert., 1876, 219 (male specimen).
Pœcilichthys niger, Jordan and Copeland Bull. Buff. Nat. Hist. Soc., 1876, 162 (name only). Nelson Bull. Ills. Nat. Hist. Mus. 34 (Wabash Valley).
Etheostoma maculata, Kirtland Bost. Journ. Nat. Hist., III., 276, 1841 (description incomplete and partly erroneous). Storer Synopsis, 271, 1846.
Nothonotus maculatus, Agassiz Bull. M. C. Z., 1863, 3 (name only).
Boleosoma maculatum, LeVaillant, Archives du Museum, 1873.
Catonotus maculatus, Jordan Ind. Geol. Surv., 1874, 214 (name only).
Pœcilichthys camurus, Cope, Proc. Am. Phil. Soc. 1870, 265 (Cumberland River, Tenn. Excellent description).

3. **Pœcilichthys variatus** (Kirt.), Ag.
Pœcilichthys cœruleus (Storer), Ag., and of most authors.

I have restored Dr. Kirtland's name for this species for the reasons given below. His description of *Etheostoma variata* has been variously misunderstood, as may be seen in its reference to genus *Hadropterus* by Putnam and *Boleosoma* by Le Vaillant. The latter author establishes a new genus, *Astatichthys*, for *P. cœruleus* and its relatives, because, as assumed, the original type of *Pœcilichthys*, Ag. (*E. variata*) is a *Boleosoma*. Dr. Kirtland ascribes twelve dorsal spines to his *variata* and ten to his *maculata*. The reverse is the truth, and the two figures were perhaps accidentally interchanged, otherwise his descriptions in both cases are characteristic and fairly correct.

Recently specimens from Wisconsin, fully identified as *P. cœruleus* (Storer) by Profs. Putnam, Cope, Copeland, and the writer, were sent by Dr. Hoy to Dr. Kirtland, who unhesitatingly pronounced them to be his own *Etheostoma variata*. The following in regard to this point is from a private letter from Dr. Kirtland to Dr. Hoy in November, 1876.

"The *Etheostoma variata* I first indicated as an undescribed species of fish in the 2d Geological Report of Ohio, Nov. 1, 1838. In 1841 I published a description of it in Vol. III. of the Boston

Journal of Natural History, p. 274. In 1838 I indicated it as a native of the upper waters of the Ohio, and of the Lake Erie waters.

" Dr. Storer first described the *Etheostoma cœrulea* in the Proceedings of the Boston Society of Natural History in 1845. At the time Dr. Storer's description appeared I had no doubt that his fish was the same as my *variata*, nor have I seen any reason since to change that conclusion. His specimen was probably received preserved in spirits; mine was described as it was fresh and alive—conditions affecting extensively their appearance. Sex, season of the year, spawning, locality, etc., vary greatly the character of fishes, and none more than this *Etheostoma*.

" My figure and description were made out from an old and large male taken from the spawning bed in the Mahoning River, in Youngstown, just as it had discharged its milt. It was lank, dull, and easily captured in its weak and emaciated condition, as all male fish are prone to be at this juncture. The brilliancy of its coloration had not yet become impaired. In a collection of many specimens you may find almost each one to differ from the others—some so essentially in their characters as to furnish new species to our 'new species mongers.'

" To that class of meddling naturalists I belonged at the time I described the *Etheostoma erythrogaster* and figured it in Hamilton Smith's 'Annals of Science.' It was a variety no doubt of the *variata*, a female teeming with eggs."

4. **Imostoma shumardii**, (Grd.) Jordan.

Hadropterus shumardi, Grd. Proc. Acad. Nat. Sci. Phila., 1859, 100, Arkansas. *Etheostoma shumardii*, Jord. & Copel. Bull. Buff. Soc. Nat. Sci. 1876.

Several specimens from the Wabash River at Hutsonville, are probably referable to this species. They appear to represent a new generic type, for which the name *Imostoma* is proposed (*eimi* to move, go—*stoma* mouth, in allusion to the projectile jaw, which distinguishes this genus from *Alvordius*). *Imostoma* may be thus characterized: Lateral line complete; body scaly; no ventral plates (?); upper-jaw projectile; vomerine teeth; anal as large as second dorsal. Type, specimens from Wabash River supposed to be *Hadropterus shumardii*, Grd.

Specific characters.—Body stout and heavy forward, compressed behind. Depth about 5 in length. Head blunt, broad, and thick, resembling that of *Diplesium* (*Hyostoma*, Ag.), its length $3\frac{4}{5}$ in length of body to caudal, its depth at pupil half its length. Eye large, rather shorter than snout, $3\frac{1}{2}$ in head. Interorbital width $\frac{2}{3}$ of eye.

Mouth large and broad, the lower jaw wide, a little shorter than upper; maxillary reaching to eye. Cheeks, opercles, and neck scaly; chest naked. Abdominal region naked anteriorly, scaly in front of vent; no traces of mucronate plates in any of my specimens. Scales of body rather large; lateral line with 56 scales, about 6 above and 11 below.

Fin rays, D. x—15, A. ii. 11.

Dorsal fins large, first larger than second, which is smaller than anal, the two dorsal fins well separated. Anal fin large, prolonged behind, farther than the dorsal; in one specimen greatly elevated, reaching to the caudal. This is perhaps a sexual feature. Anal spines large, the first largest. Pectorals reaching to tips of ventrals $\frac{2}{3}$ to vent.

Color dark, densely but vaguely blotched with darker but not black. Sides with 10 or 12 obscure blotches, the anterior ones bars. A large black spot on base of spinous dorsal behind, and a small one in front. Second dorsal, caudal and pectoral barred as in *Alvordius aspro*. A very strong black suborbital bar, and a faint dark line across muzzle. Length 3 inches.

Habitat. Wabash River (Jordan), Arkansas River (Girard).

5. **Alvordius phoxocephalus** (Nelson), Cope and Jordan.

Etheostoma phoxocephalum, Nelson, Bull. Ills. Mus. Nat. Hist. I. 1876, 35 (Illinois River), Jordan and Copeland, Bull. Buff. Soc. Nat. Sci. 1876.

An additional specimen of this species, in better preservation than any of Nelson's types, enables me to give a fuller description, and to correct one or two slight errors in the original account.

Body rather slender, compressed, depth $5\frac{1}{2}$ in length. Head 4 in length, extremely long, narrow, and tapering; the snout very acuminate. Mouth large, somewhat oblique, the maxillary reaching to eye, the lower jaw unusually narrow and long, scarcely shorter than upper. Depth of head at pupil one-third its length. Eye $4\frac{1}{4}$ in head, about equal to snout; half wider than interorbital space. Teeth small, on jaws and vomer. Upper-jaw not projectile.

Cheeks, opercles, and neck with small scales; those on the cheeks imbedded but numerous; chest naked. Ventral line with enlarged plates. Scales small, 68 in lateral line, about 12 above and 14 below. Fin rays, dorsal xii—13 (xiii—12, Nelson) A. ii. 9. Dorsal fins well apart, the second about equal to anal; the spinous dorsal long; caudal lunate. Pectorals reaching to tips of ventrals, $\frac{2}{3}$ to vent.

Color brownish above, mottled with darker. Lateral line with about 12 blackish spots, which are more or less quadrate, and scarcely twice the size of the eye. Both dorsals, and caudal with narrow dark bars of spots. A black streak on muzzle, but the suborbital bar very obscure. A small black spot at each end of the lateral line.

The peculiar form of the head and mouth separate this at once from all the previously known species except *A. macrocephalus*, Cope. The latter has naked cheeks and opercles, and differs in several other respects.

Habitat. Illinois River (Nelson), Wabash River (Jordan).

6. **Alvordius aspro**, Cope and Jordan, nom. sp. nov.

Etheostoma blennioides, Kirtland, Bost. Journ. Nat. Hist. (figure, but not description, which is copied from Rafinesque).

E. blennioides, Agassiz, and later writers.

Etheostoma blennioides, Raf., is the fish usually known as *Hyostoma cymatogrammum*, and for that fish his name must be retained. *E. blennioides*, Auct., being thus left without a specific name, that of *aspro* is here proposed.

The genus *Etheostoma*, Raf., was originally based on *E. flabellaris*, *E. caprodes*, and *E. blennioides*. The last two afterwards formed the subgenus *Diplesion*, leaving *Etheostoma* for *E. flabellare*.

7. **Alvordius evides**, Jordan & Copeland, sp. nov.

Etheostoma nigrofasciatum, Manual Vert. 1876, p. 223 (not *Hadropterus nigrofasciatus*, Ag.).

Etheostoma evides, Jordan & Copeland, Mss. in Nelson, Bulletin Ills. Hist. Soc. Dec. 1876, p. 36.

Body elongate, rather short for the genus, little compressed, depth $5\frac{1}{3}$ in length, without caudal. Head heavy, $4\frac{1}{4}$ in length to caudal; its greatest depth equal to its breadth, $1\frac{3}{4}$ in its length. Profile convex, outlines prominent just behind eyes, depressed at occiput. Eye large, rather high, their length rather more than snout, and than interorbital space $3\frac{1}{2}$ in head. Upper jaw a little the longer. Mouth not so large as in *A. aspro*, a little oblique, the maxillary reaching to opposite front of orbit. Vomerine teeth. Upper jaw not protractile, the skin of the middle of the lip continuous with that of the forehead. Cheeks, neck above, and throat naked; opercles with a few rather large scales. Ventral strip naked in one specimen, with a few enlarged scales in the other. Vent midway between eye and tip of caudal.

Fin rays; dorsal x—10 (xi—10), anal ii. 8 (ii. 9).

Pectoral fins as long as head, their tips about even with those of the ventrals. Ventrals long, their tips reaching $\frac{2}{3}$ the distance to vent. Anal rather short and unusually high, the longest rays extending farther back than the longest dorsal rays when the fin is depressed, the height of the longest ray $\frac{2}{3}$ the length of the head. Anal spines well developed, their height $2\frac{1}{2}$ in head.

Spinous dorsal long, moderately high, lower than the soft dorsal, its base equal to the distance from its first ray to the front of the eye. Dorsal fins well apart, separated by a distance greater than the diameter of the eye. Second dorsal lower than anal, but with a longer base, the two fins about equal in absolute size. Caudal fin moderate, emarginate, as long as from tip of muzzle to anterior margin of opercle.

Color dark-grayish or olivaceous above, tessellated with black. Top of head dark. A black band across top of head, just behind the interorbital space; a distinct vertical suborbital bar; a broad horizontal stripe across upper part of cheeks on the level of the pupil, becoming a narrow stripe across the opercle.

Body with about seven broad transverse black bars, extending from below lateral line on one side across the back and down the other side. These are rather faint above, their color blending with the dark of the back, and they are broadest and most distinct along the lateral line, just below which they end rather abruptly. These bars are wider than the eye, and most of them extend a distance below the lateral line equal to the diameter of the eye. These bars are connected along the lateral line by a faint black stripe. The fourth band is rather the most distinct, and it passes over the back in the interspace between the two dorsal fins. The two posterior bars are rounded and spot-like, but they also meet across the back. Dorsal with one or two longitudinal blackish streaks, and some vague markings on caudal. Fins otherwise uncolored.

Belly and lower parts clear, creamy, becoming pale orange behind ventrals. Interspaces between bands whitish with dark spots. In the smaller specimen which has been longer in alcohol, the black has faded to a dark chestnut.

Habitat. White River near Indianapolis in rapid water on stony bottom. The three specimens known were taken by Prof. Copeland and the writer at the same point at different times. The largest specimen measures $2\frac{1}{2}$ inches, the others $2\frac{1}{4}$.

This species is one of the most beautiful of all the darters. Its colors, though not gaudy, are very striking, and quite unlike those of any other species known to me, resembling most those of *Alvordius aspro.*

In the Manual of the Vertebrates of the N. E. U. S., I identified the only specimen then in my possession with *Hadropterus nigrofasciatus*, Ag., but that species turns out to be something quite different. The small number of dorsal spines as well as the peculiar coloration separates *A. evides* at once from its congeners *aspro*, *maculatus*, *macrocephalus*, *phoxocephalus*, and *nevisensis*. *A. fasciatus* is the only species which resembles it in this respect, but it is otherwise entirely different.

Percina manitou, Jordan, sp. nov.

Body elongate, cylindrical, less compressed than in *P. caprodes*, the depth being about 7 in length. Head $4\frac{1}{4}$ in length (without caudal), slender, but noticeably shorter and broader than in *P. caprodes*, the snout being considerably shorter, blunter, and less sloping. Eye large, about equal to snout, $3\frac{1}{2}$ to 4 in head, greater than interorbital space. Mouth small, less inferior, and less deeply cleft than in *P. caprodes*, the maxillary not extending to opposite eye, the upper lip—as in *P. caprodes*—not protractile. Cheeks and opercles with small scales, the former hardly visible.

Scales small, about 90 in the lateral line, which is well-developed and continuous. Ventral line with enlarged, mucronate plates (in one specimen—in the others naked); chest naked; region anterior to dorsal fin above *entirely scaleless* and smooth—in *P. caprodes* this region is densely scaled, like the sides.

Fin rays, D. XV., 14. A. II., 10.

Fins moderate, ventrals reaching about half way to vent, rather further than pectorals.

Colors black and yellowish olive, as in *P. caprodes*, but the pattern different. The back irregularly and strongly marbled as in *Alvordius aspro*, the lateral bars being short, and not extending up the sides much above the lateral line, the bars on one side not meeting their fellows on the opposite side. The bars themselves are subequal, not so sharply defined as in *P. caprodes*, short, about 20 in number, the last few blotch like, the last one a round jet black spot.

In *P. caprodes* the bars are alternately long and short, and each one meets its fellow of the other side across the back, a particularly distinct one crossing the back between the dorsal fins.

Dorsal fins and caudal mottled in both species.

Habitat. Lake Manitou in N. Ind., one of the sources of Tippecanoe R., 3 specimens in the Ind. State collection, each $3\frac{1}{4}$ to $3\frac{1}{2}$ inches long.

This species is, of course, closely allied to *P. caprodes*, but the different coloration and physiognomy, as well as the smooth neck, well distinguish it.

P. carbonaria, B. and G., from Texas, is apparently not identical with *P. caprodes.* I have numerous specimens of the latter from Alabama R.

Comparison of the Etheostomoid Genera.

The genera, which seem to be worthy of retention, in the peculiar group, family, or subfamily of *Etheostomidæ* (or *inæ*), may be thus compared :—

* No lateral line ; dorsal fins small, not very unequal, the two well separated, both larger than anal ; jaws about even ; scales large ; no ventral plates ; upper jaw not protractile ; size small ; colors dull ; fins barred. MICROPERCA, 1.

** Lateral line present on anterior half of body or less ; upper jaw not protractile ; caudal rounded ; no ventral plates ; second dorsal larger than anal ; fins barred.

† Dorsal fins well separated, about equal ; jaws nearly equal ; lateral line curved high over pectorals ; cheeks and opercles scaly ; body elongated and compressed ; colors often bright. BOLEICHTHYS, 2.

†† Dorsal fins distinct, about equal, the first short, but nearly as high as second ; cheeks and opercles scaly ; lower jaw longest ; body elongated ; a dark lateral band. ALVARIUS, 3.

††† Dorsal fins unequal, the first scarcely half the height of the second and rather short ; cheeks and opercles naked ; lower jaw longest ; body elongated, compressed ; branchiostegal membranes broadly united ; coloration in bars or lines of dots. ETHEOSTOMA, 4.

*** Lateral developed for at least two-thirds the length of the body.

a. Body moderately elongated; sealy, exeepting sometimes definitely naked areas on neek, chest, and ventral line.

b. Second dorsal considerably larger than anal; no ventral plates; the middle region of the belly sealed.

c. Upper jaw not protraetile; dorsal fins eontiguous, the membrane of the first just reaching the base of seeond; mouth medium, the upper jaw a trifle the longer; eheeks naked (sealy in *N. zonalis*); body short, and usually deep; fins large, not barred, but in the female speckled; colors brilliant.

Lateral line incomplete. PŒCILICHTHYS, 5.

Lateral line eomplete. NOTHONOTUS, 6.

cc. Upper jaw protractile; mouth small, horizontal, and more or less inferior; lateral line complete; fins barred.

d. Vomerine teeth; anal spines often obseure or obsolete; dorsals eontiguous, but separate; spinous dorsal rather short; body elongated; colors plain. BOLEOSOMA, 7.

dd. No vomerine teeth (at least in typical species); anal spines strong; cheeks and opereles scaly; body elongated, little eompressed; head short and thiek, with swollen cheeks; mouth very small; eolor bright. DIPLESIUM, 8.

bb. Seeond dorsal not larger than spinous dorsal, and little, if any, larger than anal, the two dorsal fins well separated; body little eompressed; vomerine teeth; lateral line complete; two anal spines (exeept in *Alvordius peltatus*—a speeies of uncertain affinities); eolor, yellowish, with black bars and blotches.

e. Mouth wide, terminal, the upper jaw but little longest.

f. Upper jaw protraetile; cheeks and opercles scaly; no ventral plates (?), body stout; head short and heavy. IMOSTOMA, 9.

ff. Upper jaw not protraetile.

g. No ventral plates; the middle line of the belly with small seales; eheeks and opereles sealed. HADROPTERUS, 10.

gg. Ventral plates present (or falling, leaving a naked strip). ALVORDIUS, 11.

ee. Mouth narrow, inferior, overlapped by a tapering, more or less truneate, pig like snout; eheeks and opereles sealy; ventral plates present; or, if fallen, a naked strip; body elongated; size largest. PERCINA, 12.

aa. Body excessively long and slender, eylindric, with very thin, transparent seales, whieh are wanting over the ventral region, and searcely visible on the dorsal; lateral line eomplete; eheeks and opercles sealy; mouth large; the upper jaw sub-protraetile, and a little the longer; vomerine teeth; dorsal fins small, wide apart; head elongated; eolor transparent, with dorsal and lateral series of small dark spots. PLEUROLEPIS, 13.

Of the genera admitted above, *Alvarius* is imperfectly known. *Nothonotus* may be only a subgenus of *Pœcilichthys*, and *Alvordius* of *Hadropterus*. The claim of some of the others to independent rank seems not to be beyond question.

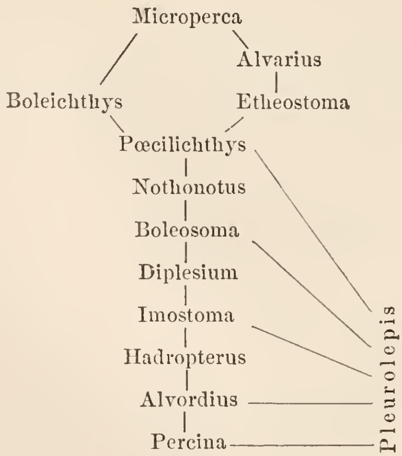
The other generic names used in this group seem to be synonyms, as follows:—

Hololepis, of Boleichthys.
Pegedictis, Catonotus, of Etheostoma.
Oligocephalus, Astatichthys, of Pœcilichthys.
Arlina, Estrella, Cottogaster, of Boleosoma.
Hypohomus, Plesioperca, of Hadropterus.
Pileoma, Asproperca, of Percina.

Aplesion, Grd., I do not know. *Pegedictis*, Raf., is, perhaps, based in part on *Catonotus*, and in part, perhaps, on the young of some Cottoid.

It is undoubtedly best to discard the name *Pegedictis*, which I unadvisedly revived in place of *Potamocottus*, Gill.

The relations of these genera may be rudely shown by the following diagram:—



7. **Copelandia eriarcha, Jordan, sp. nov.**

In a collection of Wisconsin fishes sent by Dr. Hoy to Prof. Copeland and myself for identification, I find a species of saw-fish which appears to be the type of a distinct genus. For this genus I have proposed the name of *Copelandia*, dedicating it to the memory of one of the most enthusiastic of naturalists, and most genial of men, whose untimely death has been a great loss to our science.

The genus *Copelandia* is allied to *Enneacanthus*, *Hemioplites*, and *Centrarchus*. Its characters are as follows:—

Dorsal with 10 spines, anal with 4; the anal spines strong, the soft rays high; caudal fin rounded; opercle emarginate, with a black dermal border (as in *Enneacanthus*). A supernumerary maxillary bone. Palatine teeth. Appendages of anterior gill arch long, and in small number, much as in *Ambloplites*.

The typical species *C. eriarcha* is thus characterized: Body rather elongated, more so than in *Enneacanthus*, the profile forming a nearly uniform curve. Depth $2\frac{1}{4}$ in length; head $2\frac{3}{4}$; caudal peduncle rather abruptly narrowed. Form most like that of *Apomotis cyanellus*, Raf. (*mineopas*, Cope). Eye very large, 3 in head; longer than snout; much more than interorbital space; mucous channels not large: scales on cheek large, in about three rows; mouth moderately large; the maxillary short and broad, with a distinct supplemental bone. Distance from snout to dorsal equal to length of the base of that fin; spines rather high, the longest equal to distance from snout, just past pupil; the first spine short, the last regularly longer. Soft dorsal high, its height equal to distance from snout to front of opercle. Caudal fin slightly rounded, its length $\frac{4}{5}$ that of head. Anal fin very large, beginning well forward, midway between base of caudal and nostrils. Spines 4, all strong, the last very large and strong, as long as from snout to posterior part of pupil. Soft rays a little higher than those of dorsal, and reaching base of caudal. Ventral fins large, with a strong spine which reaches to beginning of anal, the longest soft ray reaching first soft ray of anal. Pectorals moderate, about as long as the base of anal, reaching to tips of ventrals. Scales large, 3—33—10; lateral lines running high, parallel with the back, ending about opposite last rays of dorsal.

Fin rays D. X., 9; A. IV., 8; V. I., 5.

Color faded in spirits. Vertical fins with numerous round whitish spots, which were probably blue in life; a black, opercular spot. Length, 3 inches.

Habitat.—Menomonee R., at Wauwatosa, Milwaukee Co., Wis. Coll., Dr. P. R. Hoy.

8. **Lepomis peltastes**, Cope.

The sunfish referred to by Nelson (*op. cit.* 38) as *Ichthelis anagallinus*, from Fox R., Ills., is not Cope's *anagallinus*, but another species, probably *Lepomis peltastes*, Cope, a species which, following Prof. Bliss (*in lit.*), I have hitherto considered identical with *anagallinus*. Both *oculatus*, Cope, and *peltastes*, Cope, I now consider distinct species. I have specimens of *anagallinus* from Salt R., Ky., of *oculatus* from Racine, Wis., and of *peltastes* from the Upper Illinois.

Prof. Cope and the writer have reviewed the nomenclature of our Centrarchine genera, and have jointly come to the conclusion that the genera mentioned in the synopsis below are the ones worthy of adoption.

We have deemed that science would be best served by applying to these names the strict rules of zoological nomenclature. The grounds on which proposed changes are based are given in a supplement to this paper. The characters of the genera adopted are brought out in the following synopsis. Most of them were first pointed out by Prof. Cope, but for their arrangement here the present writer only is responsible.

Comparison of the Centrarchine Genera.

The genera of sunfishes (*Centrarchidæ*) may be thus compared:—

* Dorsal fin much more developed than anal fin (the base of the former $1\frac{1}{2}$ to 3 times that of the latter), the soft parts of the two fins about equal, and terminating at the same vertical behind; long gill rakers if present, in small number, about 10.

† Anal spines 3 or 4.

a. Caudal fin emarginate; anal spines 3; dorsal spines (normally) 10.

b. Opercle ending behind in an entire convex process or flap, which always has a black spot; dorsal fin not notched.

c Maxillary without supplemental bone; mouth rather small, with equal jaws; maxillary usually not reaching to orbit; scales ctenoid.

d. Lower pharyngeal bones broad, with blunt, rounded, "paved" teeth. Appendages on anterior branchial arch ("gill rakers"), short, blunt, and weak; no palatine teeth.

POMOTIS, 1.

dd. Lower pharyngeal bones narrower, with fewer teeth which are conic and sharp.

e. Gill appendages short, blunt, and weak, not differentiated—as in *Pomotis* (species with the opercular flap much elongated—the spines low, the colors brilliant, cheeks ordinarily with blue stripes, and no palatine teeth).
XENOTIS, 2.

ee. Gill rakers long and slender, the lowermost 8 or 10 larger than the rest (species with the dorsal spines more or less elevated, the opercular flap comparatively broad and short, the colors less brilliant—though often lustrous, and often no blue lines on cheeks—palatine teeth often present.
LEPOMIS, 3.

cc. Maxillary with a supplemental bone; gill appendages long (as in all the following genera); lower pharyngeal teeth conic (as in all the following); mouth rather large, the lower jaw protruding; scales weakly or not ctenoid; palatine teeth (as in all the following).

f. Tongue without teeth; supplemental bone narrow; maxillary reaching to between front and middle of orbit; general aspect of *Lepomis*. APOMOTIS, 4.

ff. Tongue with a conspicuous patch of teeth; supplemental bone large; mouth wide, reaching to opposite posterior margin of eye; form, aspect, and dentition of *Amblo-plites*, etc. CHÆNOBRYTTUS, 5.

bb. Opercle emarginate behind—ending in two flat points with a dermal border (as in all the genera following); dorsal fin deeply notched, separated almost into two fins, the last spines being shortened; body elongate; mouth very wide—the lower jaw longest, the supplemental maxillary large; gill appendages long; size large. MICROPTERUS, 6.

aa. Caudal fin rounded; mouth small, with equal jaws; gill appendages long, in small number; opercle emarginate; species of small size.

g. Dorsal fin angulated, the middle spines longer than some of the posterior ones; supplemental maxillary wanting (or rudimentary?); anal spines 3; dorsal 10; body barred. MESOGONISTIUS, 7.

gg. Dorsal fin continuous; supernumerary bone well developed.

h. Dorsal spines normally 9; anal spines 3.
ENNEACANTHUS, 8.

hh. Dorsal spines 10; anal 4. COPELANDIA, 9.

hhh. Dorsal spines 8; anal 4. HEMIOPLITES, 10.

†† Anal spines 5 to 7; dorsal spines 10 to 13; teeth on tongue and palate; mouth large; a strong supplementary maxillary bone; lower jaw longest; opercle emarginate; gill appendages long and strong—8 or 10 of the large ones.

i. Caudal fin rounded; scales cycloid; anal spines normally five. ACANTHARCHUS, 11.

ii. Caudal fin emarginate; scales ctenoid; anal spines normally six. AMBLOPLITES, 12.

** Dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; lower jaw longest; supplemental maxillary bone present; opercle emarginate; gill rakers very long, in large number (20 to 30); fins large; scales faintly or not ctenoid.

k. Spinous dorsal shorter than soft part, continuous with it—the species 5 to 8 in number, rapidly graduated; anal spines normally 6; body compressed and rather elongate; mouth large. POMOXYS, 13.

kk. Spinous dorsal longer than soft part, forming an angle with it, the spines about 12 in number, not rapidly graduated; anal spines normally 8; body deep; mouth moderate. CENTRARCHUS, 14.

9. **Aphrodedirus cookianus**, Jordan, sp. nov.

In the collection from St. Joseph's River of the Maumee, I find a single specimen of a Pirate Perch, which differs about equally from the Eastern *A. sayanus*, and the *Sternotremia isolepis*, recently described by Mr. Nelson from Illinois. Its characters are so peculiar that I see no alternative but to consider it as a new species, and to refer it to the genus *Aphrodedirus*.

Body broad, stout, elevated at the dorsal, the depth $3\frac{1}{3}$ in length, without caudal. Head large, broad and stout, 3 in length, its greatest thickness a little more than half its length, its depth at the pupil a little less. Mouth wide, lower jaw longest; maxillary reaching anterior margin of eye. Eye moderate, $4\frac{1}{2}$ in snout, its posterior margin nearly midway of head, $1\frac{1}{2}$ in snout, and in interorbital space. Lower posterior angle of cheek about a right angle.

Fin rays D. III., 11. A. II., 6. V. 7. B. 6.

Beginning of dorsal much nearer snout than base of caudal, base of dorsal $1\frac{4}{5}$ in distance from snout to first ray; pectoral as long as from snout to opercular margin; tips of pectorals not reaching as far as those of ventrals.

Ventrals considerably more than half length of head, reaching $\frac{4}{5}$ the distance to anal. Long anal spine $2\frac{1}{3}$ in head; caudal rounded.

Vent midway between junction of branchial membranes and ventral fins, about $\frac{2}{3}$ the diameter of the eye behind the little knob which is on the throat in all the species of this family, the length of the snout in advance of the ventrals, about under the middle of the opercles.

Scales very small, strongly ctenoid, not easily seen along middle of body, largest on cheeks and on opercles. Lateral line distinct for a short distance only, about 58 scales in its entire course.

Color dark olive, appearing bronze in spirits, profusely speckled with dark points, which give the fins a dark color; a dark bar at base of caudal and a light one behind it. Length 3 inches.

Habitat. Sawyer's Creek, outlet of Long Lake, Kendallville, N. E. Indiana (Waters of Lake Erie). This species is named in honor of the naturalist who first collected it.

This fish differs from *Sternotremia isolepis* in the anterior position of the vent, which is nearly as in *Aphrodedirus sayanus*. It is stouter, has a larger head, smaller scales, and a shorter anal spine. The ventral fins are also decidedly larger and longer. Several minor differences are noticeable on comparison with one of Nelson's types. *Aphrodedirus sayanus* has a more elongated body, a longer head, much larger scales, a more backward position of the dorsal, and an increased number of spines in the dorsal and anal. At least such is the case in a specimen examined by me from near Philadelphia. The position of the vent in *Sternotremia* seems sufficient to characterize that genus, but the species of the two genera, as among our *Centrarchidæ* and *Cottidæ*, are "cast in the same mould." *Sternotremia* apparently represents a step in a transition from *Aphrodedirus* towards *Percidæ.*

In the original description of *S. isolepis* (Bull. Ills. Mus. Nat. Hist., I., 1876, 39), "Vent more than twice as far from lower jaw as from ventrals," should read from *tips* of ventrals."

10. **Cottopsis ricii**, Nelson.

Nelson, Bull. Ills. Nat. Hist. Soc., 1876.

A second specimen of this curious species, received from Dr. P. R. Hoy, of Racine, Wis., enables me to supplement the original description. The occurrence in the Great Lakes of this type formerly supposed to be peculiar to the Pacific Slope is very interesting.

Body moderately elongated, depressed; the head especially so. Depth $5\frac{1}{3}$ in length, the head $3\frac{2}{3}$. Body quite abruptly contracted opposite the base of anal, the body behind head nearly as deep as wide.

Body behind the vent rather slender, subterete, giving a tadpole-like form to the body.

Jaws about equal, the lower narrower, but projecting in front; mouth rather contracted, the maxillary scarcely reaching to eye. Palatine teeth. Eye $4\frac{1}{2}$ in head, half wider than the interorbital space, about equal to snout. Eyes close together, entirely superior.

Head very broad and flat, as broad or broader than long, including the perpendicular spines, its depth half its length. Profile rising rapidly from head to base of dorsal, which runs along a decided ridge or carina.

Preopercular spine extremely large, more than three times as large as in any other of our fresh-water Cottoids, and as long as the eye. This spine is hooked backwards, and is slightly spiral, giving the fish a decidedly buffalo-like or cow-like physiognomy. Three spines hooked downwards, below the large one, the lower concealed. A strong spine directed forwards at base of opercle. Isthmus as wide as from snout to middle of orbit.

Fin rays, D. VIII—17. Anal 12. Ventrals I. 4. Pectorals 16. Branchiostegals 6.

Base of pectorals crescentic, their tips just short of anal, the rays all simple. Ventrals under pectorals reaching $\frac{2}{3}$ to vent; their membrane decurrent. Dorsal beginning a trifle beyond ventrals, rather nearer anal than snout. Vent midway between base of caudal and snout. Depth at first ray of anal less than half length of head, the thickness at the same point a little more than one-third. Least depth $\frac{1}{4}$ of head. Caudal peduncle slenderer than in any other Cottoid known to me in our fresh waters. Head smooth. Space above lateral line, behind head covered with small stiff prickles, slightly hooked backwards, readily visible as little black specks when the skin is dry. Axillary region *not* provided with spines. (These are present in most species of *Potamocottus*.)

Color pale brown, rather finely specked and mottled with darker brown, not at all as in *Uranidea*, much as in *Lota*, more as in *Lophopsetta*. Pectorals mottled; belly white. Length of smaller specimen (Nelson's type) $2\frac{5}{8}$ inches; of larger, $3\frac{2}{3}$.

Habitat. Lake Michigan, in deep water. Two or three other specimens have been seen, but never preserved (Dr. Hoy). The cow-like expression of the face is very characteristic.

11. **Uranidea hoyi**, Putnam, MS.

Uranidea hoyi, Putnam MS. (1875). Jordan, Man. Vert., 1876, 244 (name only). Jordan and Copeland, Bull. Buff. Soc. Nat. Sc., 1876 (name only). Nelson, Bull. Ills. Mus. Nat. Hist., 1876, 41 (diagnosis).

This species has been for some time named in MS., but no full description published. Putnam's types are now in my possession. They show the following characters. The portion relating to the vertical fins is taken from notes by Dr. Hoy, as those parts are now entirely obliterated on the specimens.

Body small, rather short and thick, the depth about $5\frac{1}{2}$ in length. Head $3\frac{1}{3}$ in length, to base of caudal. Eyes large, high up, and close together; about equal to snout, $3\frac{2}{3}$ in head, three times the interorbital space. Head rather narrow and contracted; the lower jaw narrowed and slightly projecting. No palatine teeth (?); maxillary reaching anterior border of eye, or a little beyond.

Preopercular spine prominent, sharp, very nearly straight, directed backwards, but not strongly upwards; its form and direction peculiar in this genus. Below this is another sharp, prominent spine, also nearly straight, directed partly downwards. One or two minute concealed spines still lower. Isthmus well developed.

Pectoral fins long, longer than the head, reaching beginning of anal. Ventral fins long, reaching almost to vent. Vent midway between snout and base of caudal (in ♂); in the female further back, owing to the distended abdomen. Ventral rays I. 3 (on one side of each specimen apparently I. 4; perhaps a soft ray has been split).

Fin rays "D. VI. 15; A. 11; V. I. 3; P. 13; C. 12; the first dorsal low and small, $\frac{3}{4}$ as long as soft part, and connected to it by membrane. Fins all low." (Dr. Hoy.)

Color nearly obliterated. Lower parts profusely punctate.

Length of specimens, $2\frac{1}{6}$ inches.

Habitat. Lake Michigan—in deep water.

Female specimen taken 12 miles off Racine, Wis., in 12 fathoms, June 4th, 1875, by Dr. Hoy; the male off Milwaukee, June 15th. The specimens are now in bad condition, from rough handling.

The female is distended with ripe eggs, so that the width of the body is one-third the total length.

This species seems to be quite distinct from all those described by Girard. The peculiar characters are the number and form of the preopercular spines, the contracted mouth, the large eyes, the small size of the body, and the length of the ventral fins. The characters first mentioned are the most striking, and they indicate some affinity with *Triglopsis*.

12. **Uranidea kumlienii**, Hoy, MS.

U. kumlienii, Hoy, Nelson, Bull. Ills. Mus. Nat. Hist., 1876, 41.

One of Dr. Hoy's types, in very bad condition, is in my possession. It has grown soft in weak alcohol, and its remarkable slenderness of body is, perhaps, in part at least, due to this fact.

Body slender and elongated, as in *U. boleoïdes;* its depth 6 (?) times in length. Head large and long, its width a little more than half its length, its depth a little less, $3\frac{1}{3}$ in length of body. Eye large, $3\frac{1}{2}$ in head, about equal to snout, more than twice the width of interorbital space.

Base of pectorals crescentic ; the fin about as long as head ; the lower rays rapidly shortened, reaching second or third dorsal ray, and falling just short of anal ; fourth and fifth rays longest. . . . . Vent equidistant between base of caudal and front of eye.

Mouth pretty wide and oblique, the maxillary reaching to middle of eye. Lower jaw projecting. No palatine teeth. Preopercular spine large, directed upwards and backwards, not strongly hooked.

Fin rays, D. VI. 17 ; A. 12 ; P. 14 ; V. I. 3.

First dorsal rather high ; $\frac{5}{6}$ the height of the second ; the second spine longest, and filamentous (as is apt to be the case in rotten Cottoids) ; the two fins connected by a membrane. Caudal peduncle slender. Caudal fin narrow, more than $\frac{3}{4}$ length of head. Second dorsal and anal high.

Lateral line disappearing under middle of second dorsal.

Color obliterated—traces of a black spot on spinous dorsal.

Length of specimen, 3 inches.

Lake Michigan, in deep water. (Dr. Hoy.)

This species is dedicated by Dr. Hoy to Mr. A. L. Kumlien.

Nelson's description (l. c.) was made up from my notes on this specimen.

Genus EUCALIA, Jordan, 1876.

(Man. Vert., 1876, 248; type, *Gasterosteus inconstans*, Kirt.)

Some three years since I separated this genus in MS., and I adopted it in the Manual of Vertebrates (above cited), but it has not yet been fully characterized. I give below a comparison of the typical species of *Eucalia* with that of *Apeltes*, the genus most nearly related.

Common characters: Sides not mailed; caudal keel undeveloped; spines not serrated; dorsal spines in small number (3 to 6), ♂ in spring, with colors intensified.

Apeltes, Dekay, 1842. (Type, *Gasterosteus quadracus*, Mit.)	Eucalia, Jordan, 1876. (Type, *Gasterosteus inconstans*, Kirt.)
Generic characters.	
1. Dorsal spines not in a right line, the first being on one side of the median line when erected, the next two on the other.	1. Dorsal spines in a right line.
2. Ventral plates two, one on each side of the ventral fins.	2. Ventral plates coalesced into a narrow plate on the median line between the ventral fins.
3. No distinct post-pectoral plate.	3. A distinct sub-quadrate post-pectoral plate.
Associated characters.	
4. Dorsal spines normally III–I.	4. Dorsal spines normally IV–I.
5. Dorsal spines high, diminishing in size backwards.	5. Dorsal spines lower, diminishing in height forwards.
6. Suborbital plate, silvery, very distinct, semicircular.	6. Suborbital plate, indistinct, lunate.
7. A developed bony ridge on each side of the dorsal spines.	7. Dorsal ridge rudimentary and on median line.
8. Caudal peduncle very long and slender—as long as head; its least depth 4 to 5 times in its length.	8. Caudal peduncle short and relatively stout—shorter than head; its least depth about $\frac{1}{3}$ of its length.
9. Species in salt or brackish waters.	9. Species in inland brooks and lakes.

13. **Eucalia inconstans** (Kirt.), Jor.

Depth equal to length of head, four times in body to base of caudal. Curve of the back rising very slowly. Eyes rather large, longer than snout, $3\frac{1}{4}$ in head, much wider than interorbital space. Curve of back descending rather abruptly towards the tail along the base of the soft dorsal. Curve of belly moderately convex, ascending to form a slight constriction on caudal peduncle. Caudal peduncle rather thick, slenderest in females. Vent much nearer tip of caudal than snout (in Ohio specimens this is not true). Body compressed, but much less so than in either *pygmæa* or *cayuga*. Fin rays, D. IV.–I., 10 varying to III.–1, 9, and V.–I., 10. A. I, 10, V. I, 1. P. 10 to 12. C. 14.

Dorsal spines low and distant, not half so high proportionally as in *cayuga;* soft dorsal low, the first ray about twice as long as the spines. Anal similar, rather smaller, about three times the height of the curved spine which precedes it. Ventrals short and weak, shorter than eye (Wisconsin specimens), or rather longer (Ohio specimens).

Colors in life (in May), males jet black, somewhat coppery about the mouth; females olivaceous and mottled, finely dotted with black; young like the females. Length 2 to $2\frac{1}{2}$ inches.

Habitat. Little sluggish brooks, among weeds and grass, from Ohio to Minnesota (? Greenland, Cope). Usually in company with *Umbra limi*. The species is notable for its pugnacity and voracity, and for its nest-building habits.

I have specimens from Oconto, Outagamie, Calumet, Winnebago, Brown, Racine, Sauk, Dane, Walworth, Green, and Jefferson Counties, in Wisconsin and from Cuyahoga County, Ohio.

14. **Eucalia inconstans** subsp. **cayuga**, Jordan, Man., Vert., 1876, p. 249.

Depth much less than length of head, $4\frac{1}{5}$ in length of body; head $3\frac{1}{3}$. Back arched considerably. Eyes large, as long as snout, wider than interorbital space, $3\frac{1}{4}$ in head. Caudal peduncle relatively much longer and more slender than in *inconstans*, its length about equal to depth of body.

Vent much nearer snout than base of caudal, as near as middle of caudal. Head, ventral cuirass, etc., about as in *inconstans*, body more strongly compressed.

Fin rays D. IV.–I., 10; A. I., 10.

Ventral spine stout, long, equal to depth of head at eyes, or to length of head behind eyes. Last dorsal spine $\frac{3}{8}$ height of first soft ray; fins all high. Anal spine $\frac{2}{3}$ height of first ray.

Color olivaceous, reticulated and mottled with darker. Length $1\frac{1}{8}$ to 2 inches.

Habitat. Cayuga Lake, N. Y.; many specimens dredged by Dr. B. G. Wilder.

The special characters of this variety seem to be its small size, high fins, and long caudal peduncle. If these prove constant, it may be necessary to consider it a species.

Sauvage (Nouvelles Archives du Museum, 1873) has distinguished a genus, *Gasterostea*, based on *G. pungitius*, Linnæus, which seems to be equivalent to *Pygosteus*, Brevoort.

15. **Zygonectes dispar**, Agassiz.

Zygonectes dispar, Agassiz, Am. Journ. Sc. Arts, 1854 (Illinois River). Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 42 (Illinois River).

Body short and deep, much compressed. The depth $4\frac{1}{3}$ in length. Head short and very broad, the flat interorbital space being $\frac{3}{4}$ of its length, and nearly twice the distance between the eyes below. The eyes, therefore, are oblique, sloping downwards and inwards, therefore better seen on a view from below than from above. Head $3\frac{3}{4}$ in length; eye nearly 3 in head.

Snout broadly rounded in front. Upper cheeks and top of head with large scales. Lower parts with small ones, appearing naked.

Fin rays D. about 7; A. 9 or 10. Fins all small except caudal and perhaps anal. Dorsal much behind anal and not half as large, its front midway between front of eye and tip of caudal. Pectorals narrow; caudal large and rounded. The fins are very fragile, so that it is almost impossible to count the rays.

Scales large, in 33 to 36 transverse rows, about 10 longitudinal ones, the scales strongly marked with concentric ridges.

Branchiostegals apparently 3. Vent a little nearer snout than base of caudal. Ventrals small and short.

Color pale olive in spirits, bluish in life; a brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales. About 10 of these lines, which are very distinct, a little wider forwards, narrower than the interspaces.

Males (?), with these lines interrupted and further marked with about 9 crossbars, not one-third as wide as the interspaces, obscure forwards, most distinct over anal.

Length of all adult specimens seen, just $1\frac{1}{2}$ inches.

Habitat. Rivers and lakes of N. Ind. and Illinois. Abundant wherever noticed. They swim about near the surface, slowly, as if it were very hard work.

This species bears little resemblance to *Z. notatus*, the type of *Zygonectes*. This latter species is Rafinesque's "*Semotilus? notatus.*" I have accordingly substituted the name of *notatus* for *olivaceus*, Storer. I have also substituted *Fundulus diaphanus* for *F. multifasciatus.* Le Sueur's type of his *Hydrargira diaphana* and *multifasciata* both came from Saratoga Lake, and his descriptions apparently refer to the same species. *Diaphanus*, Le Sueur, is the name first used. *Fundulus diaphanus* is the most widely diffused of all our Cyprinodonts, occurring in brackish water as well as in ponds and springs, from Massachusetts to Colorado.

Zygonectes is not well distinguished from *Haplochilus*, McClelland. *Micristius*, Gill, is probably a synonym.

16. **Fundulus menona**, Jor. and Copeland, sp. nov.

Among the fishes sent to us by Dr. Hoy is a species of *Fundulus*, which seems to be new to science. It is characterized as follows:—

Body elongate, slightly compressed, not elevated, its depth 5 in length. Head long and large, $3\frac{2}{5}$ in length, flat on top, and rather narrow, the breadth of interorbital space half greater than width of eye. Eye 4 in head.

Mouth moderate, of the usual form. Length of head $1\frac{3}{4}$ in distance to dorsal.

Fin rays D. 12; A. 10; V. 6; B. 5.

Dorsal in advance of anal moderately long, and not very high. Anal short and very deep, the longest ray $\frac{2}{3}$ the length of the head. Pectorals short, reaching ventrals; ventrals short, scarcely reaching anal. Vent midway between front of eye and base of caudal.

Scales moderate, in 48 transverse rows, and about 12 longitudinal ones, not small, but very closely imbricated.

Color in spirits dark olive brown, with numerous narrow vertical silvery bands, or dark olive above, this color extending down the sides and around the belly, forming 16 bands, which are separated by shining, silvery interspaces, which are narrower than the bands, and very distinct. The dark spaces are broadest behind. Cheeks and opercle silvery. Traces of dark lines along the rows of scales. Fins unspotted.

Length $3\frac{1}{4}$ inches.

Habitat. Catfish River, Dane Co., Wisconsin (outlet of Lake Menona near Madison).

This species is most nearly related to *Fundulus diaphanus* (*multifasciatus*). The latter, however, differs entirely in coloration, being silvery olive, with narrow black bars, and the dorsal region irregularly spotted. *F. menona* further has the head longer and narrower, the scales rather larger and more closely imbricated. The vent in *F. diaphanus* is about midway between the middle of caudal and the front of eye. *F. menona* perhaps reaches a larger size than the other species.

17. **Dorosoma cepedianum** (Le S.), Gill.

This species is now abundant in Lake Erie and Lake Michigan, as well as in the larger tributaries of the Mississippi River. It has come into the great lakes through the canals. As a help to the settlement of the question of the relation of the western fish (*Dorosoma notatum*, Raf., *Chatoëssus ellipticus*, Kirt.) and the eastern one, I give here a detailed account of the specimen in the Indiana collection from the Wabash River, at Merom.

Body deep, much compressed, but not greatly elevated. Mouth small, inferior, snout rounded. Depth $2\frac{1}{2}$ in length, without caudal. Head 4. Eye twice length of snout, $4\frac{1}{2}$ in head. Length of top of head $3\frac{1}{4}$ in distance to origin of dorsal.

Fin rays D. II., 11 ; A. II., 30 ; V. 8.

Scales in about 56 transverse rows and 20 longitudinal ones. 17 scutes in front of ventral fins, 12 behind.

Dorsal fin beginning midway between snout and middle of base of caudal, the last or filamentous ray being equal to the length of the head, nearly twice the length of the longest ray not filamentous, and more than twice the base of the fin. Pectorals scarcely reaching ventrals, $1\frac{1}{4}$ in head. Ventrals reaching half way to anal, $2\frac{1}{6}$ in head. Vent about midway between snout and tip of caudal. Anal base a little longer than head, three times its longest ray. Caudal fin widely forked, largely scaly at base. Depth of caudal peduncle half length of head.

In spirits, nearly uniformly silvery.

Length of specimen $10\frac{1}{2}$ inches.

18. **Esox salmoneus**, Raf.

I have adopted Rafinesque's name for the common Little Pickerel of the Western States, because it is undoubtedly the species which Rafinesque had in mind, notwithstanding his statement that "it reaches the length of five feet." *Esox umbrosus*, Kirtland, is the same fish, as I know from the examination of his original type. Some of Le Sueur's unidentified species probably belong here.

Esox cypho, Cope, of which I have examined specimens from

Fox River, Illinois, is quite distinct. It is locally known as the Buffalo Pike.

Rafinesque's name, *Picorellus*, may be used for the species of *Esox*, with the cheeks and opercles entirely scaled. It is equivalent to the group "Pickerels" of Girard. This character is, however, hardly of generic value.

19. **Minnilus ariommus**, Cope.

This species is locally quite abundant in White River, about Indianapolis, in which stream Cope's original type was taken. I have, however, not found it in any other river, nor in any of the tributary creeks. It is a rather large and striking species. In size of eye it surpasses all of our other *Cyprinidæ*.

20. **Lythrurus cyanocephalus**, Copeland, MS., sp. nov.

"*Hoy's Red Fish.*" Hoy in Reports on Fishes of Wisconsin.

Lythrurus cyanocephalus, Copeland, MS., Nelson, Bull. Ills. Mus. Nat. Hist., 1876. (Name only.)

Among the unfinished papers of the late Prof. Copeland, are fragments of a synopsis of the Fishes of Wisconsin. In this MS. "Hoy's Red Fish" is described under the above name, from specimens sent by Dr. Hoy, and from others examined from Bass Creek, near Hanover, Wis. The following is Prof. Copeland's description, with a few additional characters taken from the type specimens which are now in my possession.

Body short, stout, deep, chubby, moderately compressed, the depth about 4 in length; dorsal outline elevated, the axis of the body being about half nearer the ventral outline than the dorsal, so that the form is quite unlike that of *L. diplæmius*. Caudal peduncle rather short, not specially contracted.

Head very short, deep, $4\frac{1}{8}$ to $4\frac{1}{5}$ in length, its greatest depth $1\frac{1}{3}$ in its length, equal to the distance from front of eye to edge of opercle. Snout blunt, shorter than eye. Mouth large, very oblique; more so than in any of the others, its angle fully 45°. Lower jaw longest. Maxillary reaching to opposite anterior border of eye. A slight occipital depression. Interorbital space wide, wider than eye. Eyes large, $3\frac{1}{3}$ in head.

Fin rays D. I. 8; A. I. 11 in one, I. 12 in others.

Fins large. Dorsal well behind ventrals, with a large black spot which involves the bases of the anterior rays, the whole spot about equal to the eye in extent. Longest dorsal ray about equal to head. Pectorals rather short and broad, not reaching ventrals.

Ventrals shortish, reaching anal. Anal long and high, its free border concave. Dorsal considerably nearer caudal than snout. Ventrals a little nearer snout than caudal.

Lateral line with 46 scales, 9 rows above and 4 below it. Scales small, much crowded anteriorly. Lateral line strongly decurved, forming a broad and regular arc from opercle to opposite end of dorsal, thence nearly straight to the tail. Dorsal scales small. Region anterior to ventrals mostly naked.

Whole top of head, lower jaw, lower part of cheeks, suboperele, muzzle, whole region anterior to dorsal fin and down the sides nearly to the pectorals, studded with small whitish tubercles in the type specimens, which are spring males.

These prominences are smaller and more crowded than in *diplæmius*. In addition, minute asperities occur on the scales of the sides and about the ventral fins.

Color in spirits dark bluish above, pale below, not silvery. In life, males with the sides and fins clear bright red, back and especially the top of the head, a bright glaucous blue. Females probably pale olivaceous.

Length $2\frac{1}{3}$ inches. Teeth 2, 4–4, 2, as in *L. diplæmius*.

Habitat. Root R., Racine Co., Wis. (Hoy). Tributary of Rock R. (Copeland).

This species has been long known to Dr. Hoy and Dr. Kirtland, but it has hitherto escaped description. Specimens were long ago sent to Girard for description, but in some way they were lost. *L. cyanocephalus* resembles *L. diplæmius*, but it is smaller and more compact, with smaller fins. Dr. Kirtland's *Leuciscus diplemius* is the male of *Luxilus cornutus* var. *gibbus*, Cope. His *Leuciscus compressus* is probably, in part at least, the female of *Lythrurus diplæmius*.

21. **Chrosomus erythrogaster**, Rafinesque.

In an unfinished MS. "Review of the genus *Chrosomus*," Prof. Copeland shows that the current species of this genus, viz., *C. erythrogaster*, Raf. (= *C. oreas*, Cope), *C. pyrrhogaster*, Jordan (= *C. erythrogaster*, Ag.), and *C. eos*, Cope., are probably forms or varieties of one species, the alleged distinctions proving quite illusive.

Highly colored males of *C. erythrogaster* from Wisconsin have the fins bright yellow, and the scales of nearly the whole body provided with very minute tubercles, similar to those on the head of *Minnilus rubifrons.*

22. **Moxostoma anisurum** (Raf.).

Catostomus anisurus of Kirtland, and undoubtedly that of Rafinesque also, is the fish lately called *Ptychostomus collapsus* by Prof. Cope. *P. velatus*, Cope, seems to be the young of the same species.

23. **Placopharynx carinatus,** Cope.
Proc. Am. Philos. Soc. 1870.

Through the kindness of Dr. Levette, I have received a set of the pharyngeal bones of this species. A member of the Geological Survey informs me that they are found in a large, coarse species of sucker, which is common in the spring at Terre Haute and elsewhere on the Wabash. The genus and species were originally based on a single specimen, but there can be no doubt as to their validity. Since the above was written, I have seen another set of these bones from the Falls of the Ohio, and also a skull and part of the skeleton of this species, found in the Scioto R. at Columbus, Ohio, by Dr. J. M. Wheaton.

24. **Carpiodes difformis,** Cope.
Proc. Am. Philos. Soc. 1870.

The *Ichthyobus difformis* of Nelson (Bull. Ills. Mus. p. 49) is *Carpiodes cutisanserinus*, Cope. The two species are undoubtedly distinct, although I once held the contrary opinion.

25. **Carpiodes carpio,** Rafinesque.
Carpiodes nummifer, Cope. Proc. Am. Philos. Soc. 1870.

Although Rafinesque's *Catostomus* (*Carpiodes*) *carpio* is said to have 36 dorsal rays, yet his description so evidently refers to this common species, that I have adopted his specific name. I do not now think it necessary to unite *Ichthyobus* with *Carpiodes.*

26. **Ichthyobus bubalus,** Rafinesque.

This species, which reaches quite a large size, differs from its congeners in having the dorsal region but very little elevated, so that the axis of the body is very nearly midway between the dorsal and ventrals.

A specimen from the Wabash R., 27 inches long, and weighing 15 lbs., showed the following characters:—

Head = depth, $3\frac{1}{2}$ in length; eye, small, $6\frac{1}{2}$ in head; depth of head, $\frac{5}{6}$ its length; opercle, very wide, convex, and furrowed;

scales, very large; color, dull brownish-olive, not silvery. D. II. 27; A. I, 9; lateral line, 40.

27. **Ichthyobus cyanellus**, Nelson.
Bull. Ills. Mus. Nat. Hist. 1876, 49.

This species is undoubtedly distinct from all previously described, unless it be *I. rauchii*, Ag. Specimens from St. Louis, which I have identified as probably *I. rauchii*, differ from Nelson's types in several particulars, notably in the midway position of the dorsal. What Agassiz's *I. rauchii* and *I. stolleyi* really are, no one can tell from the descriptions.

I. cyanellus differs from *I. bubalus* in having a much deeper body, larger and higher dorsal, and smaller mouth.

28. **Ichthyobus ischyrus**, Nelson, sp. nov.

In the Illinois State Collection, Mr. Nelson has found still another species of this type, remarkable for the stout and deep body. The following description has been forwarded by him for publication:—

"This is a very stout and heavily built species. Depth, $2\frac{1}{2}$ in length; head, extremely broad between the eyes and but slightly convex; its length $3\frac{1}{2}$ times in length of body; snout, short and rounded, opercular apparatus large; depth of head, $1\frac{1}{5}$ in its length; width of head, $1\frac{1}{2}$; eye, $6\frac{2}{3}$ in head, $1\frac{2}{3}$ in snout, 4 in interorbital space; caudal peduncle a little deeper than long.

"Scales, 7–37–7, nearly uniform, a little crowded anteriorly, finely punctate. Fins, all small. Dorsal, I. 27; A. I. 8; bluish-olive above, yellowish below; fins blackish."

Type specimens $11\frac{1}{2}$ inches long, from Mackinaw Creek in Central Illinois, a tributary of Illinois R. Several younger specimens also in the State Collection.

29. **Bubalichthys altus**, Nelson, sp. nov.

"This specimen is very deep and much compressed. The back is much arched and the profile descends steeply in front to end of snout, not forming an angle with it as in many species of *Ichthyobus*.

"Depth of body, $2\frac{1}{2}$ in length; head, 4 in length; greatest thickness of body, $1\frac{2}{5}$ in length of head; depth of head, $1\frac{1}{5}$ in its length; width, $1\frac{1}{2}$ in length. Eye, $5\frac{1}{2}$ in head, $2\frac{1}{2}$ in interorbital space, which is but little rounded.

"Lateral line perfectly straight from upper edge of opercle to caudal.

"Scales, 8–35–5. Dorsal I. 25; A. I. 9.

"Color in spirits, dull yellowish-olive; fins dusky.

"Type specimen 12 inches long, in Ills. State Museum, from Cairo, Illinois."

The type specimen I have examined. It is certainly distinct from *B. bubalus*, Ag., and still more so from *B. niger*. *B. vitulus*, Ag., as far as one can tell, judging from the very superficial description, is also different. The most striking characters of *B. altus*, are the great depth and compression of the body.

30. **Bubalichthys bubalus**, Agassiz.

? *Catostomus bubalus*, Kirtland, Bost. Journ. Nat. Hist. (not of Rafinesque).

Bubalichthys bubalus, Agassiz, Am. Journ. Sc. Arts, 1855.

Four specimens of this species from the Mississippi River at Quincy, Illinois, show the following characters:—

Body considerably elevated and compressed above; the dorsal region sub-carinate; belly thicker. Depth $2\frac{3}{4}$ in length. Axis of the body above the ventrals, below the lateral line and nearly twice as far from the back as the belly. Greatest depth of body at beginning of dorsal, which is in advance of ventrals, and a trifle nearer the snout than the caudal.

Head wide, rounded across the top, wider above eyes than across cheeks. Interorbital space 2 in head. Head 4 in length of body, its greatest depth $1\frac{1}{8}$ in its length. Eye = snout 4 in head, much larger than in *B. niger*.

Mouth small, notably smaller than in *B. niger*, and with thinner lips, which are granulated and feebly plicate. Mandible about equal to eye. Humeral and suborbital bones slightly different from those of *B. niger*, quite unlike those of "*I. rauchii*."

Pharyngeal bones very strong, with large teeth, which grow larger downward. Intestinal canal long, longer than body.

A decided occipital depression. Head triangular in outline, viewed from the side. Ante-orbital region strongly elevated and curved; length of top of head $2\frac{3}{4}$ in distance from snout to occiput. Nostrils large.

Scales 8–40–6 in two specimens, 8–39–6 in one, 7–39–5 in the fourth.

Fin rays, D. I. 28 in two, I. 29 in rest. A. I. 10, V. i. 10.

Dorsal elevated in front and rapidly declined, the seventh ray half the length of the third or longest. The latter reaches to the base of the 18th ray, or more than half the base of the fin. Anal reaching caudal, its rays rapidly shortened. Pectorals shorter than anal, anal than ventrals, all than head.

Length of specimens, three, $12\frac{1}{2}$ inches, the fourth 12 inches. The species probably does not reach a large size.

It is probably best to retain the name *bubalus* for this fish, although it is perhaps doubtful whether it is really Agassiz's species, still more doubtful whether it is Kirtland's *C. bubalus*, and finally it is certainly not Rafinesque's *C. bubalus*, which is an *Ichthyobus.*

31. **Bubalichthys niger** (Rafinesque), Agassiz.
?? Catostomus (*Ictiobus*) *niger*, Raf. Ich. Oh., 1820, 56.
Bubalichthys niger, Am. Journ. Sc. Arts, 1855.

My specimens undoubtedly belong to Agassiz's *B. niger*, but Rafinesque's "entirely black, lateral line straight," are hardly sufficient to characterize his species.

Body much less elevated and less compressed than in *B. bubalus*, the back not at all carinated. Axis of body over the ventrals about at the lateral line, and but an eighth or tenth further from the dorsal line than the ventral. Greatest depth midway of body over ventrals and just in advance of dorsal. Depth $3\frac{1}{8}$ in length.

Head strongly transversely convex, almost ridged above, in length, less narrowed downwards than in *bubalus*. Greatest depth of head $1\frac{1}{8}$ in its length. Interorbital space $2\frac{1}{8}$. Eye = snout $5\frac{1}{2}$ in head, much smaller than in *bubalus*. Snout scarcely projecting. No depression at occiput. An almost even curve from snout to dorsal. Head bounded by curves, therefore not triangular, thicker, larger, and less pointed than in *bubalus*.

Mouth large, with a large and pappillose lower lip. Mandible longer than eye.

Scales 8–41–7.

Fin rays D. I. 30, A. I. 11.

Dorsal not so high nor so rapidly depressed as in *bubalus*, the longest ray scarcely half the length of the base of the fin, reaching to the 15th, the 9th ray, half the height of the first. Anal reaching caudal, its middle rays more rounded, not so much shorter than the first. Pectorals as long as ventrals, both longer than anal and less than head.

Color as in other species of *Ichthyobus* and *Bubalichthys*, but darker. Fins all black.

Length of specimen, from which above measurements are taken, 14 inches.

Habitat. Quincy, Illinois.

Supplement.

Revision of Genera and other Ichthyological matters.

XENOTIS, Jordan, gen. nov.

I have for some time noticed a striking difference in the character of the appendages to the anterior branchial arches in the different genera of sunfishes. In *Pomotis*, and part of the species of *Lepomis*, these appendages are soft, short, and blunt, similar to those on the other gill arches. In the other genera, one of the rows on the anterior arch is considerably modified—those on the lower part of the arch, at least, being stiffer, more slender, and very much longer than those in *Pomotis*. This character seems to me a very important one, and one of generic value. In this view I am supported by Prof. Cope.

The original type of *Lepomis*, Raf., was *Labrus auritus* of authors, which, with Prof. Gill, I identify as *Ichthelis rubricauda*, Holbrook, one of the species with long gill appendages. The name *Lepomis* remains, therefore, for those species with the gill rakers long.

For the species of the old genus *Lepomis*, with the gill appendages short, I would propose the name of *Xenotis*. The type of *Xenotis* is *Pomotis fallax*, B. & G. The full generic characters are given above.

The following species have been examined with reference to this character:—

Appendages long (*Lepomis*).	Appendages short, undifferentiated (*Xenotis*).
Auritus, Linné (type).	Fallax, B. & G. (type).
Appendix, Mitchill.	Sanguinolentus, Agassiz.
Incisor, Cuv. & Val.	Megalotis, Raf.
Speciosus, B. & G.	Nitidus, Kirtland.
Obscurus, Ag.	Inscriptus, Agassiz.
Aquilensis, Grd.	Breviceps, B. & G.
Anagallinus, Cope.	Popii, Grd.
Oculatus, Cope.	
Nephelus, Cope.	

The following are the changes in nomenclature in the *Centrarchidæ* which are considered necessary by Prof. Cope and the writer:—

(*a*) *Pomotis*, Cuvier, for *Pomotis*, Raf. (1819). Rafinesque's name can only be considered as a synonym of his own *Lepomis*. *Pomotis*, if used at all, must stand as characterized by Cuvier, who proposes it as a new genus, and makes no direct allusion to Rafinesque. It does not seem necessary to coin a new name for this group.

(*b*) *Apomotis*, Raf. 1819, for *Telipomis*, Raf. 1820 (Nelson emend.). *Apomotis* was based on two species, *cyanellus* and *macrochirus*, the first of which seems to belong to this genus as emended by us. In the Ichthyologia Ohiensis, the name *Apomotis* was without reason changed to *Telipomis*. The species referred by Cuvier to *Bryttus* probably belong to *Apomotis*, but, as no American author has recognized any of them, that point must at present remain undecided.

(*c*) *Calliurus*, Raf. 1819, for "*Micropterus*, Lacépède, 1800" (Gill emend.) = *Grystes*, *Huro*, *Dioplites*, etc., auct. Lacépède's original description of his *Micropterus dolomieu* is absurd, but his figure bears some resemblance to the black bass. Notwithstanding the fact that Cuvier asserts that Lacépède's original specimen, then still preserved in the museum, was identical with *Labrus salmoides*, Lac., since Lacépède found teeth on the tongue, only five branchiostegals and two anal spines, Cuvier's identification was uncertain and insufficient for the preservation of the name. Cuvier himself thought the name unworthy of adoption ("Le genre et l'espèce du microptère doivent disparaître du catalogue des poissons," Hist. Nat. des Pois., vol. v. p. v. Cuv. et Val.). In view of this, Prof. Cope thinks that *Micropterus* (like *Aplocentrus*, *Pogostoma*, and *Proceros*, Raf.) should be rejected as an unidentifiable myth, and the name next in order of priority—*Calliurus*, Raf.—be adopted as the generic name for the black bass.

EPISEMA, Cope and Jordan, gen. nov.

Pharyngeal teeth with the principal series 4–4, of the raptorial type, with acute edges. Alimentary canal short. Dorsal fin standing immediately above the ventrals. Fin radii normal; lips soft, not enlarged; the upper protractile; no barbels. Lateral line complete.

The above characters were formerly applied by Prof. Cope to the genus *Photogenis*, but it appears that the dorsal fin is not immediately above the ventral in *P. spilopterus*, the type, which must on this account be referred to the neighborhood of *Minnilus*.

Four of the seven species referred by Prof. Cope to *Photogenis* present the characters above enumerated, and one of them, the *P. scabriceps*, is regarded as the type of the genus so defined. As the name *Photogenis* was first employed for, and has been specially attached to, the *P. spilopterus*, it cannot be used for the *P. scabriceps* and its allies, so that a new name, *Episema*, is now proposed for the latter.

The following species are at present referred to *Episema*:—

Group I. Colors transparent, without pigment; scales with usual surface exposed.

Episema leucioda, Cope.
Episema telescopus, Cope.
Episema piptolepis, Cope.
Episema scabriceps, Cope (type).

Group II. Colors pigmented, brilliant; exposed surfaces of scales more narrow and high.

Episema (?) *pyrrhomelas*, Cope.
Episema callisema, Jordan.

The species last mentioned has the teeth in a single row.

Episema may be compared with related genera as follows:—

Teeth raptatorial, with the principal series 4–4; lateral line complete; fin radii normal; no barbels; lips soft, not enlarged.

- *a.* Teeth with masticatory surface developed.
  - *b.* Dorsal decidedly posterior to ventrals. LYTHRURUS.
  - *bb.* Dorsal over ventrals.
    - *d.* Scales normal. HYBOPSIS.
    - *dd.* Scales closely imbricated, the exposed surfaces high and narrow. LUXILUS.
- *aa.* Teeth with the edges crenate. CYPRINELLA.
- *aaa.* Teeth entire without masticatory surface.
  - *e.* Dorsal over ventrals. EPISEMA.
  - *ee.* Dorsal behind ventrals. MINNILUS.

Moniana, Grd., is not generically distinct from *Cyprinella*. *Codoma* and *Cliola* are, perhaps, synonymous with *Minnilus*. *Tigoma* is an "*omnium gatherum*," the precise value of which is not yet determined.

Minnilus xænurus, Jordan, sp. nov.

Form moderately elongated, subfusiform, heavy forwards; the head being decidedly like *Luxilus*. Depth $4\frac{1}{3}$ in length.

Head stout, somewhat elongated, about 4 in length, the snout but slightly overlapping the large, oblique mouth; the maxillary reaching the orbit. Head roundish above in males, with many small, whitish tubercles, not much crowded, and arranged somewhat in rows—one or two rows of these extend backwards to the dorsal; several series of strong tubercles on each side of caudal peduncle; one along each row of scales. These are very striking, and are apparently characteristic of this species.

Scales high, closely imbricated, as in *Luxilus cornutus*, dark edged, being punctate with black. Lateral line with 37 scales (36 to 39).

Color dark-steel-blue; silvery below; a faint black spot at base of caudal. Fins mostly bright crimson red in males, the dorsal largely black on its upper posterior part. Dorsal, anal, and caudal tipped with white pigment; belly, base of anal, ventral and pectoral fins with white pigment.

Eye large, $3\frac{3}{4}$ in head.

Dorsal low, $5\frac{1}{2}$ in length of body. Caudal fin large. Fin rays: dorsal 1.8; anal 1.11 (1.10). Length 3 to $3\frac{1}{4}$ inches.

Teeth 1, 4–4, 1, hooked, entire, without masticatory surface.

Hab. South Fork of the Ocmulgee River, at Flat Shoals, De Kalb Co., Georgia.

This species is one of the most beautiful of the *Cyprinidæ*. The long anal fin and the presence of rows of tubercles on the caudal peduncle are striking characters. The latter feature suggests the specific name (*xaino*, to scratch). It resembles *Episema pyrrhomelas*, Cope, but is distinguished at once by the generic character of the backward dorsal.

This species belongs to the subgenus of *Minnilus*, which has been called *Photogenis*. The following are the species of *Minnilus* as at present understood—several species now referred to other genera probably also belong here:—

Subgenus MINNILUS: colors transparent; little or no pigment; scales normal.

Minnilus arge, Cope.
Minnilus dinemus, Raf. (type of genus).
Minnilus jemezanus, Cope.

Minnilus lepidulus (Grd.), C. & J.
Minnilus micropteryx, Cope.
Minnilus matutinus, Cope.
Minnilus rubellus (Ag.), C. & J.
Minnilus dilectus (Grd.), C. & J.
Minnilus amœnus (Abbott), C. & J.
Minnilus megalops (Grd.), C. & J.
Minnilus amabilis (Grd.), Nelson.
Minnilus socius (Grd.), C. & J.
Minnilus stilbius, Jordan.
Minnilus umbratilis (Grd.), C. & J.
Minnilus percobromus, Cope.
Minnilus rubrifrons, Cope.
Minnilus altipinnis, Cope.
Minnilus oligaspis, Cope.
Minnilus simus, Cope.
Minnilus ariommus, Cope.
Minnilus photogenis, Cope.

Subgenus PHOTOGENIS: colors brilliant, pigmentary; scales imbricated, so that the exposed surfaces are high and narrow.

Minnilus spilopterus, Cope.
Minnilus analostanus (Grd.), C. & J.
Minnilus eurystomus, Jordan.
Minnilus callistius, Jordan.
Minnilus stigmaturus, Jordan.
Minnilus cœruleus, Jordan.
Minnilus xænurus, Jordan.
Minnilus lirus, Jordan.

The last species has the teeth 2, 4–4, 2, as in *Lythrurus;* the other colored species 1, 4–4, 1.

Certain species of *Ceratichthys*, Baird, were separated from that genus under the name of *Nocomis*, Girard, before *Ceratichthys* itself had ever been characterized. It seems necessary therefore to substitute *Nocomis* for *Ceratichthys*.

Moxostoma anisurum, Raf.

Catostomus (*Moxostoma*) *anisurus*, Raf. Ich. Oh. (not of Ag.).
Catostomus anisurus, Kirt. Bost. Journ. Nat. Hist.

Prof. Cope, after examination of one of my specimens of this species, dissents from my identification of *Ptychostomus collapsus*, Cope, with it, considering the *anisurum* a related species, previously unknown to him. I therefore give its full characters, leaving the matter for further investigation.

Body compressed, short and stout, the back strongly elevated. Depth $3\frac{2}{3}$ in length, without caudal.

Head $4\frac{1}{3}$ in body, short and thick, with vertical cheeks and a broad, flat, and steep interorbital space. Interorbital space equal to snout, $2\frac{1}{3}$ in head. Eye midway of head, 4 in length of head. A prominent depression across nose.

Mouth very small, the lower lip small, infolded, and Λ-shaped behind.

Pectorals small, reaching two-thirds the distance to the ventrals. Dorsal large; its height $\frac{5}{6}$ length of head; its last ray half-way between snout and base of caudal. Eyes large and high up.

Scales 5–44–4.

Fin rays: D. 1.15; A. 1.8; V. 9.

Color pale olivaceous; sides silvery; dorsal and caudal dark; lower fins orange.

Specimen described 12 inches long, from Lake Erie, at Toledo, Ohio.

Genera of Catostomidæ.

The genera of *Catostomidæ*, accepted by Prof. Cope and the writer, may be thus compared:—

* Body oblong or elongate, with a short, subquadrate dorsal fin of 10 to 17 developed rays (*Catostominæ*, Gill).

† Air-bladder in three parts; lateral line presênt; fontanelle present; scales large, subequal.

a. Pharyngeal bones very broad and strong; the lower 7 to 10 teeth on each side, greatly enlarged, smooth, and truncate above; the teeth on the upper part of the bone small, as usual in the family. PLACOPHARYNX, 1.

aa. Pharyngeal bones not specially enlarged; the teeth of the usual type. MOXOSTOMA, 2.

†† Air-bladder in two parts.

b. No lateral line; fontanelle present. ERIMYZON, 3.

bb. Lateral line well developed.

c. Fontanelle distinct. CATOSTOMUS, 4.

cc. Fontanelle obliterated by the union of the parietal bones. PANTOSTEUS, 5.

** Body much elongated, subcylindrical forwards; dorsal elongate, falciform, of 30 or more rays; fontanelle obliterated by the union of the parietal bones (*Cycleptinæ*, Gill).

d. Mouth small, subinferior, with pappillose lips. CYCLEPTUS, 6.

*** Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present (*Bubalichthyinæ*, Gill).

e. Pharyngeal bones narrow, with the teeth relatively thin and weak.

f. Mouth small, inferior, protractile downwards; fins often greatly elevated. CARPIODES, 7.

ff. Mouth larger, subterminal, protractile forwards (species of larger size, dusky colors, with lower dorsal). ICHTHYOBUS, 8.

ee. Pharyngeal bones strong; the teeth comparatively coarse and large, increasing in size downwards; dorsal fin moderately elevated; mouth inferior. BUBALICHTHYS, 9.

Of the above genera, *Carpiodes* and *Ichthyobus* are doubtfully distinct, such species as *C. carpio* connecting them closely.

Moxostoma, Rafinesque, 1820 (Jordan emend. 1876) is equivalent to *Ptychostomus*, Agassiz, 1854 = *Teretulus*, Cope, 1868. *Moxostoma*, Raf., is based on two species: *Catostomus anisurus* and *C. anisopterus*. The latter, described "from a drawing by Mr. Audubon," is unrecognizable or mythical; the former is a common species of "Red Horse," although Agassiz strangely misconstrued both Rafinesque's and Kirtland's descriptions of it. For *C. anisurus* and its numerous congeners, the name *Moxostoma*, having clear priority, must obviously be retained.

ON THE GENERA OF NORTH AMERICAN FRESH-WATER FISHES.

BY DAVID S. JORDAN AND CHARLES H. GILBERT.

In the present paper, the authors design to give in strict chronological order the names of all the genera thus far proposed which have been based on species of North American fresh-water fishes.

In the chronological catalogue is given under the head of each genus (*a*) its author, (*b*) the place where it was first proposed, and (*c*) its type species. In case no species is designated, either explicitly or virtually, as the type of a genus, the species first mentioned as belonging to it is, according to general custom, considered as the intended type.

A discussion of synonyms is next given; and, finally, an alphabetic list of genera with the etymology of generic names completes the paper.

No distinction has been here made between names proposed for "genera" and for "subgenera." Most modern "subgenera" have been at some time regarded as "genera," and most "subgenera" have been proposed in the expectation that future writers would elevate them to generic rank.

Generic names used without any sort of definition (e. g., *Cheilobus*, *Glanis*, *Miniculus*, *Oplictis*, *Leptostomia*, etc., of Rafinesque, Am. Monthly Magazine) have been left unnoticed, except in cases (e. g., *Apeltes*, Dekay, *Pygosteus*, Brevoort) where reference to some previously known species as the type is in itself a sort of characterization.

The authors have endeavored to ensure accuracy in quotations. A few works, not at present accessible to them, have been cited at second hand. These cases are designated by the use of quotation marks.

CATALOGUE.

Year.		Page.
1766.	Amia, Linnæus, Systema Naturæ I.	500
	Amia calva, Linnæus, 1766.	
1798.	Polyodon, Lacépède, Hist. Nat. des Poissons I.	402
	"P. feuille," Lac. 1798 (folium). (*Sine patria.*)	
1802.	Micropterus, Lacépède, "Hist. Nat. des Poissons IV."	324
	M. dolomieu, Lac. 1801. (*Sine patria.*)	

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1803.	Fundulus, Lacépède, Hist. Nat. des Poissons V.	37
	F. mudfish, Lac. 1803.	
1803.	Lepisosteus, Lacépède, Hist. Nat. des Poissons V.	331
	L. gavialis, Lac. 1803.	
1803.	Hydrargira, Lacépède, Hist. Nat. des Poissons V.	378
	H. swampina, Lac. 1803.	
1803.	Cyprinodon, Lacépède, Hist. Nat. des Poissons V.	486
	C. variegatus, Lac. 1803.	
1804.	Spatularia, Shaw, General Zoology V.	362
	S. reticulata, Shaw, 1804.	
1814.	Morone, Mitchill, Report in Part on Fishes of New York.	18
	Morone pallida, Mitch. 1814.	
1814.	Roccus, Mitchill, Report in Part on Fishes of New York.	25
	R. striatus, Mitch. 1814.	
1817.	Catostomus, LeSueur, Journal Acad. Nat. Sci. Phila. I.	89
	Cyprinus catostomus, Forster (C. hudsonius, LeS.).	
1818.	Notropis, Rafinesque, Amer. Monthly Magazine II.	204
	N. atherinoides, Raf. 1818.	
1818.	Platirostra, LeSueur, Journal Acad. Nat. Sci. Phila. I.	223
	P. edentula, LeS. 1818.	
1818.	Hiodon, LeSueur, Journal Acad. Nat. Sci. Phila. I.	364
	H. tergisus, LeS. 1818.	
1818.	Glossodon, Rafinesque, Amer. Monthly Magazine II.	354
	G. harengoides, Raf. 1818.	
1818.	Pomoxis, Rafinesque, Journal Acad. Nat. Sci. Phila. I.	417
	P. annularis, Raf. 1818.	
1818.	Sarchirus, Rafinesque, Journal Acad. Nat. Sci. Phila. I.	419
	S. vittatus, Raf. 1818.	
1818.	Exoglossum, Rafinesque, Journal Acad. Nat. Sci. Phila. I.	420
	E. lesueurianum, Raf. 1818.	
1818.	Maxillingua, Rafinesque, Journal Acad. Nat. Sci. Phila. I.	421
	Cyprinus maxillingua, LeSueur, 1818.	

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1818.	Hypentelium, Rafinesque, Journal Acad. Nat. Sci. Phila. I.	421
	Exoglossum macropterum, Raf. 1818.	
1818.	Litholepis, Rafinesque, Amer. Monthly Magazine III.	447
	L. adamantinus, Raf. 1818.	
1819.	Aplodinotus, Rafinesque, Journal de Physique, etc.	418
	A. grunniens, Raf. 1819.	
1819.	Etheostoma, Rafinesque, Journal de Physique.	419
	E. flabellaris, Raf.	
1819.	Pogostoma, Rafinesque, Journal de Physique.	419
	P. leucops, Raf. 1819.	
1819.	Leucops, Rafinesque, Journal de Physique.	419
	Pogostoma leucops, Raf. 1819.	
1819.	Aplocentrus, Rafinesque, Journal de Physique.	419
	Bodianus calliops, Raf. 1818.	
1819.	Calliurus, Rafinesque, Journal de Physique.	420
	C. punctulatus, Raf. 1820.	
1819.	Lepomis, Rafinesque, Journal de Physique.	420
	Labrus auritus, "of authors."	
1819.	Pomotis, Rafinesque, Journal de Physique.	420
	(No type; Cuvier emend.; type P. vulgaris, C. & V.).	
1819.	Apomotis, Raf., Journal de Physique.	420
	Lepomis cyanellus, Raf. 1819.	
1819.	Notemigonus, Rafinesque, Journal de Physique.	420
	N. auratus, Raf. 1819.	
1819.	Amphiodon, Rafinesque, Journal de Physique.	421
	A. alveoides, Raf. 1819 (misprint for alosoides).	
1819.	Amblodon, Rafinesque, Journal de Physique.	421
	Teeth of Aplodinotus grunniens, ascribed to A. bubalus, Raf. 1819.	
1819.	Cycleptus, Rafinesque, Journal de Physique.	421
	C. nigrescens, Raf. 1819.	
1819.	Noturus Rafinesque, Journal de Physique.	421
	N. luteus, Raf. 1819. (Called N. flavus in 1818.)	
1819.	Pylodictis, Rafinesque, Journal de Physique.	422
	P. limosus, Raf. 1819.	
1820.	Lepibema, Rafinesque, Ichthyologia Ohiensis.	23
	Perca chrysops, Raf. 1820.	

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1820.	Stizostedion, Rafinesque, Ichthyologia Ohiensis.	23
	Perca salmonea, Raf. 1818.	
1820.	Pomacampsis, Rafinesque, Ichthyologia Ohiensis.	23
	Perca nigropunctata, Raf. 1820.	
1820.	Icthelis, Rafinesque, Ichthyologia Ohiensis.	27
	Labrus auritus, L.	
1820.	Telipomis, Rafinesque, Ichthyologia Ohiensis.	27
	No type (L. cyanellus, Raf. 1819, Nelson emend.)	
1820.	Aplites, Rafinesque, Ichthyologia Ohiensis.	30
	Lepomis pallida, Raf. 1820.	
1820.	Nemocampsis, Rafinesque, Ichthyologia Ohiensis.	31
	Lepomis flexuolaris, Raf. 1820.	
1820.	Dioplites, Rafinesque, Ichthyologia Ohiensis.	32
	Lepomis salmonea, Raf. 1820.	
1820.	Ambloplites, Rafinesque, Ichthyologia Ohiensis.	33
	Lepomis ictheloides, Raf. 1820.	
1820.	Aplesion, Rafinesque, Ichthyologia Ohiensis.	36
	Etheostoma calliura, Raf. 1820.	
1820.	Diplesion, Rafinesque, Ichthyologia Ohiensis.	37
	E. blennioides, Raf. 1819.	
1820.	Pomolobus, Rafinesque, Ichthyologia Ohiensis.	38
	P. chrysochloris, Raf. 1820.	
1820.	Dorosoma, Rafinesque, Ichthyologia Ohiensis.	39
	D. notata, Raf. 1820.	
1820.	Clodalus, Rafinesque, Ichthyologia Ohiensis.	43
	Hyodon clodalus, LeSueur, 1818.	
1820.	Minnilus, Rafinesque, Ichthyologia Ohiensis.	45
	M. dinemus, Raf. 1820.	
1820.	Luxilus, Rafinesque, Ichthyologia Ohiensis.	47
	L. chrysocephalus, Raf. 1820.	
1820.	Chrosomus, Rafinesque, Ichthyologia Ohiensis.	47
	Luxilus erythrogaster, Raf. 1820.	
1820.	Semotilus, Rafinesque, Ichthyologia Ohiensis.	49
	S. dorsalis, Raf. 1820.	
1820.	Pimephales, Rafinesque, Ichthyologia Ohiensis.	52
	P. promelas, Raf. 1820.	
1820.	Moxostoma, Rafinesque, Ichthyologia Ohiensis.	54
	Catostomus anisurus, Raf. 1820.	

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1820.	Ictiobus, Rafinesque, Ichthyologia Ohiensis.	55
	Amblodon bubalus, Raf. 1819.	
1820.	Carpiodes, Rafinesque, Ichthyologia Ohiensis.	56
	Catostomus cyprinus, LeSueur, 1817.	
1820.	Teretulus, Rafinesque, Ichthyologia Ohiensis.	57
	No type.	
1820.	Eurystomus, Rafinesque, Ichthyologia Ohiensis.	60
	Catostomus megastomus, Raf. 1820.	
1820.	Decactylus, Rafinesque, Ichthyologia Ohiensis.	60
	Catostomus bostoniensis, LeSueur, 1817.	
1820.	Ictalurus, Rafinesque, Ichthyologia Ohiensis.	62
	Silurus maculatus, Raf. 1819.	
1820.	Elliops, Rafinesque, Ichthyologia Ohiensis.	62
	Silurus maculatus, Raf. 1819.	
1820.	Leptops, Rafinesque, Ichthyologia Ohiensis.	64
	Silurus viscosus, Raf. 1819.	
1820.	Opladelus, Rafinesque, Ichthyologia Ohiensis.	64
	Silurus nebulosus, Raf. 1819.	
1820.	Ameiurus, Rafinesque, Ichthyologia Ohiensis.	65
	Silurus cupreus, Raf. 1819.	
1820.	Ilictis, Rafinesque, Ichthyologia Ohiensis.	66
	Silurus limosus, Raf. 1819.	
1820.	Picorellus, Rafinesque, Ichthyologia Ohiensis.	70
	Esox vittatus, Raf. 1818.	
1820.	Cylindrosteus, Rafinesque, Ichthyologia Ohiensis.	72
	Lepisosteus platostomus, Raf. 1820.	
1820.	Atractosteus, Rafinesque, Ichthyologia Ohiensis.	73
	Lepisosteus ferox, Raf. 1820.	
1820.	Sturio, Rafinesque, Ichthyologia Ohiensis.	79
	Accipenser maculosus, LeSueur, 1817.	
1820.	Sterletus, Rafinesque, Ichthyologia Ohiensis.	80
	Accipenser sterletus, Raf. 1820.	
1820.	Dinectus, Rafinesque, Ichthyologia Ohiensis.	82
	Dinectus truncatus, Raf. 1820.	
1820.	Pegedictis, Rafinesque, Ichthyologia Ohiensis.	84
	P. ictalops, Raf. 1820.	
1820.	Proceros, Rafinesque, Ichthyologia Ohiensis.	87
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1821.	Mollienesia, LeSueur, Journal of Acad. Nat. Sci. Phila. II.	3
	M. latipinna, LeS. 1821.	
1828.	Huro, Cuvier and Valenciennes, Poissons II.	92
	H. nigricans, C. & V. 1828.	
1829.	Grystes, Cuvier and Valenciennes, Poissons III.	40
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1829.	Centrarchus, Cuvier, Poissons III.	62
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1829.	Pomotis, Cuv. & Val., Poissons III.	67
	P. vulgaris, C. & V. 1829.	
1831.	Bryttus, Valenciennes, Poissons VII.	346
	B. punctatus, C. & V. 1831.	
1833.	Aphredoderus, LeSueur, Poissons IX.	329
	A. gibbosus, LeSueur, 1833.	
1835.	Scaphirhynchus, Heckel, "Ann. Wien. Mus. I."	71
	S. rafinesquii, Heck. 1835.	
1842.	Percina, Haldeman, Journ. Acad. Nat. Sci. Phila. VIII.	330
	Perca nebulosa, Hald. 1842.	
1842.	Pileoma, Dekay, New York Zoology, Fishes.	16
	P. semifasciata, Dek. 1842.	
1842.	Boleosoma, Dekay, Nat. Hist. N. Y., Fishes.	20
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1842.	Uranidea, Dekay, Nat. Hist. N. Y., Fishes.	61
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1842.	Apeltes, Dekay, Nat. Hist. N. Y., Fishes.	67
	Gasterosteus quadracus, Mitchill, 1815.	
1842.	Argyrea, Dekay, Nat. Hist. N. Y., Fishes.	141
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1842.	Amblyopsis, Dekay, Nat. Hist. N. Y., Fishes.	187
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1842.	Baione, Dekay, Nat. Hist. N. Y., Fishes.	244
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1843.	Glossodon, Heckel, "Russegger's Reisen I."	1033
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1843.	Argyreus, Heckel, "Russegger's Reisen I."	1040
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1843.	Leucosomus, Heckel, " Russegger's Reisen I."	1042
	L. chrysoleucus, Heck. 1840 (not of Mitchill) =L. pulchellus, Storer.	
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1850.	Argyrosomus, Agassiz, Lake Superior.	339
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1850.	Rhinichthys, Agassiz, Lake Superior.	353
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1862.	Hypsifario, Gill, Proc. Acad. Nat. Sci. Phila.	331
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	Etheostoma maculata, Kirtland, 1838.	
1863.	Microperca, Putnam, Bull. Mus. Comp. Zool. I.	4
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1863.	Hololepis, Agassiz, in Putnam's Bull. Mus. Comp. Zool. I.	4
	Boleosoma barrattii, Holbrook, 1855.	
1863.	Cottogaster, Putnam, Bull. Mus. Comp. Zool. I.	4
	Boleosoma tessellatum, Thompson, 1853.	
1863.	Pleurolepis, Agassiz, Bull. Mus. Comp. Zool. I.	5
	Etheostoma pellucidum, Baird Mss. 1863.	
1863(?).	Schilbeoides, Bleeker, "Act. Soc. Sc. Indo-Nederl. IV."	258
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1864.	Mesogonistius, Gill, Am. Journ. Sc. and Arts.	92
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1864.	Gronias, Cope, Proc. Acad. Nat. Sc. Phila.	231
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1865.	Stilbius, Gill, Canadian Naturalist.	18
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1866.	Luciotrutta, Günther, Catalogue Fishes VI.	164
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1866.	Photogenis, Cope, Trans. Am. Phil. Soc.	378
	P. spilopterus, Cope, 1866.	
1867.	Phenacobius, Cope, Proc. Acad. Nat. Sc. Phila.	96
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1869.	Hemioplites, Cope, Journ. Acad. Nat. Sc. Phila.	217
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1870.	Hypohomus, Cope, Proc. Am. Phil. Soc.	449
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1870.	Labidesthes, Cope, Proc. Am. Phil. Soc.	455
	Chirostoma sicculum, Cope, 1865.	
1870.	Hemitremia, Cope, Proc. Am. Phil. Soc.	462
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1870.	Placopharynx, Cope, Proc. Am. Phil. Soc.	467
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1872.	Sarcidium, Cope, Hayden's Geol. Sur. Wyoming, 1870.	440
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1872.	Apocope, Cope, Hayden's Geol. Sur. Wyoming, 1871.	472
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1873.	Plesioperca, LeVaillant, Nouvelles Archives du Museum.	36
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1874.	Lepidomeda, Cope, Proc. Am. Phil. Soc.	131
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1876.	Erimyzon, Jordan, Bull. Buff. Nat. Hist. Soc.	95
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1876.	Eritrema, Cope, Lieut. Wheeler's Survey west of 100th meridian.	645
	Apocope henshavii, Cope, 1876.	
1876.	Pantosteus, Cope, Lieut. Wheeler's Survey west of 100th meridian.	673
	Minomus platyrhynchus, Cope, 1874.	
1876.	Glossoplites, Jordan, Manual Vertebrates, E. U. S.	233
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1876.	Eutychelithus, Jordan, Manual Vertebrates, E. U. S.	242
	Corvina richardsonii, Cuvier and Valenciennes, 1830.	
1876.	Eucalia, Jordan, Manual Vertebrates, E. U. S.	248
	Gasterosteus inconstans, Kirtland, 1840.	
1876.	Lythrurus, Jordan, Manual Vertebrates, E. U. S.	272
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1876.	Erinemus, Jordan, Manual Vertebrates, E. U. S.	279
	Ceratichthys hyalinus, Cope, 1869.	
1876.	Sternotremia, Nelson, Bull. Ill. Mus. Nat. Hist.	39
	S. isolepis, Nelson, 1876.	
1876.	Copelandia, Jordan, Bull. Buff. Soc. Nat. Hist.	137
	C. eriarcha, Jord. 1876.	
1876.	Xenisma, Jordan, Bull. Buff. Soc. Nat. Hist.	142
	X. stellifera, Jord. 1876.	
1876.	Scaphirhynchops, Gill, Mss. in Jordan and Copeland Bull. Buff. Soc. Nat. Hist.	161
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1877.	Imostoma, Jordan, Proc. Acad. Nat. Sc. Phila. Hadropterus shumardii, Grd. 1859.	49
1877.	Xenotis, Jordan, Proc. Acad. Nat. Sc. Phila. Pomotis fallax, B. & G. 1854.	76
1877.	Episema, Cope & Jordan, Proc. Acad. Nat. Sc. Phila. Photogenis scabriceps, Cope, 1867.	77

II. Synonyms.

The members of each of the following sets of genera appear to be founded on the same type species. In case no type is suggested by the original author, one of the species mentioned by him must be selected as the type. By the rule of exclusion, now largely adopted by systematic writers, some one of the species left after different genera may have been subtracted is to be considered as the type of the original genus, whether such type be the species first mentioned or not. Of such exact synonyms only the name first proposed should be employed, according to the rules of zoological nomenclature, unless for some reason the prior name be not available. The name to be adopted is in italics.

Type species.	*Genera.*
Etheostoma variata Kirt.,	Pœcilosoma (preoccupied), *Pœcilichthys*, Astatichthys.
Etheostoma olmstedi Storer,	*Boleosoma*, ? Arlina, Estrella.
Sciæna caprodes Raf.,	Percina, Pilcoma, Asproperca.
Calliurus melanops Grd.,	*Chænobryttus*, Glossoplites.
Perca iridea Bosc.,	*Centrarchus*, Eucentrarchus.
Labrus salmoides Lac.	*Micropterus*, Calliurus, Lepomis, Aplites, Nemocampsis, Dioplites, Grystes.
Aplodinotus grunniens Raf.,	Aplodinotus (*Haploidonotus*), Amblodon.
Triglopsis thompsoni Grd.,	*Triglopsis*, Ptyonotus.
Lucania sp. incog. Grd.,	*Girardinichthys*, Limnurgus.
Percopsis guttatus Ag.,	*Percopsis*, Salmoperca.
Salmo mackenzii Rich.,	*Stenodus*, Luciotrutta.
Hiodon tergisus Le S.,	Hiodon (*Hyodon*), Glossodon (Raf.), Amphiodon, Clodalus, Glossodon (Heck.)

Type species.	*Genera.*
Cyprinus cornutus Mit.,	*Luxilus*, Hypsolepis.
Cyprinus atronasus Mit.	Arygreus (preoccupied), *Rhinichthys.*
Leuciscus argenteus Storer,	Leucosomus, Cheilonemus.
Cyprinus maxillingua Le S.,	*Exoglossum*, Maxillingua.
Cyprinus Americanus Lac.,	*Notemigonus*, Stilbe, Stilbius.
Catostomus nigricans Le S.,	Hypentelium, ? Eurystomus, Hylomyzon.
Catostomus cyprinus Le S.,	*Carpiodes*, Sclerognathus.
Silurus olivaris Raf.,	Glanis (not char.), Pylodictis (erroneous), Leptops, Opladelus (*Hopladelus*), Ilictis.
Silurus punctatus Raf.,	*Ictalurus*, Elliops.
Litholepis adamantinus Raf.,	*Litholepis*, Atractosteus.
Polyodon folium Lac.,	*Polyodon*, Spatularia, Platirostra (Planirostra).
Acipenser platyrhynchus Raf.,	Scaphirhynchus (preoccupied), *Scaphirhynchops.*
Esox osseus Linn.,	Lepisosteus (*Lepidosteus*), Sarchirus.

III. Summary.

The foregoing catalogue comprises 225 names of genera and subgenera, whereof about 128 seem to be entitled to generic rank, and the remaining 97 are either synonyms, or else entitled to use only as designations for sections and subgenera in works where the recognition of such groups by name seems desirable.

A list of the authors referred to is here given, with the number of genera proposed by each, classified as valid and invalid as above indicated. Of course, until unanimity is reached in matters of nomenclature such an arrangement is extremely arbitrary.

Authors.	*Valid Genera.*	*Subgenera and Synonyms.*	*Total.*
Rafinesque	27	36	63
Girard	25	12	37
Agassiz	17	8	25
Cope	14	4	18
Gill	8	7	15
Jordan	8	2	10
Dekay	4	4	8
Lacépède	6	..	6
Le Sueur	4	1	5
Cuvier and Valenciennes	2	4	6
Heckel	1	4	5
Baird and Girard	3	1	4
Baird	..	3	3
Bleeker	1	1	2
Günther	..	3	3
Putnam	1	1	2
Le Vaillant	..	2	2
Mitchill	2	..	2
Linnæus	1	..	1
Shaw	..	1	1
Haldeman	1	..	1
Richardson	1	..	1
Thompson	..	1	1
Ayres	..	1	1
Brevoort	1	..	1
Nelson	1	..	1
Cope & Jordan	1	..	1
Total	128	97	225

IV. Nomenclator.

1864. Acantharchus: *akantha*, spine—*archos*, anus.
1856. Acomus: vox euphon.
1855. Acrocheilus: *akros*, sharp—*cheilos*, lip.
1859. Adinia: vox euphon.
1856. Agosia: vox euphon.
1856. Alburnellus: Alburnus. (Latin, albus, white.)
1856. Alburnops: Alburnus—*ops*, appearance.

1856. Algansea: vox euphon.
1856. Algoma: vox barbar.
1859. Alvarius: vox euphon.
1859. Alvordius: Ded. to Major B. Alvord.
1819. Amblodon: *amblus*, blunt—*odōn*, tooth.
1820. Ambloplites: *amblus*, blunt—*hoplitēs*, armed.
1842. Amblyopsis: *amblus*, blunt, *opsis*, vision.
1820. Ameiurus: *a*, privative—*meiouros*, curtailed (notched).
1766. Amia: *amia*, name of some sea fish; probably Sarda pelamys.
1819. Amphiodon: *amphi*, on all sides—*odon*, tooth.
1842. Apeltes: *a*, privative—*pelte*, a shield.
1833. Aphredoderus: *aphros*, foam—*deire*, neck.
1820. Aplesion: *haploos*, single—*plēsion*, near.
1820. Aplites: *haploos*, single—*hoplitēs*, armed.
1819. Aplocentrus: *haploos*, single—*kentron*, spine.
1819. Aplodinotus: *haploos*, single—*nōtos*, back (dorsal fin).
1872. Apocope: *apokopē*, a deficiency (lateral line).
1819. Apomotis: *a*, privative—*poma*, opercle—*ous*, ear.
1861. Archoplites: *archos*, anal—*hoplitēs*, armed.
1842. Argyrea: *argureos*, silvery.
1840. Argyreus: *argureos*, silvery.
1850. Argyrosomus: *arguros*, silver—*sōma*, body.
1859. Arlina: vox euphon.
1860. Asproperca: Aspro—Perca.
1874. Astatichthys: *astatos*, inconstant, never standing still—*ichthus*, fish.
1854. Astyanax: *astuanax*, the son of Hector.
1854. Atherinopsis: *atherine*, some small fish—*opsis*, appearance (*athar*, an arrow).
1820. Atractosteus: *atraktos*, spindle dart—*osteon*, bone.
1842. Baione: *baiōn*, some small fish known to the ancients.
1859. Boleichthys: *bolis*, a dart—*ichthus*, fish.
1842. Boleosoma: *bolis*, a dart—*sōma*, body.
1831. Bryttus: *bruttō*, to growl.
1855. Bubalichthys, *boubalos*, a buffalo—*ichthus*, fish.
1819. Calliurus: *kalos*, beautiful— *oura*, tail.
1855. Campostoma: *kampē*, curve—*stoma*, mouth.
1820. Carpiodes: Lat. *carpio*, a carp.
1854. Catonotus: *kato*, low—*nōtos*, back.

1817. Catostomus: *kato*, low—*stoma*, mouth.
1829. Centrarchus: *kentron*, spine—*archos*, anus.
1853. Ceratichthys: *keras*, horn—*ichthus*, fish.
1864. Chænobryttus: *chainō*, to gape, to yawn—*Bryttus*.
1855. Cheilonemus: *cheilos*, lip—*nēma*, thread (barbel).
1856. Cheonda: vox euphon.
1854. Chologaster: *chōlos*, maimed—*gastēr*, belly (ventral fins).
1820. Chrosomus: *chrōs*, color—*sōma*, body.
1856. Clinostomus: *klinō*, to incline—*stoma*, mouth.
1856. Cliola: vox euphon.
1820. Clodalus.
1854. Cochlognathus: *kochlos*, shell—*gnathos*, jaw.
1856. Codoma: vox euphon.
1872. Coliseus: *kolos*, a deficiency.
1876. Copelandia: Ded. to Herbert Edson Copeland.
1863. Cottogaster: *kottos*, sculpin—*gastēr*, belly.
1850. Cottopsis, Cottus: *opsis*, appearance.
1819. Cycleptus: *kuklos*, circle—*leptos*, slender (small round mouth).
1820. Cylindrosteus: *kulindros*, cylinder—*osteon*, bone.
1856. Cyprinella: *Cyprinus*.
1803. Cyprinodon: *kuprinos*, carp—*odōn*, tooth.
1820. Decactylus: *dekas*, ten—*tulos*, nail (ventral rays).
1820. Dinectus: *dis*, two— *nēktēs*, swimmer.
1856. Dionda: vox euphon.
1820. Dioplites: *dis*, two—*hoplitēs*, armed.
1820. Diplesion: *dis*, two—*plesion*, near (dorsal fin).
1820. Dorosoma: *doru*, lance—*sōma*, body.
1820. Elliops: (elliptical eyes).
1864. Enneacanthus: *ennea*, nine—*akantha*, spine.
1862. Entosphenus; *entos*, within—*sphenos*, wedge.
1877. Episema: *epi*, over; *sema*, banner (dorsal fin).
1865. Ericymba: *eri*, an intensive particle—*kumba*, cavity (mucous tubes).
1876. Erimyzon: *eri*, intensive particle—*muzaō*, to suck.
1876. Erinemus: *eri*, intensive particle—*nēma*, thread (barbel).
1876. Eritrema: *eri*, intensive particle—*trēma*, aperture (pores of lateral line).
1859. Estrella: vox euphon.
1820. Etheostoma: "Various mouths" (Rafinesque).

1876. Eucalia: *eu*, intensive particle—*kalia*, nest.
1864. Eucentrarchus: *eu*, intensive particle—Centrarchus.
1820. Eurystomus: *eurus*, wide—*stoma*, mouth.
1876. Eutychelithus: *eutuchēs*, lucky—*lithos*, stone.
1818. Exoglossum: *exo*, outside—*glōssa*, tongue.
1803. Fundulus: Lat. *fundus*, bottom.
1853. Gila: Gila River.
1860. Girardinichthys: *Girardinus* (Dr. Charles Girard)—*ichthus*, fish.
1818. Glossodon: *glōssa*, tongue—*odōn*, tooth.
1840. Glossodon: *glōssa*, tongue—*odōn*, tooth.
1876. Glossoplites: *glōssa*, tongue—*hoplitēs*, armed.
1864. Gronias: *grōnē*, a cavern.
1829. Grystes: *gruzō*, to growl.
1854. Hadropterus: *hadros*, strong—*pteron*, fin.
1869. Hemioplites: *hēmi*, half—*hoplitēs*, armed.
1870. Hemitremia: *hēmi*, half—*trēma*, pore (lateral line).
1854. Herichthys: *Heros*, an allied genus—*ichthus*, fish.
1854. Heterandria: *heteros*, different—*andria*, males.
1818. Hiodon: "toothed tongue" (*os hyoides*).
1863. Hololepis: *holos*, whole—*lepis*, scale (entirely scaly).
1856. Hudsonius: Hudson River.
1828. Huro: Lake Huron.
1855. Hybognathus: *hubos*, gibbous—*gnathos*, jaw.
1854. Hybopsis: *hubos*, gibbous—*opsis*, face.
1855. Hyborhynchus: *hubos*, gibbous—*rhugchos*, snout.
1803. Hydrargira: *hudōr*, water, *arguros*, silver.
1855. Hylomyzon: *hule*, mud—*muzaō*, to suck.
1854. Hyostoma: *hus*, hog—*stoma*, mouth.
1818. Hypentelium: *hupo*, below—*pente*, five (lower lip five-lobed).
1864. Hyperistius: *huper*, above (high)—*histion*, sail (dorsal fin).
1870. Hypohomus: *hupo*, below—*homos*, even, uniform.
1862. Hypsifario: *hupsi*, high—*fario*, a brook trout.
1854. Hypsolepis: *hupsi*, high—*lepis*, scale.
1820. Ictalurus: *ichthus*, fish—*ailouros*. cat.
1820. Icthelis: *ichthus*, fish—*hēlios*, sun
1820. Ictiobus: *ichthus*, fish—*bous*, buffalo.
1820. Ilictis: *ilus*, mud—*ichthus*, fish

1877. Imostoma: *eimi*, to move, to go—*stoma*, mouth.
1870. Labidesthes: *labia*, a pair of forceps—*esthio*, to eat.
1854. Lavinia: vox euphon.
1820. Lepibema: *lepis*, scale—*bēma*, a stair (from scaly bases of fins).
1874. Lepidomeda: *lepis*, scale—Meda.
1803. Lepisosteus: *lepis*, scale—*osteon*, bone.
1819. Lepomis: *lepis*, scale—*pōma*, opercle.
1823. Leptops: *leptos*, slender—*ops*, eye.
1819. Leucops: *leukos*, white—*ops*, eye.
1843. Leucosomus: *leukos*, white—*soma*, body.
1866. Limnurgus: *limnē*, a pond.
1818. Litholepis: *lithos*, stone—*lepis*, scale.
1859. Lucania: vox euphon.
1866. Luciotrutta: Lat. *lucius*, pike—*trutta*, trout.
1820. Luxilus: Lat. *lux*, shining, light ("shiner").
1876. Lythrurus: *luthron*, blood—*oura*, tail.
1818. Maxillingua: Lat. *maxilla*, jaw—*lingua*, tongue.
1856. Meda: vox euphon.
1854. Melanura: *melas*, black—*oura*, tail.
1864. Mesogonistius: *mesos*, middle—*gōnia*, angle—*histion*, sail.
1863. Microperca: *mikros*, small—Perca (*perkē*).
1801. Micropterus: *mikros*, small—*pteron*, fin.
1865. Micristius: *mikros*, small—*histion*, sail (dorsal fin).
1820. Minnilus: Eng. minnow; Fr. *menuise;* Lat. *minus*, small.
1856. Minomus: vox euphon.
1821. Mollienesia: Ded. to Monsieur Mollien (French Minister of Finance, a patron of Péron).
1856. Moniana: *monos*, single (row of pharyngeal teeth). (?)
1814. Morone.
1820. Moxostoma: *muzaō*, to suck—*stoma*, mouth.
1855. Mylocheilus: *mulos*, millstone, grinder—*cheilos*, lip.
1872. Myloleucus: *mulos*, grinder—*leukos*, shiner.
1855. Mylopharodon: *mulos*, grinder—*pharugx*, pharynx—*odōn*, tooth.
1820. Nemocampsis: *nēma*, thread (lateral line)—*kampsos*, curved.
1856. Nocomis: "Daughter of the Moon." (Longfellow.)
1819. Notemigonus: *nōtos*, back—*hēmi*, half—*gōnos*, angle.
1863. Nothonotus: *nothos*, spurious—*nōtos*, back.

1818. Notropis: *nōtos*, back—*tropis*, keel.
1819. Noturus: *nōtos*, back—*oura*, tail.
1859. Oligocephalus: *oligos*, few (small)—*kephalē*, head.
1820. Opladelus: *hoplon*, armature—*adēlos*, invisible, concealed.
1856. Orthodon: *orthos*, straight—*odōn*, tooth.
1876. Pantosteus: *pantos*, entirely—*osteon*, bone.
1820. Pegedictis: *pēgē*, spring—*ichthus*, fish.
1842. Percina: *Perca*.
1850. Percopsis: Perca (*perkē*)—*opsis*, appearance.
1867. Phenacobius: *phenax*, deceptive—*bios*, life.
1866. Photogenis: *phōs*, light—*gennao*, to bear (born of light).
1820. Picorellus: pickerel (vernacular).
1842. Pileoma: *pileo*, to comb (ctenoid ?).
1820. Pimephales: *pimelēs*, fat—*kephalē*, head.
1870. Placopharynx: *plax*, broad—*pharugx*, pharynx.
1874. Plagopterus: *plage*, a wound—*pteron*, fin.
1820. Plargyrus: *pleura*, side—*arguros*, silvery.
1818. Platirostra: *platus*, broad—Lat. *rostrum*, snout. (Vox hybrida.)
1861. Platygobio: *platus*, broad—*Gobio*.
1874. Plesioperca: *plēsion*, near—*Perca*.
1863. Pleurolepis: *pleuron*, side—*lepis*, scale.
1854. Pœcilichthys: *poikilos*, variegated—*ichthus*, fish.
1850. Pœcilosoma: *poikilos*, variegated—*sōma*, body
1798. Polyodon: *polus*, many—*odōn*, tooth.
1854. Pogonichthys: *pōgōn*, beard—*ichthus*, fish.
1819. Pogostoma: *pōgōn*, beard—*stoma*, mouth.
1820. Pomacampsis: *pōma*, opercle—*kampsis*, curved.
1820. Pomolobus: *pōma*, opercle—*lobos*, lobe.
1820. Pomotis: *pōma*, opercle—*ous*, ear.
1818. Pomoxis: *pōma*, opercle—*oxus*, sharp.
1861. Potamocottus: *potamos*, river—*Cottus*.
1820. Proceros: *pro*, before—*keras*, horn.
1872. Protoporus: *prōtos*, before—*poros*, pore.
1855. Ptychocheilus: *ptuche*, a fold—*cheilos*, lip.
1855. Ptychostomus: *ptuche*, a fold—*stoma*, mouth.
1860. Ptyonotus: *ptuon*, fan—*nōtos*, back.
1861. Pygosteus: *puge*, vent, rump—*osteon*, bone.
1819. Pylodictis: *pelos*, mud—*ichthus*, fish.
1850. Rhinichthys: *rhin*, snout—*ichthus*, fish.

1856. Richardsonius: Ded. to Sir John Richardson.
1814. Roccus: vox barbar. (Rock fish.)
1850. Salmoperca: *Salmo—Perca.*
1818. Sarchirus: *sarx*, flesh—*cheir*, hand.
1872. Sarcidium: *sarkidion*, a little lump of flesh.
1876. Scaphirhynchops: *Scaphirhynchus—ops*, appearance.
1835. Scaphirhynchus: *skaphe*, spade—*rhugchos*, snout.
1863? Schilbeoides: *Schilbe.*
1844. Sclerognathus: *skleros*, hard—*gnathos*, jaw.
1859. Scolecosoma: *skōlēx*, a worm—*sōma*, body.
1820. Semotilus: *sēma*, banner (dorsal fin)—*telia*, or some other word used by Rafinesque for "spotted."
1856. Siboma: vox euphon.
1804. Spatularia: Lat. *spatula.*
1860. Stenodus: *stenos*, narrow—*odōn*, tooth.
1820. Sterletus: Sterlet, a European sturgeon.
1876. Sternotremia: *sternon*, breast, thorax—*trēma*, vent.
1842. Stilbe: *stilbē*, to shine, to glitter.
1865. Stilbius: *stilbē*, to shine, to glitter.
1820. Stizostedion: *stizō*, to prick—*stēthos*, breast.
1820. Sturio: Lat. *sturgeon.*
1859. Synechloglanis: *sunēcho*, to repeat, to re-echo—*glanis*, the fish "Silurus."
1820. Telipomis: *telia*, "spotted" (see Semotilus)—*pōma*, opercle.
1820. Teretulus: Lat. *teres*, terete.
1856. Tiaroga: vox barbar.
1856. Tigoma: vox barbar.
1851. Triglopsis: *Trigla—opsis*, appearance.
1859. Typhlichthys: *tuphlos*, blind—*ichthus*, fish.
1842. Uranidea: *ouranos*, sky, heavens—*eidō*, to gaze.
1876. Xenisma: *xenisma*, surprise.
1877. Xenotis: *xenos*, wonderful—*ous*, ear.
1854. Zygonectes: *zugos*, a yoke (in pairs)—*nēktēs*, swimmer.

LIST OF PLANTS RECENTLY COLLECTED ON SHIPS' BALLAST IN THE NEIGHBORHOOD OF PHILADELPHIA.

BY ISAAC BURK.

Since 1867, when Aubrey H. Smith, Esq., published his "Notes on some Colonies of Plants," in the Proceedings of the Academy, there have been large additions made to the number, and, as some of them are likely to become permanent colonists, and others are interesting, either from their rarity or the place of their nativity, I propose to give a list of such as have been collected since that time as far as I have been able to ascertain them.

The extensive improvements made in the lower portion of the city by the Pennsylvania Railroad and the American Steamship Company, and the consequent increase in the number of vessels required to carry away merchandise and produce, have been the means of introducing a great variety of plants, many of which exist but a single season and then disappear, whilst others maintain a foothold for a longer period.

Some which do not flower the first year were given the protection of a cool greenhouse, and in this way I have become acquainted with some very interesting plants.

Much of the land on which these improvements have been made was low marsh, which was covered with the mud dredged from the docks, and when this had attained sufficient consistency covered with any kind of ballast which could be obtained, much of it being chalk or oolite, showing that it came from British ports, and producing plants common in such localities.

To avoid repetition I have not given the native habitat of such as are common on the British coasts, whether native or naturalized, as it is reasonable to suppose we have received them from that source, but in all cases where they are not noticed in the British flora, I have endeavored to give the habitat of each species.

1. Ranunculus philonotis, Ehr. Kaighn's Point.
2. Papaver dubium, L. Kaighn's Point.
3. Papaver hybridum, L. Kaighn's Point.
4. Sisymbrium Sophia, L. Greenwich Point.
5. Sisymbrium irio, L. Kaighn's Point.
6. Erisymum cheiranthoides, L. Old Navy Yard.

7. Brassica tenuifolia, Boiss. Kaighn's and Greenwich Points.
8. Brassica monensis, Boiss.
9. Brassica erucastrum, Bull. Huds.
10. Lepidium latifolium, L.
11. Rapistrum rugosum, All.
12. Alyssum incanum, L. Berton, D. C.
13. Reseda luteola, L. Kaighn's Point.
14. Reseda lutea, L. Greenwich Point.
15. Reseda lutea var. maritima. Greenwich Point.
16. Reseda alba, L. Greenwich Point.
17. Reseda odorata, L. Greenwich Point.
18. Gynandropsis pentaphylla, D. C. Girard Point. Nat. of S. America.
19. Cleome pungens, Willd. Very abundant at Greenwich Point along with Polygonum Orientale on mud freshly dredged from the bottom of the river. S. America.
20. Silene inflata, Smith. Greenwich Point.
21. Silene noctiflora, L. Greenwich Point.
22. Lychnis vespertina, Sibth. Greenwich Point.
23. Lychnis diurna, Sibth. Greenwich Point.
24. Vaccaria vulgaris, Host. Greenwich Point.
25. Corregiola littoralis, L. Kaighn's Point. Very rare.
26. Frankenia pulverulenta, L. Kaighn's Point. A single specimen.
27. Tribulus terrestris, L. Greenwich and Kaighn's Points.
28. Malva parviflora, L. Greenwich and Kaighn's Points.
29. Sphæralecea miniata, Spach. Kaighn's Point. Nat. of South America.
30. Geraneum dissectum, L. Greenwich Point.
31. Geraneum molle, L. Kaighn's Point.
32. Oxalis corniulata, L. Greenwich Point. Bentham seems to think this has been introduced into England from America, but it appears to be much more common there than here, and Linnæus gives Italy, Sicily, and Germany as its native habitat.
33. Medicago sativa, L. Kaighn's and Greenwich. Of a weak prostrate habit. Specimens at the Centennial Exhibition, grown in Kansas, were much stouter and rigidly erect.
34. Trigonella Monspeliaca, L.
35. Trigonella ornithopodoides, L. A single specimen.
36. Lotus corniculatus, L. Kaighn's Point.
37. Trifolium hybridum, L. This appears likely to take permanent possession of the sandy soil of New Jersey, and will probably make a valuable forage plant.
38. Lathyrus aphaca, L. Kaighn's Point. A single plant.
39. Psoralea bituminosa, L. Kaighn's Point. Native of S. Europe.
40. Potentilla reptans, L. Kaighn's Point.

41. Potentilla rivalis, Nutt. Greenwich Point. This is described as a native of Colorado and the Western States, and it is singular how it should have found its way here, but it is possible it may have a much wider range than supposed, and might easily be mistaken for a slender form of P. Norwegica, L.
42. Lythrum alatum, Ph. Greenwich Point.
43. Ecbalium agrestis, Reich. Nat. of Southern Europe.
44. Tetragonia, sp. Kaighn's Point.
45. Mesembryanthemum nodosum, L. Kaighn's Point.
46. Scandix pecten, L. Kaighn's Point.
47. Richardsonia scabra, St. Hil. Nat. S. America—Brazil to Peru.
48. Calycera balsamitifolia, Rich. Kaighn's Point. Nat. of Chili. Interesting as a representative of the rare natural order Calycerea.
49. Mikania gonocladus, D. C. Kaighn's Point. Nat. of the West Indies and Mexico.
50. Acanthospermum xanthoides, D. C. Kaighn's and Girard Points.
51. Acanthospermum hispida, D. C. Both natives of Brazil.
52. Bidens leucantha, Willd. Old Navy Yard. Native of the Southern States.
53. Grindelia glutinosa, Dunal. Kaighn's Point. South America.
54. Anthemis nobilis, L. Greenwich.
55. Anthemis tinctoria, L. Greenwich.
56. Chrysanthemum segetum, L. Greenwich.
57. Matricaria chamomilla, L. Greenwich.
58. Matricaria inodora, L. Greenwich.
59. Artemisia vulgaris, L. Greenwich.
60. Artemisia absynthium, L. Greenwich.
61. Centaurea cyanus, L. Greenwich.
62. Centaurea nigra, L. Greenwich.
63. Centaurea solstitialis, L. Greenwich.
64. Carduus tenuifolius, L. Kaighn's and Greenwich.
65. Tussilago Farfara, L. Kaighn's and Greenwich.
66. Senecrio Jacobæa, L. Kaighn's Point.
67. Calendula arvensis, L. Kaighn's and Greenwich Points.
68. Onopordon acanthium, L. Greenwich.
69. Picris hieracioides, L. Greenwich.
70. Helminthia echioides, Gært. Kaighn's and Greenwich Points.
71. Crepis tectorum, L. Greenwich Point.
72. Crepis biennis, L. Greenwich Point.
73. Hypochæris radicata, L. Greenwich Point.
74. Apargia hirta, Hoff. Greenwich Point.
75. Plantago coronopus, L. Old Navy Yard.
76. Linaria spuria, Willd. Greenwich.
77. Linaria Elatine, Desf. Kaighn's Point.
78. Linaria minor, L. Kaighn's Point.
79. Antirrhinum Orontium, L. Kaighn's Point.

80. Veronica hederæfolia, L.
81. Veronica Buxbaumii, Tenore. Greenwich Point.
82. Scrophularia aquatica, L. Kaighn's Point.
83. Scoparia flava, Cham. Kaighn's Point. Nat. of South America.
84. Mentha aquatica, L. Petty's Island.
85. Ballota nigra, L. Kaighn's Point.
86. Stachys annua, L. Kaighn's Point.
87. Stachys sylvatica, L. Greenwich Point.
88. Stachys arvensis, L. Greenwich Point.
89. Tournefortia heliotropioides, Hook. Kaigkn's Point. Nat. of Beunos Ayres.
90. Solanum sisymbrifolium, Lam. Native of Brazil.
91. Solanum rostratum, Dunal. Native of the Western States and Territories.
92. Solanum eleagnifolium, Cav. S. America, Mexico, and Chili.
93. Datura Metel, L. Girard Point. Nat. of East Indies.
94. Nicotiana glauca, Graham. Kaighn's Point. Nat. of Brazil.
95. Nicotiana longiflora, Cass. Kaighn's Point. Native of Chili, but naturalized to some extent in this neighborhood.
96. Hyoscyamus niger, L. Kaighn's Point.
97. Hyoscyamus alba, L. Kaighn's Point. Southern Europe.
98. Chenopodium polyspermum, L. Kaighn's and Greenwich Points.
99. Chenopodium vulvaria, L. Kaighn's and Greenwich Points.
100. Atriplex rosea, L. Greenwich, very abundant on chalky ballast, and with A. patula and A. arenaria presenting a great variety of forms.
101. Blitum maritimum, L. Greenwich Point.
102. Alternanthera achyrantha, R. Br. E. I., S. America, and Brazil.
103. Amarantus blitum, L. Greenwich Point.
104. Amarantus deflexus, L. Greenwich Point.
105. Polygonum herniarioides, Nutt. Camden. One specimen.
106. Polygonum amphibium, L., var. terrestre, Willd. Greenwich Point.
107. Rumex maritimus, L. Greenwich Point.
108. Beta maritima, L., var.
109. Euphorbia paralias, L. Girard Point.
110. Euphorbia peplis, L. Greenwich Point.
111. Euphorbia peplus, L. Greenwich Point.
112. Euphorbia segetalis, L. Greenwich Point.
113. Mercurialis annua, L. Kaighn's and Greenwich Points.
114. Carex muricata, L. Kaighn's Point.
115. Agrostis spica venti, L. Kaighn's and Greenwich Points.
116. Agrostis ovina, L. Greenwich.
117. Alopecurus pratensis, L. Greenwich.
118. Phalaris paradoxus, L. Greenwich, E. Indies, and shores of the Mediterranean.
119. Lolium Italicum, Braun. Kaighn's Point.
120. Hordeum murinum, L. Kaighn's Point.

121. Panicum colonnum, L. Nat. of India, but found in Florida by Dr. Chapman.
122. Panicum miliacea, L. Kaighn's and Greenwich Points.
123. Andropogon halapensis, L. Girard Point. Nat. of Syria.
124. Pragmitis communis, L. Kaighn's Point. If this is not a distinct species, it is a very singular variety. The whole plant is but about 2 feet high, and of a pale glaucous hue. It has been growing there for two or three years, but did not flower till this season.
125. Holcus mollis, L. Kaighn's Point.

I am under obligations to Messrs. Parker and Martindale who collected many of the plants, and to Professor Porter who assisted in naming them.

THE VALSEI OF THE UNITED STATES.

BY M. C. COOKE, M.A., A.L.S.

As a contribution towards the more complete and satisfactory knowledge of the Fungi of the United States, I have from time to time essayed the revision of particular groups, in order to bring together the determined, as well as the doubtful or uncertain species, in order to assist the student, and serve as a basis for a more perfect and critical enumeration.

The present group has been selected as having been subjected to a more critical examination than many others, and as being a large and important one in which it is probable many important additions will yet be made.

The classification adopted is a purely artificial arrangement, which it was thought would best serve the purpose which this communication had in view. It will be observed that the names of only two genera are included, namely, *Valsa* and *Melanconis*, whereas many of the mycologists of the day admit several genera, amongst which they distribute the species. A very few words of explanation will exhibit my views on this subject, with which most European mycologists are familiar.

The principles on which the new genera have been constructed are held to be unsound and delusive, inasmuch as the fundamental assumption that the character of the fructification should hold the first rank, and all other characters be subsidiary to this, tends to reduce a natural to a purely artificial system. They are also unworthy because retrogressive.

In the genus *Valsa*, for example, it has been proposed that the limits of the genus should be confined to such species as have simple sporidia. For species with uniseptate sporidia the genus *Valsaria* was first proposed. This again became modified under *Diaporthe*. This, however, did not satisfy the cravings of the supposed reformers, for after passing through almost every type of sporidia and constituting new genera for them, they reverted to the number of the sporidia contained in each ascus, and, whereas, *Valsa* was to include all octosporous species with simple spores, the species with a larger number of sporidia were to be relegated to *Valsella*.

That this view is unsound it is only necessary to refer to *Valsa* *salicina*, which has sometimes a tetrasporous form, which was at one time supposed to be a distinct species under the name of *Valsa tetraspora*, and it is sometimes octosporous as in typical *Valsa salicina*. If Tulasne is right, then *Sphæria ditopa*, with its polysporous asci, is the same species as *Sphæria conformis* with octosporous asci, and both grow together on the same twig. If the proposed basis of classification be sound, then it is applicable here, and we have the same species, in two conditions, belonging to two distinct genera, which is simply an absurdity.

Without attempting here to enter into details wherefore we have rejected each individual genus, it will be sufficient to announce our faith in the sufficiency of the Friesian system based on external characters supplemented by internal structure. No objection can be urged against the artificial grouping of the members of any one genus by means of the sporidia, as adopted here, for any special purpose, provided always that no fictitious value be assigned to the groups.

The following is the order in which the species are arranged:—

VALSA, Fries, S. V. S., p. 410.

Sect. I. Sporidia hyaline.
- A. Sporidia allantoid, or sausage-shaped—minute.
  - α. Asci polysporous.
  - β. Asci octosporous.
    - * Ostiola sulcate.
      - *a*. Necks abbreviated.
      - *b*. Necks elongated.
    - ** Ostiola not sulcate.
      - *a*. Necks abbreviated.
      - *b*. Necks elongated.
- B. Sporidia allantoid, or sausage-shaped—large.
- C. Sporidia cylindrical.
- D. Sporidia fusiform.
- E. Sporidia subelliptical.
- F. Sporidia uniseptate.
  - α. Without appendages.
  - β. With appendages.
- G. Sporidia multiseptate.

Sect. II. Sporidia colored.
- A. Sporidia simple.
- B. Sporidia uniseptate.
- C. Sporidia multiseptate.
  - α. Without appendages.
  - β. With appendages.
  - γ. With transverse septa, or fenestrate.

The known species being arranged in the above order, the uncertain, or imperfectly known species, chiefly those of Schweinitz, follow in the hope that their enumeration may eventually lead to a knowledge of their fructification. Any such information derived from authentic sources will be accepted with gratitude.

Sect. I. Sporidia hyaline.

A. Sporidia allantoid (minor).

α. Asci polysporous.

1. **Valsa melastoma,** Fries S. V. S. 411; Schwz. Am. Bor. 1341; Nitschke Pyr. Germ., p. 237.

Sporidia numerous, .005 × .001 mm. On apple. Penna. (Schw.).

We have seen no American specimens, and give the characters of the fruit from Nitschke.

Valsa angulata, Fr., is more closely allied to *Diatrype*.

β. Asci octosporous.

* Ostiola sulcate.

a. Necks abbreviated.

2. **Valsa stellulata,** Fries, S. V. S. p. 411; Ntke. Pyr. p. 165; Schw. Bor. 1313; Cooke Handbk. No. 2461.

Sporidia .008–.012 × .002 mm. On bark of various trees. Common. Carolina (Rav. Curt.). Penna. (Michener). Texas (Wright). New Jersey (Berk.). Ohio (Lea). New England (Sprague).—*Ravenel Fungi*, *Car.* i. 51.

3. **Valsa tetraploa,** B. & C.; Cooke Handbk. 2478.

Sporidia about .01 mm. long. On branches. Carolina (Curt. Rav.). New Jersey (Ellis).

Berkeley has latterly united this, or at least some forms of it, with *Valsa stellulata.*

4. **Valsa fraxinicola,** C. & Pk. in N. Y. Museum Reports.

Sporidia .008–.012; very slightly curved, amber-colored. On *Fraxinus Americana.* New York (Peck, 232). Measurements given from an authentic specimen.

5. **Valsa Berchemiæ,** Cooke in herb. (*Valsa syngenesia*, var. *Berchemiæ* Curt. in lett.)

Sporidia .008–.01 mm., pale-brownish. On *Berchemia.* Carolina (Curt. Rav. 1205). Differing in habit from *V. syngenesia*, and also from the foregoing.

6. **Valsa monticulosa,** B. & C. in herb.

Sporidia .008–.01 mm. long. On *Magnolia glauca.* Carolina

(Curt.). Sporidia from authentic specimen sent out by the late Dr. Curtis.

7. **Valsa tumidula,** C. & Pk. in N. Y. Museum Reports.

Sporidia .01–.012 mm. long, pale-brownish. On *Cratægus* and *Platanus*. New York (Peck, 266; Gerard, 35). New Jersey (Ellis). There is a distinct black line on the wood surrounding the perithecia.

8. **Valsa platani,** Schw. Am. Bor. 1372.

Sporidia .01–.012 × .003 mm., pale. On *Platanus*. Carolina (Curt. Rav. 1821). New Jersey (Ellis). New York (Peck). Habit somewhat that of *V. quaternata*; measurement given from specimen sent by Dr. Curtis.

9. **Valsa goniostoma,** B. & C. in Curt. Cat., p. 142.

Sporidia .008–.011 mm., pale-brown. On branches. Carolina (Curtis). Sporidia from specimen communicated by Dr. Curtis.

10. **Valsa rugiella,** C. & E. in Grevillea, vol. v. pp. 92.

Ostiola minute, faintly sulcate, sporidia about .006 mm. long. Asci very small, lanceolate. On *Acer rubrum*. New Jersey (Ellis 2426), with the habit of *V. tetraploa*, but with smaller sporidia.

11. **Valsa juglandina,** C. & E. in Grevillea, vol. v. pp. 92.

Perithecia, 3–5 together, rather large and prominent, with a snowy white powder about the base. Ostiola deeply sulcate. Sporidia .01–.012 × .003 mm. On *Juglans regia*. New Jersey (Ellis, 2421). Certainly not *V. juglandicola*, Schw., and distinct from *V. stellulata*, to which it is allied.

12. **Valsa leaiana,** Berk. in Hook. Lond. Journ. 1845, p. 311.

Sporidia .007 × .002 mm., pale-brown. On Hornbeam. Ohio (Lea). S. Carolina (Rav. 1364). Sporidia from authentic specimen.

13. **Valsa vitis,** Schw. Am. Bor. 1362 (not Nitschke).

Sporidia .012–.014 mm. long. On twigs of *Vitis*. New York (Peck). Penna. (Mich.). Carolina (Curt.). The *Valsa vitis*, Fckl. & Ntkc. is quite a different species, although it has been referred to this for which the name of *Valsa vitigera* will have to be substituted, as Schweinitz has priority. (Grevillea v. p. 125.)

14. **Valsa cerviculata,** Fries, S. V. S. 411; Schw. Am. Bor. 1825; Ntke. Pyr. p. 174; Not Sfer. Ital. tab. 33.

Sporidia .006–.007 × .002 mm. On Hornbeam, etc. Bethlehem

(Schw.). Measurement of sporidia given from European specimens, not having seen it from the United States.

15. **Valsa radula,** Pers. Syn. p. 37; Schw. Am. Bor. 1369; Nitschke Pyr. Germ. p. 164?

Sporidia .01–.012 mm. long. On *Populus*. Carolina (Schw.). Measurements from European specimens.

16. **Valsa prunastri,** Fr. S. V. S. p. 411; Schw. Am. Bor. 1312; Ntke. Pyr. 170; Not Sfer. Ital. t. 35; Cooke Hdbk. 2460.

Sporidia .006–.008 × .0015 mm. On *Cerasus*. South Carolina (Rav. 1271; Curt. Schw.); Penna. (Schw.).

b. Necks elongated.

17. **Valsa corynostoma,** B. & C. in Grevillea, No. 871.

Sporidia .006–.008 × .0015 mm. On *Acer rubrum*. S. Car. (Rav. 1587; Curt.). Measurements from authentic specimen in herb. Berkeley.

** Ostiola not sulcate.

b. Necks abbreviated.

18. **Valsa nivea,** Fr. S. V. S. p. 224: Schw. Am. Bor. 1338; Ntke. Pyr. 224; Cooke Hdbk. 2463.

Sporidia .012–.014 × .003 mm. On *Populus* and apple. Penna. (Mich.), Carolina (Curt.), N. Eng. (Frost).

19. **Valsa leucostoma,** Fr. S. V. S. p. 411; Schw. Am. Bor. 1339; Ntke. Pyr. 222; Cooke Hdbk. 2464.

Sporidia .01–.012 × .0025 mm. On *Prunus* and *Persica*. Carolina (Curt. Rav.), Penna. (Mich.), New York (Berk.), N. Eng. (Sprague). *Ravenel's Fungi Car.* iii. 67.

20. **Valsa syngenesia,** Fr. S. V. S. 411, Curt. Cat. 142; Schw. Am. Bor. 1321; Cooke Hdbk. 2462.

Sporidia .01 mm. long. On *Rubus strigosus*. Carolina (Curt.). We have seen no American specimen. The measurements are from a British, according to Rev. M. J. Berkeley's determination. Mr. F. Currey's is a different species, with lanceolate, quadrinucleate sporidia.

21. **Valsa microstoma,** Fr. S. V. S. p. 411; Schw. Am. Bor. 1342; Ntke. Pyr. 193; Cooke Hdbk. 2466.

Sporidia .01 × .002–.0025 mm. On bark. Carolina (Schw.), Penn. (Schw.).

22. **Valsa americana,** B. & C. in Grevillea 873 (probably *V. alni*, Pk.).

Sporidia .01–.012 × .002 mm. On bark of various trees. Common. Carolina (Cut. Rav.), N. Eng. (Sprague), with the habit of *M. stilbostoma*, but with different fruit.

23. **Valsa colliculus**, Worms, in Fr. Sys. Myc. ii. 389.

Asci and sporidia very minute. Sporidia .005–.006 mm. long. On bark of *Pinus*. New York (Sartwell, Peck). Sporidia from specimen communicated by the late Dr. Curtis.

24. **Valsa abietis**, Fr. S. V. S. 412; Grevillea, v. p. 53; Ntke. Pyr. 186; Cooke Hdbk. 2473.

Sporidia .008–.009 × .0015 mm. On bark of White Cedar. New Jersey (Ellis, 2398).

25 **Valsa pini**, Fr. S. V. S. 412; Ntke. Pyr. 183.

Sporidia .006–.009 × .0015 mm. On bark of *Pinus*. N. York (Peck), New Eng. (Sprague). Sporidia from Fries Scler. Suec. No. 7.

26. **Valsa leiphœmioides**, B. & C. in Grevillea 868 (not *Cryptospora leiphæmioides* of Fuckel).

Sporidia .01 mm. long. On Oak. Carolina (Curt.), New Eng. (Sprague). The exposed ostiola, when the cuticle is stripped off, are mixed with a white powder. We have seen no specimen.

27. **Valsa fulvella**, B. & Rav. in Grevillea No 870.

Sporidia .01–.014 mm. long; pale amber. On *Platanus occidentalis*. S. Carolina (Rav. 1825). Sporidia from specimen furnished by Ravenel.

28. **Valsa haustellata**, Fr. Sys. Myc. ii. 383; Schw. Am. Bor. 1320.

Sporidia .006–.008 × .002 mm. Rather strongly curved, amber colored. On *Alnus serrulata*, and *Ostrya virginica*. S. Carolina (Curt. Rav.), N. York (Peck). *Ravenel Fun. Car.* iii. 53.

29. **Valsa liquidambaris**, Schw. Am. Bor. 1352; Grevillea, v. p. 34, pl. 75, fig. 16.

Sporidia .012 mm. long. On bark of *Liquidambar*. Carolina (Curt.), N. Jersey (Ellis). This appears to be the species of Schweinitz on the faith of specimens from Dr. Curtis.

30. **Valsa subclypeata**, C. & Pk. in N. Y. Museum Reports.

Sporidia .01–.012 × .003 mm., very slightly curved. On *Rhododendron* and *Quercus*. New York (Peck, 341). The disk is white, surrounded by the blackened cuticle.

31. **Valsa gossypina**, Cooke in herb.

Sporidia minute, .005–.006 mm. long; colorless. On branches of *Gossypium*. S. Carolina (Rav. 1387). Habit similar to that of *V. quaternata*.

32. **Valsa caryigena**, B. & C. in Grevillea, 872.

Sporidia .01–.012 mm. long. On branches of *Carya*. Penna. (Mich.), N. Jersey (Ellis?). Pustules small, in rows; covered below with the smooth bark; disk white, studded with the black ostiola. Not having seen anthentic specimen, those of Ellis from New Jersey are referred doubtfully.

33. **Valsa subscripta**, Wallr. Fl. Crypt. ii. 813.

Sporidia minute. On *Robinia*. Carolina (Curt.). Hitherto we have no knowledge of this species.

34. **Valsa anomia**, Schw. Am. Bor. 1316.

Sporidia .007–.008 mm. long. On *Robinia*. Carolina (Schw.), According to Berkeley, the Schweinitzian specimens have sausage shaped sporidia, .01 mm. long. In others there are uniseptate stylospores. The above dimensions are from specimens in Herb. Berkeley.

35. **Valsa decorticans**, Fr. S. V. S. 412; Schw. Am. Bor. 1354; Ntke. Pyr. 194.

Sporidia .01–.012 × .0025 mm. On bark of *Kerria Japonica* and *Syringa*. Carolina (Curt.). We have seen no American specimens, but Nitschke gives the sporidia as .01–.012 × .0025 mm. In specimen published by Mougeot and Nestler, they are rather smaller.

36. **Valsa coronata**, Fr. S. V. S. 412; Schw. Am. Bor. 1351; Ntke. Pyr. 196; Cooke Hdbk. 2471.

Sporidia .006–.007 × .0015 mm. On *Castanea* and *Bignonia*. Carolina (Curt.). The measurements are given from European specimens.

37. **Valsa munda**, B. & C. in Grevillea, No. 864.

Asci lanceolate. Sporidia sausage-shaped. On smooth branches of *Cornus*. Alabama (Peters). Pustules completely covered by the bark, which is blackened over them, or appears black; the disk, bordered with white, being free. We have seen no specimen.

38. **Valsa orbicula**, B. & C. in Grevillea, No. 867.

Sporidia .01–.012 mm. long. On Willow. Carolina (Curt.). Minute, orbicular, showing the subjacent perithecia by transparence, but not blackened; surrounded by a black line. This species also we have not seen.

39. **Valsa tessella,** Fr. S. V. S. 411; Schw. Am. Bor. 1348; Curt. Cat. p. 142.

Sporidia .01–.012 mm. long. On willows. Carolina (Schw.), Penna. (Schw.). Sporidia from specimens derived from Fries.

40. **Valsa monadelpha,** Fr. Sys. Myc. ii. 382; Schw. Am. Bor. 1317.

Sporidia about .01 mm. long. On *Prunus*. New England (Torrey), Penna. (Schw.). Sporidia from specimens published by Desmazieres, No. 961.

41. **Valsa truncata,** C. & Pk. in N. Y. Museum Reports.

Spermatia profuse .003–.005 mm. long. Sporidia .009–.011 mm. long. On *Alnus*. New York (Peck, 35).

42. **Valsa prœstans,** B & C. in Curt. Cat.

Measurements from original specimen. Sporidia .01–.012 × .003 mm. On branches of *Nyssa*. Carolina (Curt.), New Jersey (Ellis, 2425).

We have seen no authentic specimen and no description. The dimensions of the sporidia are given from the New Jersey specimens which we have referred to this species with hesitation.

43. **Valsa ceratophora,** Tul. Fung. Carp. ii. 191; Schw. Am. Bor. 1266; Ntke. Pyr. 180; Cooke Hdbk. 2472 (*Sphæria ceratosperma*, Tode).

Sporidia .006–.008 × .0015 mm. On branches of oak, holly, etc. Carolina (Schw. Rav. 1832), New England (Frost).

44. **Valsa rosarum,** Not. Sfer. Ital. t. 42; Cooke Hbdk. No. 2472, var.

Sporidia .006 × .0015 mm. On Rose. Carolina (Rav. 1466).

The *Diatrype hystrix* of the United States is *not* the *Valsa longirostres*, Tulasne.

46. **Valsa pulchella,** Fr. S. V. S. 412; Schw. Am. Bor. 1380; Cooke Hdbk. 2481. *Calosphæria princeps*, Ntke. Pyr. 91.

Sporidia .006 × .0015 mm. On bark of cherry, peach, etc. Carolina (Curt.), New York (Gerard, 72). *Ravenel*, *Fun. Car.* i. 66.

47. **Valsa ciliatula,** Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1379; *Calosphæria Wahlenbergii*, Ntke. Pyr. 92 (?).

Sporidia .009–.012 × .002 mm. On bark of *Betula*. Bethlehem (Schw.). Sporidia described from specimen published by Fries. Scler. Suec. 147.

B. Sporidia allantoid (Major).

48. **Valsa quaternata,** Fr. S. V. S. 412; Schw. Am. Bor. 1386; Cooke Hdbk. 2482; *Quaternaria Persoonii*, Ntke. Pyr. 87.

Sporidia .014–.02 × .004 mm. On *Populus* and *Alnus serru-*

lata. Penna. (Mich.), Vermont (Russell), Carolina (Curt.), Ohio (Lea), New York (Gerard, 29, Peck).

49. **Valsa salicina,** Fr. S. V. S. 412; Schw. Am. Bor. 1361; Ntke. Pyr. 212; Cooke Hdbk. 2476.

Sporidia .014–.018 × .003 mm. On willow. Carolina (Curt.). New England (Russell), Penna. (Schw.), New York (Peck, 231). *Ravenel Fun. Car.* iv. 60.

50. **Valsa ambiens,** Fr. S. V. S. 412; Schw. Am. Bor. 1364; Ntke. Pyr. 213; Cooke Hdbk. 2475.

Sporidia .016–.022 × .005 mm. On apple, *Prunus*, etc., Penna. (Schw.), New York (Sartwell, Peck), Carolina (Schw. Curt.).

51. **Valsa coaperta,** Cooke in Grevillea, v.

Sporidia .016–.018 × .004 mm. On *Ulmus.* New York (Rav. 1903).

52. **Valsa dissepta,** Fr. S. V. S. 412; Schw. Am. Bor. 1347; Cooke Hdbk 2467; *Quaternaria dissepta*, Ntke. Pyr. 88.

Sporidia pale brown, .024–.03 × .006–.008 mm. On *Salix* and *Amorpha fruticosa.* Carolina (Curl. Rav.). We have seen no American specimens; all the specimens, including Rav. 1219, belong to quite a different species. The fructification above given is from British specimens.

53. **Valsa mesoleuca,** B. & C. in Grevillea No. 879.

Sporidia .02 mm. long. On *Viburnum dentatum.* Penna. (Mich.). Disk white, surrounded by the black osteola, or sometimes dotted.

54. **Valsa dolosa,** Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1368; Ntke. Pyr. 200.

Sporidia .014–.018 × .003–.005 mm. On branches of *Celastrus.* Carölina (Schw.). The dimensions above are given from Nitschke. Notaris states that the sporidia are uniseptate.

55. **Valsa corniculata,** Ehr. Crypt. No. 300; Curtis Cat. p. 142; Schw. Am. Bor. 1325; Cooke Hdbk. 2438.

Sporidia .02 mm. long. On bark of ash. Carolina (Curt. Schw.).

56. **Valsa acclinis,** Fr. S. V. S. 412; Schw. Am. Bor. 1389.

Sporidia clustered together in a subglobose mass at the top of the ascus; .025–.02 mm. long. On branches of sassafras. Carolina (Schw. Curt.). Nitschke (Pyr. 207) gives the measurement of the sporidia as .007–.009 × .002 mm., which must be quite a different species.

C. Sporidia cylindrical.

57. **Valsa suffusa,** Fr. S. V. S. 412; Schw. Am. Bor. 1357; Cooke Hdbk. 2485.

Sporidia .04–.05 × .004 mm. On *Alnus* and *Salix*. New Jersey (M. J. B.); Bethlehem (Schw.); New York (Peck, 34). American specimens accord with British in the dimensions of the sporidia.

58. **Valsa trichispora,** C & Pk. in N. Y. Museum Reports.

Sporidia very slender, almost filiform, .05 mm. long, faintly multiseptate. On oak twigs. New York (Peck, 7).

59. **Valsa albofusca,** C. & Ellis in Grevillea, vol. v. p. 31, pl. 75, fig. 8.

Sporidia linear, nucleate, .04 × .005 mm. On *Quercus obtusiloba*. New Jersey (Ellis, 2325). Measurements from the original specimen.

60. **Valsa cinctula,** C. & Pk. Grevillea, v. p. 31, pl. 75, fig. 15.

Sporidia linear, curved, triseptate when mature; .05 mm. long. On chestnut. New York (Peck, 272); New Jersey (Ellis, 2326). The clusters of perithecia are girt by a white ring. The sporidia in the original specimens from New York were simple, those from New Jersey faintly triseptate; apparently a question of maturity.

D. Sporidia fusiform.

61. **Valsa aculeatus,** Schw. Am. Bor. 1399. (*Valsa rufescens*, Schw. Am. Bor. 1395).

Sporidia fusiform, narrow, quadrinucleate, then triseptate; .015–.017 mm. long. On *Rhus typhina*. Massachusetts (M. J. B.); Carolina (Rav.). In our copy of Ravenel's Fungi, Car. fasc. iii. No. 68, under the name of *Valsa stilbostoma*, is this species. Dr. Curtis also seems to have fallen into this error.

62. **Valsa albovelata,** B. & C in Grevillea No. 875.

Sporidia fusiform, narrow, quadrinucleate; .02 × .004 mm. On *Rhus copallina*. Carolina (Curt. Rav. 527). Disk white, pierced by the cylindrical ostiola. *Valsa polystoma*, B. & C. in herb. On *Rhus copallina*. According to specimen from Dr. Curtis, this must be the same species.

E. Sporidia subelliptical.

63. **Valsa innata,** B. & C. in Grevillea No. 874.

Sporidia oblong, uniseriate, narrowed towards each end; .0075 mm. long. On *Castanea vesca*. New York (Berk.). We have seen no specimen.

F. Sporidia uniseptate.

α. Not appendiculate.

64. **Valsa albocincta**, C. & Pk. in N. Y. Museum Reports.

Sporidia elliptic, uniseptate, slightly constricted, uniseriate; .018 × .006 mm. On *Acer spicatum*. New York (Peck). When the bark is removed, the perithecia are encircled with white, a black circumscribing line enters deeply into the wood.

65. **Valsa fibrosa**, Fr. S. V. S. p. 412; Schw. Am. Bor. 1324; Cooke Hdbk. 2489.

Sporidia elliptic, uniseptate; .015 × .007 mm. On branches. New York (Berk.), Carolina (Curt.). We have seen no American specimens. Rev. M. J. Berkeley states that the sporidia are uniseptate, at length fenestrate; .015 mm. long. European specimens do not exhibit any tendency to become fenestrate, and if this should prove a feature in the United States species, there is good ground for believing it distinct. Some authors unite *Valsa extensa* with this species.

66. **Valsa extensa**, Fr. S. V. S. 412; Schw. Am. Bor. 1315; Cooke Hdbk. 2488.

Sporidia elliptic, uniseriate; .013–.015 mm. long. On branches. Bethlehem (Schw.). Very closely allied to *Valsa fibrosa*, Fr.

67. **Valsa enteroleuca**, Fr. S. V. S. p. 412; Schw. Am. Bor. 1314; Cooke Hdbk. 2501.

Sporidia shortly fusiform, uniseptate; .015–.017 mm. long. On *Robinia*. Carolina (Curt.).

68. **Valsa leiphemia**, Fr. S. V. S. 412; Schw. Am. Bor. 1356; Cooke Hdbk. 2490.

Sporidia shortly fusiform, uniseptate; .015.–017 × .006 mm. On oak. South Carolina (Rav.); Penna. (Mich.) Sporidia described from British specimens.

69. **Valsa impulsa**, C. & Pk. in N. Y. Museum Reports.

Sporidia narrowly elliptic, uniseptate, nucleate; .02–.022 × .008 mm. On *Pyrus Americana*. New York (Peck, 273).

70. **Valsa glyptica**, B. & Curr. Grevillea No. 866.

Sporidia fusiform, sometimes sigmoid, uniseptate; .05 mm. long. On willow. Carolina (M. J. B.). We have not seen this species, but it reminds one so strongly of *Valsa tessera*, Fr., that we doubt whether the slight appendages may not have been overlooked.

71. **Valsa carpini**, Pers. Fr. S. V. S. 412; Schw. Am. Bor. 1326.

Sporidia lanceolate, uniseptate, nucleate; .014 × .004 mm. On *Carpinus betulus*. Carolina (Schw.); Penna. (Schw.).

72. **Valsa furfuracea,** Fr. S. V. S. 412; Schw. Am. Bor. 1387; Cooke Hdbk. 2493.

Sporidia uniseriate, narrowly elliptical, uniseptate, .025–03 × .011 mm. On *Tilia*. Bethlehem (Schw.). Sporidia from British specimens referred to this species.

73. **Valsa conjuncta,** Nees Sys. p. 305; Fr. S. V. S. 412; Schw. Am. Bor. 1383

Sporidia lanceolate, uniseptate, .016 × .004 mm. On *Prunus*. Bethlehem (Schw.). Sporidia described from European specimens.

β. Sporidia appendiculate.

74. **Valsa tessera,** Fr. Sys. Myc. ii. 405; Schw. Am. Bor. 1367 (*Valsa mucronata*, Peck).

Sporidia fusiform, straight or curved, uniseptate, .05–.06 × .011–.012 mm., with a short hyaline apiculus at each extremity. On bark of *Corylus* and *Salix*. Bethlehem (Schw.). New York (Peck).

75. **Valsa thelebola,** Fr. S. V. S. 412; Schw. Am. Bor. 1384; Cooke Hdbk. 2503.

Sporidia elongated, rounded at the ends, often curved, uniseptate, aristate at each extremity, .04–.045 × .01 mm., without the appendages. On *Juniperus Virginiana* and *Alnus*. Bethlehem (Schw.). N. York (Peck, 52). The New York specimens accord with the European.

76. **Valsa taleola,** Fr. S. V. S. 411; Schw. Am. Bor. 1345: Cooke Hdbk. 2502 (*Valsa oxyspora*, Peck).

Sporidia elliptical, uniseptate, .02–.03 mm. long, aristate at either end, and sometimes at the commissure at each side. On oak limbs. Carolina (Curt.). New York (Peck).

G. Sporidia multiseptate.

77. **Valsa gemmata,** B. & C. in Grevillea No. 876.

Sporidia fusiform, triseptate. On *Rhus radicans*. Carolina (Curt.). Ostiola stellate, necks united. Our specimen under this name (Rav. 1222) has very different fruit, and is similar to *Valsa tetraploa*.

78. **Valsa pennsylvanica,** B. & C. in Grevillea 865.

Sporidia narrow, oblong, sometimes wide at one end, sometimes slightly curved, triseptate, .025 mm. long. On *Cerasus Pennsylvanica*. New York (Berk.). Bursting transversely, perithecia in the centre of a facette. We have seen no specimen.

79. **Valsa capsularis,** Pers. Syn. p. 42; Curt. Cat. p. 142; Schw. Am. Bor. 1363.

Sporidia fusiform, triseptate, hyaline. On bark of *Ampelopsis*.

Carolina (Curt.). The characters of the fruit are given on the authority of Notaris.

Sect. II. Sporidia colored.

A. Sporidia simple.

80. **Valsa turgida,** Fr. S. V. S. p. 413; Curt. Cat. p. 142; Schw. Am. Bor. 1359. Cooke Hdbk. 2504.

Sporidia elliptic, brown, .0076–.01 mm. long. On *Liriodendron*. Carolina (Curt.). Penna. (Schw.). Described from European specimens.

B. Sporidia uniseptate.

81. **Valsa toxici,** Schw. Am. Bor. 1330.

Sporidia elliptical, uniseptate, brown, .012 × .005 mm. On *Rhus radicans*. S. Carolina (Rav. 1424).

82. **Valsa celtidis,** Cooke in Grevillea, v. p. 55, pl. 81, fig. 3.

Sporidia uniseriate, elliptic, uniseptate, brown, .02 × .008 mm. On branches of *Celtis*. S. Carolina (Rav. 1833). Quite distinct from *Sphæria celtidis* B. & C., according to the description.

83. **Valsa notarisii,** D. R. & M. Fl. Alg. t. 25, fig. 6.

Sporidia uniseriate, uniseptate, brown, constricted at the septum, .02 × .008 mm. On *Robinia* and *Gleditschia*. Carolina (Curt.).

83 *bis*. **Valsa clethræcola,** C. & E. Grevillea v. p. 92.

Sporidia biglobose, brown, uniseptate, .018 × .009 mm. On *Clethra alnifolia*. New Jersey (Ellis).

84. **Valsa peckii,** Howe MSS. in N Y. Museum Reports.

Sporidia uniserrate, uniseptate, brown, .014 × .006 mm. On *Kalmia*. New York (Howe). N. Jersey (Ellis).

85. **Valsa fulvopruinata,** Berk. in Lea's Cincinnati; Curr. Linn. Trans.

Sporidia elliptic, uniseptate, brown. On *Platanus*. Ohio (Lea), Carolina (Curtis), Conn. (Wright).

86. **Valsa melastroma,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1358.

Sporidia elliptic, uniseptate, brown, .032 × .014 mm. On bark of *Ulmus*. Salem (Schw.). We have seen no authentic American specimen. Character of sporidia given from specimen published by Fries Scler. Suec. 223.

C. Sporidia multiseptate.

87. **Valsa tubulosa,** B. & C. in Grevillea.

Sporidia fusiform, obtuse at the ends, triseptate, brown, .03 × .01 mm. On *Alnus*. Carolina (Curtis). Sporidia from original specimen from Dr. Curtis.

88. **Valsa profusa,** Fr. S. V. S. p. 411 (*Valsa Sartwelli*, B. & C. in herb. *Aglaospora profusa*, Tul. Carp.); *Sphæria profusa*, Schw. Am. Bor. 1346; Cooke Hdbk. 2511.

Sporidia large, oblong, elliptic, quadrilocular, at length brown, .06–.07 × .018–.02 mm. On bark of *Robinia*. Carolina (Curt.), New England (Sprague), New York (Gerard, 9 Peck.). Authentic specimens of *V. Sartwelli* are undoubtedly this species.

89. **Valsa convergens,** Tode Fr. Sys. Myc.; Sch. Am. Bor. 1390; Cooke Hdbk. 2505.

Sporidia sub-cymbœform, irregular, triseptate, brown. On *Rosa corymbosa*. Carolina (Schw.), Penna. (Schw.).

β. Sporidia appendiculate.

90. **Valsa hapalocystis,** B. & Br.; Cooke Hdbk. No. 2515.

Sporidia oblong-elliptic, appendiculate at either end, biseptate, brown, .035 × .015 mm. On *Platanus occidentalis*. New York (Peck). Inserted on the authority of Mr. Peck.

γ. Sporidia transversely septate.

91. **Valsa condensata,** B. & C. Grevillea, No. 878.

Sporidia obovate, 5 septate, here and there vertically divided, brown, .02 mm. long. On *Quercus montana*. Virginia (Curt.).

92. **Valsa castanicola,** B. & C. in Grevillea, No. 869.

Sporidia cymbœform, pointed, triseptate, at length vertically divided, .01 mm. long. On small twigs of *Castanea*. Virginia (Curt.). We have not seen this species. Probably it is the same with *Valsa castanophila* of Curtis's catalogue.

93. **Valsa vestita,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1388; Cooke Hdbk. 2514.

Sporidia elliptic, brown, transversely and longitudinally septate, .02 mm. long. On *Ribes florida*. Bethlehem (Schw.). Described from European specimens.

Sporidia uncertain.

94. **Valsa plagia,** B. & C. Curt. Cat. p. 141.

Fallen limbs of *Liriodendron*. Carolina (Curt.). This species does not appear to be known to the Rev. M. J. Berkeley.

95. **Valsa Bignoniæ,** Schw. Am. Bor. 1310; Curt. Cat. p. 141.

On bark of *Tecoma*. Carolina (Curt. Schw.).

96. **Valsa scoparia,** Schw. Am. Bor. 1318; Curt. Cat. p. 141.

On bark of *Juglans*. Carolina (Curt.).

97. **Valsa pugillus,** Schw. Am. Bor. 1322; Curt. Cat. p. 142.

On wood of maple. Carolina (Curt.). Penna. (Schw.).

98. **Valsa scutellata,** Pers. Syn. Fung. 37; Curt. Cat. p. 142; Schw. Am. Bor. 1344.

On *Prunus* and *Cornus*. Carolina (Schw.). Penna. (Schw.

99. **Valsa frustrum-coni,** Schw. Am. Bor. 1329; Curt. Cat. p. 142.

On roots of oak. Carolina (Curt.).

100. **Valsa ciliata,** Fr. S. V. S. p. 141; Curt. Cat. p. 142; Schw. Bor. 1349. (*Vide* Tul. Carp. ii. pp. 201.)

On bark of *Ulmus*. Penna. (Schw.). Carolina (Curt.).

101. **Valsa pusio,** B. & C. in herb.; Curt. Cat. p. 142.

On braches of *Morus multicaulis*. Carolina (Curt.). This species does not appear to be known to the Rev. M. J. Berkeley.

102. **Valsa umbilicata,** Pers. in Fr. S. V. S. p. 412; Curt. Cat. p. 142; Schw. Am. Bor. 1385.

On branches of *Lonicera sempervirens*. Carolina (Curt.). Bethlehem (Schw.).

103. **Valsa divergens,** Schw. Am. Bor. 1393; Curt. Cat. p. 143.

On *Liquidambar*. Carolina (Schw. Curt.).

104. **Valsa juglandicola,** Schw. Am. Bor. 1328.

On *Juglans tomentosa* and *alba*. Carolina (Schw.). Penna. (Schw.).

105. **Valsa rubincola,** Schw. Am. Bor. 1329.

On *Rubus*. Bethlehem (Schw.).

106. **Valsa allostoma,** Schw. Am. Bor. 1332.

On Robinia. New England (Torrey).

107. **Valsa oligostoma,** Schw. Am. Bor. 1333.

Inside bark of *Castanea*. Bethlehem (Schw.).

108. **Valsa amorphostoma,** Schw. Am. Bor. 1334.

On *Gleditschia*. Bethlehem (Schw.).

109. **Valsa radicium,** Schw. Am. Bor. 1335.

On roots of trees. Bethlehem (Schw.).

110. **Valsa conspurcata**, Schw. Am. Bor. 1336.
On oak branches. Bethlehem (Schw.).

111. **Valsa modesta**, Schw. Am. Bor. 1337.
On young branches of *Ulmus*. Bethlehem (Schw.).

112. **Valsa comptoniæ**, Schw. Am. Bor. 1353.
On *Comptonia*. Bethlehem (Schw.).

113. **Valsa variolaria**, Schw. Am. Bor. 1371.
On *Tilia*. Bethlehem (Schw.).

114. **Valsa conseptata**, Schw. Am. Bor. 1373.
On bark of *Gleditschia*. Bethlehem (Schw.).

115. **Valsa papyriferæ**, Schw. Am. Bor. 1375.
On *Broussonetia papyrifera*. Bethlehem (Schw.).

116. **Valsa ceanothi**, Schw. Am. Bor. 1376.
On dead stems of *Ceanothus*. Bethlehem (Schw.).

117. **Valsa indistincta**, Schw. Am. Bor. 1377.
On young branches of sassafras. Carolina (Schw.).

118. **Valsa quadrifida**, Schw. Am. Bor. 1378.
On *Vaccinium corymbosum*. Bethlehem (Schw.).

119. **Valsa scabriseta**, Schw. Am. Bor. 1394.
On other *Sphæria* on bark of *Castanea*. Bethlehem (Schw.).

120. **Valsa expers**, Schw. Am. Bor. 1396.
On *Rosa corymbosa*. Bethlehem (Schw.).

121. **Valsa rimicola**, Schw. Am. Bor. 1397.
On *Comptonia asplenifolia*. Bethlehem (Schw.).

122. **Valsa rhizina**, Schw. Am. Bor. 1398.
On roots of *Rhododendron*. Bethlehem (Schw.).

123. **Valsa halseyana**, Schw. Am. Bor. 1319.
On bark of *Betula*. New York (Schw.).

124. **Valsa lixivia**, Fr. S. V. S. p. 411; Schw. Am. Bor. 1327.
On *Juglans cinerea*. Bethlehem (Schw.).

125. **Valsa tortuosa**, Fr. Act. Holm. 1817, p. 98; Schw. Am. Bor. 1350.
On pine branches, infested with *Peridermium*. New Jersey (Schw.).

126. **Valsa deformis**, Fr. Sys. Myc. ii. 398; Schw. Am. Bor. 1355.
On *Quercus*. Bethlehem (Schw.).

127. **Valsa clopima,** Fr. S. V. S. p. 142; Schw. Am. Bor. 1360.

On twigs. Bethlehem (Schw.).

128. **Valsa leucopis,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1365.

On *Syringa*. Bethlehem (Schw.).

129. **Valsa sphinctrina,** Fr. S. V. S. p. 412; Schw. Am. Bor.

On *Catalpa* and *Juglans nigra*. Bethlehem (Schw.).

130. **Valsa aperta,** Fries (?); Schw. Am. Bor. 1381.

On *Populus italica*. Bethlehem (Schw.).

131. **Valsa vasculosa,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1382.

On *Prunus*. Bethlehem (Schw.).

132. **Valsa pusilla,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1391.

On bark of *Castanea*. Bethlehem (Schw.).

133. **Valsa abnormis,** Fr. S. V. S. p. 412; Schw. Am. Bor. 1392.

On *Sambucus*. Fries writes of this "*V. abnormis*, dubia sp." We have seen no specimen.

MELANCONIS, Tul. Carp. ii. 115.

A. Sporidia colored.

1. **Melanconis stilbostoma,** Tul. Carp. ii. 120; Schw. Am. Bor. 1366; Cooke Hdbk. 2454.

Conidia subglobose, olive, .014–.016 × .008–.01 mm. Stylospores elliptic, uniseptate, brown. Sporidia biseriate, colorless, uniseptate. .018 × .008 mm. On bark of *Betula*, *Acer*, *Melia*. Carolina (Schw. Rav.), Penn. (Schw.), New York (Peck 15). In the New York specimens stylospores, like the spores of *Diplodia*, occur in perithecia, which are collected in circles, and so much like those containing ascospores, that the one cannot be distinguished from the other by any external feature. Hitherto we have not seen such stylospores associated with European specimens, nevertheless there is no reason for supposing that the American species is distinct. The size and character of the ascospores are precisely identical. This is an interesting contribution to the life history of the species for which we are indebted to Mr. C. Peck, on *Betula papyrifera*.

2. **Melanconis chrysostoma,** (Fr.), Tul. Fung. Carp. ii. p. 125; Cooke Hdbk. 2456 (not Fuckel).

Conidia ovate, apiculate at the base; olive brown; 1–2 nucleate, 015 × .01 mm. Sporidia elliptic, uniseptate, hyaline, .0177–.022 mm. long. On bark of *Carpinus*, *Quercus alba*. Carolina (Peck).

B. Sporidia colored.

a. Not appendiculate.

3. **Melanconis lanciformis,** Tul. Carp. ii. t. 16; Schw. Am. Bor. 1263; Cooke Hdbk. 2458.

Conidia clavate, 3- 4- 6-celled. Sporidia long, elliptical, brown, quinqueseptate, .036 × .012 mm. On *Betula*. Bethlehem (Schw.).

Melanconis elliptica, Peck, on *Betula populifolia*; does not appear to be specifically distinct from *M. lanciformis*.

b. Sporidia appendiculate.

4. **Melanconis bicornis,** C. & Pk. in N. Y. Museum Reports.

Sporidia .06 × .015 mm. with appendages, together .15 mm. long. On *Platanus*. New York (Peck, Gerard).

5. **Melanconis amygdalina,** Cooke in Grevillea, v. p. 55, pl. 81, fig. 4.

Sporidia almond-shaped, simple brown, .025 × .01 mm. with thin hyaline appendages at each end, .02–.03 mm. long. On *Liquidambar*. Carolina (Rav.).

MARCH 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-eight members present.

Influence of Nutrition on Fertilization.—Mr. THOMAS MEEHAN said that considerable interest had been manifested in England in the unusual failure of the Holly to produce berries, and Mr. Darwin had written a letter to say that bees were everywhere rare in the localities examined by him last spring, and suggesting that this scarcity had resulted in non-pollenization through lack of insect aid. Mr. Meehan was surprised at the suggestion, as the Holly was classed with the anemophilous (wind loving) plants, which were not considered, even by Mr. Darwin's friends, as requiring this assistance. With all respect, however, for the immense services which Mr. Darwin and his close followers had rendered to science, he felt quite sure that they frequently mistook the work of ordinary laws of nutrition for the effects of pollenization; and of this he would now offer an illustration in the case of the common mignonette. In the open air with us this plant seeded freely; in close greenhouses in winter forcing very rarely. Until this year he had never had plants to produce seeds in winter. Others had found a similar experience, and it was common to hear the remark "behold the results of insect agency! In the open air insects visit them, and you get seeds—in the winter greenhouse there are no insects and no seed." But as if to protest against this conclusion, his plants, of which he distributed specimens, had taken to producing seed in abundance; that is to say, every flower had seed. There were from two to six perfect ones in each capsule, not so much as in the open air; but still all had some seed. As regards insects, the conditions this winter were precisely the same as heretofore. They had nothing to do with it. There may have been more light or less light, more heat or less heat, or the earth in which they are growing may not have been exactly the same; or there may have been some other circumstances which gave nutrition a better chance to work on the reproductive organs than heretofore; at any rate insect aid is out of the question in cases like these. He had shown before that so far as the clover was concerned in this country, it would produce seed freely without insect aid; and in explanation of this it had been urged that the doctrine in relation to this question did not preclude the plants in many cases fertilizing themselves when insect aid could not be obtained, and quotations from Mr. Darwin's works had been made before the Academy and elsewhere in support of this view. But in this very letter on the Holly, Mr. Darwin must have forgotten if he ever held to this accommodating view, as he reiterates the statement that clover seed is a failure when the flowers are not visited by bees.

The Bluebird and Holly berries.—Mr. THOMAS MEEHAN observed that the Blue bird had this season stripped his Holly trees of their berries, though it had been supposed by all, he believed, that no birds ate them. Some of the trees were but a few feet from his library window, which gave him a good opportunity to note that it was this and not the Snow-bird. These birds remained with him all through the severe weather of December, not leaving till the January snows came. They fed also on the berries of the common red cedar. He believed in the case of this bird the migration south in the winter season was not with them a question of temperature, but one of food. At least they remained with him in his cedar woods till the berries were all gone.

Vitality of Seeds under Low Temperature.—Mr. THOMAS MEEHAN referred to the seeds of wheat, oats and Indian corn, which, after having been left by the Polaris in 1872, had been found in 1876 by the Nares exploring expedition, and which, though exposed to the severity of four arctic winters, had yet grown. The growing plants had recently been exhibited before an English scientific society, and surprise expressed, particularly that seed of the maize, a tropical plant, should have received no injury. Mr. Meehan said that though the facts may not have been placed on record, it was not unknown in America that seeds of tropical plants had a power of resisting low temperatures not possessed by the plants themselves. The common forms of *Ipomæa*, known as "morning glories," the "Balsams" (*Impatiens*), the common tomato, and others, came up in gardens from self-sown seeds; and indeed there were large numbers of tropical weeds, which the first frosts destroy, and yet the seedlings appear the next year in great numbers. He called attention to this arctic experience with seeds, however, chiefly to suggest what had often occurred to him, from such observations, that seeds may keep for an indefinite time in low temperatures, when under high ones they soon lose vitality. There is no reason that he knew of why seeds might not get into an iceberg—keeping fresh perhaps for centuries—and in this way some problems in the geographical distribution of plants be solved. He suggested trials by those who had the opportunity. The common silver maple (*Acer dasycarpum*) had seed which usually completely lost vitality in a couple of months from maturity. Experiments with these by those who had large ice-houses, could not fail of resulting in useful knowledge.

On Rocky Mountain Locusts.—Dr. LE CONTE exhibited some recently hatched Rocky Mountain locusts, commonly called grasshoppers, which had just been sent to him by Professor Henry, of the Smithsonian Institution, and read the following communication, including extracts from the letter which accompanied them, giving the statement of Mr. J. N. High, by whom the eggs were collected near Fort Kearney, Nebraska:—

"They are found in small cylindrical tubes about one-tenth of an inch in diameter and four or five inches below the surface. Freezing does not destroy the eggs, nor the young 'hopper. It is said they may be frozen solid in water, and when the ice is thawed they will still exhibit life. They are said always to move in one direction, eastward, and that the tendency of the young is instinctively to hop in that direction. When the wind is unfavorable, or from an easterly direction, they alight and remain on the ground until the wind changes."

While these remarks are perhaps founded upon too limited observation, they at all events enable the members of the Academy to make the personal acquaintance of this formidable pest, and to hear a brief synopsis of the plans devised for its suppresion.

It will of course be impossible within the few minutes available at this meeting to condense the voluminous literature on the Locust in this and other countries, but there are a few points to which I may call your attention with profit.

The injury inflicted by these insects had extended over so large a space and so long a time, that towards the end of October (25th and 26th), a conference of Governors of Missouri, Iowa, Kansas, Nebraska, Minnesota, and Dakotah was held at Omaha. In this meeting they were assisted by the counsel of several eminent men of science, among whom were the State Entomologists of Missouri and Illinois, Professors Riley and Thomas.

Various methods of destroying the locust were suggested, in accordance with the experience gained in other countries, and from the study of other insects. But the efficacy of all these methods was clearly shown to depend upon principles not dissimilar to some of the propositions set forth by me in an address delivered at Portland, in August, 1873, and another at Detroit, in August, 1875, and these principles may be summed up as follows, and are applicable to all insect pests:—

First. Correct observations in regard to the history and habits of the noxious insect, including its range of distribution; the time of its appearance in its different stages of development; in various parts of its area of distribution, its habits in these different stages; so that the proper time for most efficient attack may be found.

Second. Careful study of the most effective means of destruction, whether by means of mechanical (rolling, crushing, etc.), chemical (poisons, etc.), purely industrial (human labor), or vital (encouragement of birds and other enemies of the noxious insect).

Third. The publication in a popular form of this calendar of growth and habits of each species, and the effect of the various modes of suppression which are found efficacious, and the distribution to farmers within the infested district of this compendium of useful knowledge.

Fourth. The procuring by wise legislation enactments of combined effort on the part of the agriculturists of the afflicted region, under the directions contained in the publication suggested in section 3, based upon the careful observations required by sections 1 and 2. Such information as is required for this purpose cannot be obtained without the aid of the National Government, as I have said on former occasions; and the whole spirit of the record of the proceedings of the conference of Governors, which I have mentioned above, is that the Government should take hold of this subject with the earnestness which its importance demands. Many similar appeals had been made before, but never by so distinguished a body, representing the will of five populous States and one Territory, all of which had been greatly devastated by this single insect, and in which the channels of human immigration had been changed by its ravages.

Yet this application failed as all former ones had done; and to this day there is not in the possession of any farmer or any student of science the information necessary for the suppression of even a single insect pest, unless it has been laboriously acquired by sifting many volumes of difficult access or of large cost.

On Mineral Caoutchouc.—Mr. GALLOWAY C. MORRIS presented specimens of mineral caoutchouc from South Australia, and stated that the material had attracted his attention in the exhibit of the South Australian Department of the Centennial Exhibition. From the exhibitor, Mr. C. W. Stuart, he had obtained the specimens, and from him learned that the substance is found during the dry season in a small section of country of a swampy nature in the Coorong District. It occurs in sheets from the thickness of a sheet of paper to about five-eighths of an inch; and is being manufactured into a good article of illuminating oil.

The geological formation of the basin in which it is found is thus described:—The surface is sand, either white and barren or brown and loamy, with occasional ridges or distributions of limestone. Below that is segregated limestone, hard and approaching crystallization, the interstices filled with light brown tenacious clay, followed by compact light red sandstone of various thickness gradually fading in color and consistence until it touches the water and merges into quicksand. On the lowest flats, fissures occur in the limestone; the orifices are very small and irregular but reach to the underlying quicksand.

In connection with this mineral caoutchouc is found another material, a sample of which he also presented which goes under the local name, from the district in which it is found, of Coorongite. He was told that it is found over the same ground as the caoutchouc, but at a rather lower level. He had found this material to consist principally of fresh-water Diatomaceæ cemented together with some hydrocarbon.

An analysis of the caoutchouc had been forwarded to him, which was as follows:—

Moisture	0.4682
Carbon	64.7300
Hydrogen	11.6300
Ash	1.7900
Fixed carbon	1.0050
Oxygen and other unestimated matters	20.3768
	100.0000

March 13.

The President, Dr. Ruschenberger, in the chair.

Thirty-two members present.

Papers entitled "Notes on Genera Acidaspis, Murchison, Odontopleura, Emmrich, and Ceratocephala, Warder," by A. W. Vogdes, and "Chemical Notes," by Geo. Hay, were presented for publication.

The death of Frank W. Lankenau was announced.

Evolutionary Law as illustrated by Abnormal Growth in an Apple Tree.—Mr. Thomas Meehan exhibited some branches of a "Smoke-house" apple tree, which had the cluster of flowers at the end of a young shoot, flowering after the leaves and growth had matured, instead of blooming in spurs early in spring, and simultaneously with the expansion of the leaves, as in ordinary cases. There were numerous instances of the normal and abnormal growths on the same tree, the abnormal ones flowering about six weeks after the normal ones, but both classes maturing the fruit at about the same time in the fall. He explained that physiologically there was but a slight difference between what was known in the botanies as plants which bloom from last season's wood, and plants which flower from the growth of the same year. In the case of the former the spirals are closely appressed, as could be seen by examining the old apple spurs exhibited. The scars where the leaves or their equivalent bud scales had existed were so close together that there were scarcely any internodes. In the case of that class which flower from the growth of the same year, it was simply that the spirals closely appressed in the spurs were now drawn out. In these apple branches there were from six to nine internodes before the clusters of flowers were borne.

The point he wished particularly to draw attention to was that when there was a change in one important character, there was often change in others making a complete set of characters which need nothing but permanence to be regarded as specific. For instance, the fruit from these terminal clusters was as unlike the normal "Smoke-house" as it was possible to be. The fruit stems were very long and slender, and the fruit flattened—what pomologists term oblate. It might further be noted that this change was not a change by gradual modification through seminal agency; but a leap, and from a tree that had always produced flowers in the normal way. There was apparently no more reason why the law, whatever it may be, that operated on this one tree might not under some circumstance operate on all the trees in the orchard, or on other wild trees in native places of growth, or on the individuals of a whole district, as well as on a single tree. If trees with such a set of differences were found in a wild condition and their parentage not known, a botanist would undoubtedly regard them as constituting very distinct species, and describe and name them accordingly. It was such illustrations as these which made the doctrine of evolution in some form an absolute certainty.

March 20.

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

Thirty-four members present.

March 27.

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

Twenty members present.

A paper entitled "On Elaterite and Coorongite from New South Wales, Australia," by E. Goldsmith, was presented for publication.

Charles Ashburner and Thomas Mackellar were elected members.

P. A. Von Kotschubey, of St. Petersburg, was elected a correspondent.

The following papers were ordered to be printed:—

ON THE VITAL POWERS OF ANTS.

BY REV. H. C. McCOOK.

It is well known, that insects generally are highly endowed with vital powers for the maintenance of existence and the perpetuation of their species. The following facts may illustrate the ability of the Formicidæ to maintain life under most unfavorable conditions:—

1. *The Survival of Ants under Exposure to severe Cold.*—A portion of a formicary of *Formica Pennsylvanica*,[1] the Pennsylvania carpenter ant, was cut during the month of January last, from an oak bough on Brush Mountain, Blair Co., Pa. It was preserved by the wood-choppers and sent to me by Mr. Jas. W. Riddle, of Bell's Mills. The ants, as usual during winter, were torpid. A few of them were put in a bottle; the others remaining in the nest were placed out of doors, where they remained for two weeks exposed to the rigor of a mountain winter. When the formicary reached Philadelphia, it was placed in the cellar of the Academy for several days. Upon removing the wrappings and sawing the block into sections, the ants were found to have become active. A great number, several hundred, with a few larvæ were stowed away within this small space. As it was necessary to free the formicary of its contents, all the ants were knocked out, and deposited in the yard, to give them some chance for their lives. A few happened to drop upon the ice, which lay several inches thick upon the ground. Forty-eight hours afterward I found these ants alive. They were imbedded in the ice within the small depressions made by their animal heat. They moved about as soon as removed and became quite active when placed in the closed hand. I have had the opinion that many of these ants were destroyed by our severe winters; but the above facts, viz., the preservation of the entire contents of the formicary, and the power to endure unharmed forty-eight hours freezing upon ice, seem to indicate that most of these insects survive the winter, and enter upon the spring in unbroken community. The ants preserved in the bottle had amongst them the wingless or fertile queen, and have been

[1] *Camponotus Pennsylvanicus*, according to Mr. Norton's recent classification.

kept in a glass jar under observation. They become torpid at night, but thaw out again in the heat of the room, and are very active, cutting galleries in wood, and constructing galleries from particles of paper and other litter cut into pellets.

In connection with this, I will barely allude to observations made on the 12th of February, 1877, upon the winter habits of the Fallow ant, *Formica rufa*. The ants were found in the hills at temperatures varying from 30° to 34° (Fahr.). At 30 degrees, in the frozen portion of the cone of the formicary, they were active but sluggish. In the centre of the hill at a temperature of 34°, they were found active and lively. It would thus seem that these interesting creatures are also proof against the rigors of our mountain frosts, and the prolonged season of fasting which winter compels.

2. *The Ability of Ants to endure extreme Heat.*—While encamped last summer upon Brush Mt., studying the habits of the Fallow ant, my attention was called to the following fact: There had been placed upon the camp-fire a portion of a decayed stump, one end of which touched the top of the wall of flat stones which our servant had erected on two sides of the hearth. A large flat stone was laid across the angle of these walls. The servant having occasion to remove this stone found the under surface thickly covered with black ants. I was called to the spot, and found that a community of Pennsylvania ants (*F. Pennsylvanica*) had been established within the stump, a fact of course unknown when it was placed upon the fire. One end of the stump touched the wall, over which the ants, driven by the heat, had passed, and lodged upon the under surface of the stone. I did not take the temperature of the stone, but it may well be conceived that it was quite hot. The ants had clustered on the side toward the fire, which filled the hearth. I rescued the individuals still within the log. When the stone was dropped, the others straightway began to scamper off into the grass evidently unhurt, and not even inconvenienced by their severe baking.[1]

Mr. E. T. Cresson recently placed in my hands a package of original MS. notes made by Dr. G. Lincecum upon the ants of Texas. I find in these a fact concerning the agricultural ant, *Myrmica molefaciens*, which shows something of the same sala-

[1] The incident is fully recorded in Proc. Am. Ent. Soc., Dec. 1876.

mander-like qualities upon the part of that insect. A community of agricultural ants was located near a blacksmith's shop, which had been in operation for five years. During all that period the smiths had built their fires for heating wagon tires, upon the pavement or flat mound of these ants. This occurred on an average as often as two or three times a week. Frequently as many as nine tires a day had been heated upon the mound. After five years of such experience, Dr. Lincecum records that he saw numbers of ants at work, cleaning out the entrance to their city, before the fire that had just been used for heating tires was entirely extinguished. They seemed to have learned all about fire, and knew how to work around and among the half extinguished coals without injury. At the expiration of the five years, the colony was not numerous, had perhaps suffered a decrease; but they had not been driven away, and showed every sign of strong determination still to "hold the fort."

3. *Ability to survive exposure under Water.*—Last summer (1876), I discovered near Marple, Delaware Co., Pa., a formicary of mason ants, apparently a variety of *F. rufa*, the Fallow ant. The nest was in the ground, the communication thereto being by a gallery opening directly upon the surface. I placed these ants for observation in an artificial formicarium which was insulated in a tub of water. One night the covering by which the formicarium was protected during bad weather was left off, or removed by some meddler. A heavy shower fell early in the evening. In the morning the formicary was flooded; the ants were dead. Dead and lying under five inches of water, mixed up with the mortar, which the rain had formed with the soil that composed the galleries. I poured out the water, and set the box in the sun with a forlorn hope that some of the ants might revive. At noon I chanced to open a paper box in which I had placed a dead female ant of the genus *Myrmica*, a jet black insect. It had fallen into the tub, where it had been floating for many hours apparently drowned. It was now crawling about the box alive. Thereupon I visited my dead Fallow ants, and found three of them moving about in the slush endeavoring to extricate themselves. Another was struggling out of the muddy sediment in the jar which formed the lower part of the formicary. In short, the greater part of the drowned ants proved themselves to be veritable Noachians and survived the flood.

I conclude, by giving another observation from the MS. notes of Mr. Lincecum. During protracted periods of dry weather the agricultural ant of Texas is frequently found in great numbers in the wells whither they had probably gone in pursuit of water. Being unused to such a novel position, they are unable to return, and fall into the water. Instead of succumbing individually to the threatened doom, they extemporize a most efficient life-raft by collecting and clinging together in floating masses as large as an orange. In this condition they are often drawn up in the bucket, and notwithstanding they may have been in the water a day or more, they are all found to be alive, although half drowned and barely able to move. According to Mr. Lincecum, this species of ant cannot survive longer than six minutes under water, so that the submerged portion of the globular mass must have perished within that period, if they are supposed to remain in the same relative position. Yet the ants are *all* alive! The ball must therefore have been caused to revolve in the water. Shall we account for this life-saving process by considering it simply an accident of the instinctive struggles of the insects to rise out of the water and reach and remain upon the surface of the mass; or, with the observer, shall we consider it the result of a united, properly directed and systematic motion of the disengaged limbs of the outer tier of ants occupying the submerged portion of the revolving mass? The former theory seems sufficient to explain the phenomenon, but the wonderful intelligence of hymenopterous insects makes the latter opinion at least quite plausible. In either case we have another example of the high endowments of the *Formicidæ* to maintain and perpetuate their race through the severest struggles for life.

NOTES ON THE GENERA ACIDASPIS, MURCHISON; ODONTOPLEURA, EMMERICH; AND CERATOCEPHALA, WARDER.

BY A. W. VOGDES.

The genus *Acidaspis* was established by Sir R. I. Murchison in his Silurian System, published 1839. In the same year Dr. Emmerich's De Trilobiten Dessert. inauguralis, appeared, with the generic classification *Odontopleura*, for the same genus; therefore great doubt has been expressed with regard to the priority of the two generic names; the German school have followed Dr. Emmerich's nomenclature, the British Palæontographical writers Murchison's generic name. The American geologists have generally given the generic name *Acidaspis* to species of this family, with the exception of Dr. Lock, who classed a species of this genus (*C. crosotus*) under Green's *Ceraurus*.

The special study of American trilobites has caused us to investigate the early works upon American palæontology, and we find this genus described by Dr. Warder (Am. Journ. Sci. and Arts, vol. xxxiv., No. 2, p. 377, 1838), under the generic name *Ceratocephala*.

His generic characters are very imperfect; he has not only inverted his description, but also his figure, mistaking the two divergent spines on the neck-furrow for antennæ. The generic characters point to the two surface granules, the divergent spines of the occipital furrow, the three pair of rounded lateral lobes which occupy the spaces between the glabella and cheeks; also to the connection of the eyes in front of the glabella by a strong ocular ridge. The figure indicates good generic characters.

Dr. Anthony, in the same journal, places a species under Dr. Warder's genus, with the error of mistaking a pygidium for the cephalic shield.

With regard to Dr. Warder's generic name, *Ceratocephala*, we advance the opinion that Dr. Warder has clearly established his genus, having given a description accompanied with a figure, and under the rule, his generic name, being the earliest, ought certainly to take precedence.

The objection may be made that the generic characters of *Ceratocephala* are obscure and somewhat inaccurate. To this argument we would advance as positive evidence, that the accepted genus *Triarthrus*, Green, was established upon the errors of its author. Dr. Green mistook the glabella for the entire animal; and the genus *Ogygia*, Brongniart, was founded upon the typical species *Ogygia buchii*, which was classed and described by the author under his genus *Asaphus*. In fact, all the *Ogygia* described by Brongniart have been referred to the genus *Asaphus*, except *O. desmarestii*, the last species described.

Corda objects to Warder's genus under the 10th Rule (Rules for rectifying the present nomenclature of zoölogy, British Assoc. Adv. Sci., 1842) in consequence of its similarity to *Ceratocephalus*, De Candolle, Methodus, 1794.

These names, however, seem to be sufficiently distinct to prevent confusion; certainly they are as much so as many others retained in natural history—for instance, *Pica* and *Picus*, *Cyprina* and *Cyprinus*, etc.

The objection to *Ceratocephala* cannot be made under this rule, for De Candolle's genus has been cancelled in toto by Bentham and Hooker, who unhesitatingly refer it to the genus *Ranunculus*.

CERATOCEPHALA, Warder.

Western Acad. of Nat. Sci., Cincinnati, May 25, 1838.
Am. Journ. Sci. and Arts, vol. xxxiv., No. 2, p. 377, 1838, fig.
Not *Ceratocephalus*, De Candolle, 1794.
Odontopleura, Emmerich, 1839.
Acidaspis, Murchison, 1839.
Ceraurus crosotus, Lock, 1843.
Dicranurus, Conrad, 1841.
Trapelocera, Corda, 1847.

Generic Char.—Head short, broad, truncate in front; the glabella broadest at the base, with a median portion strongly separated from the three lateral lobes, which are obscurely divided from the cheeks; cheeks thickened, generally spinous at the margin, and the angle produced into spines; eyes smooth, convex, connected with the front of the glabella by a strong ocular ridge; neck segment much enlarged, and generally produced into spines; body of 9 or 10 segments (fewer during the metamorphosis), with a narrow convexed axis, and horizontal pleuræ which are produced at their ends into spines; pygidium small, axis abbreviated, limb multidentate, with one strong lateral rib on each side produced beyond the margin (*fide* Salter, Decade vii. pl. vi.).

With our present knowledge we would follow the lead of a previous author, and subdivide the genus *Ceratocephala* into two groups, viz.:—

I. *Ceratocephala Trapelocera*, Corda, 1847; type *C. vesiculosa*, Beyrich.
II. " *Odontopleura*, Emmerich, 1839; type *C. ovata*, Emmerich.

American Species.

Acidaspis cincinnatiensis, Meek, 1872, Geol. Ohio, Pal. vol. i. 167, pl. 14 (fig. pygidium). Compare *O. crosotus*, Lock, *O. prevosti*, Barrande.

Ceratocephala ceralepta, Anthony, 1838, Am. Journ. Sci., vol. xxxiv. figs. 1–2. Meek, Geol. Ohio, Pal. vol. i. p. 169, pl. xiv., figs. 8–9. Cincinnati.

Ceraurus crosotus, Lock, 1842, Am. Journ Sci., vol. xliv., wood-cut, p. 347. Meek, Geol. Ohio, vol. i. p. 165, pl. xiv. fig. 10 a–b. Cincinnati.

Ceratocephala goniata, Warden, 1838, Western Acad. Nat. Sci., Cincinnati, May 25, 1838. Am. Journ. Sci. and Arts. vol. xxxiv., No. 2, 1838. Niagara group.

Compare—

O. vesiculosus, Beyrich, 1846, Uber Trilobiten, pl. iii. fig. 7 a–b.
Danai, Hall, 1862, Geol., Wisconsin, vol. i. 462. No figure or description.

Acidaspis Ida, Winchell & Marcy, Mem. Boston Soc. Nat. Hist., vol. i. 106, pl. iii. fig. 13.

Hall, 20th Regents' Report, 333, pl. xxi., figs. 8–9. Niagara group, Bridgeport, Ill.

Prof. Hall refers (20th Regents' Report, p. 400) *Acidaspis Ida*, W. & M., to his species *A. Danai*, and says *A. Danai* differs from *A. vesiculosus*, Beyrich, "in being more transverse, in the narrower front of the glabella, and in the straight instead of curving ocular ridges."

C. Halli, Shumard, 1855, Geol. Missouri, 200. pl. A, fig. 7. Cape Girardeau.

C. Horanii, Billings, 1843–4, Geol. Survey Canada, 341. Trenton group, R. la Frepinne.

Dicranurus hamata, Conrad, 1841, Ann. Report Pal. N. Y., page 48.

C. hamata, Hall, Pal. N. Y. vol. iii. 37. Also 15th Regents' Rep., plate ii. fig. 1. Meek, Geol. Ill., vol. iii. 390.

Lower Helderberg group, Albany and Schoharie Counties.

Acantholoma spinosa, Conrad, 1841, Rep. 39.

A. tuberculatus, Hall, Pal. N. Y. vol. iii. 368. 15th Regents' Rep. pl. ii. fig. 3; Conrad, 1840, Ann. Report Pal. N. Y., 205.

This name was used by Kloden, for a species of this genus, *vid.* Verst. der Mark Brandenberg, 112.

Lower Helderberg group, Albany and Schoharie Counties, New York.

A. trentonensis? Hall, 1847, Pal. N. Y. pl. 64. Trenton group, Bay of Quinta, Lake Ontario.

A. speniger? Hall, 1847, Pal. N. Y., vol. i. pl. 64, fig. 5. Trenton group, Mohawk Valley.

ON THE NITRATES OF TIN, ANTIMONY, AND ARSENIC.

BY GEO. HAY, M.D.

Since the publication (May, 1876), in the Proceedings of the Academy of Natural Sciences of Philadelphia, of my paper on Tin, Antimony, and Arsenic, I have attempted to isolate and procure in the crystalline form the nitrates whose reactions were therein described, and now commit to the Academy the results of my investigations.

Prepared solution of protonitrate of tin as described in previous paper. Placed solution in porcelain cup over another cup containing concentrated sulphuric acid, and alongside of this placed several fragments of caustic soda on ground-glass plate, and covered the entire arrangement with a ground bell-jar with its edge greased. Exhausted the receiver of two-thirds of its air, and left the solution for several days to evaporate. It became a syrupy liquid, of a yellow color, but showing no tendency to crystallization, occupying about one-tenth part of the inside of the cup. On the following day this syrupy liquid had the appearance on the surface of dry gum Arabic, and was gently heaving upwards from some gas being formed beneath the pellicle. Re-admitted the air into the receiver and removed the sulphuric acid and the gummy-looking mass to another plate, and covered both with the bell-jar, its edge being greased. My back being turned upon the apparatus, in about ten minutes a somewhat violent explosion took place, without, however, injuring the bell-jar. The bell-jar was filled with dense, orange-red fumes, so dense that I could scarcely see the two cups inside. On removing the bell-jar from the plate, I found that a remarkable change had taken place in the contents of the upper cup. It was now quite full of a white, flaky substance, and a stratum of the same substance was lying upon the glass plate. This substance I examined, and found it to be soluble in hydrochloric acid, and to yield all the reactions of hydrated binoxide of tin. It contained a minute portion of hydrate of metastannic acid, but no protoxide of tin. The yellow, syrupy liquid previously mentioned I believed to have been protonitrate of tin, which had spontaneously decomposed upon being sufficiently inspissated.

Prepared a fresh solution, and evaporated as before for several days in a partial vacuum. When the liquid had assumed the syrupy condition, showing as previously no disposition to crystallize, I removed the cup containing it from the receiver. The substance was entirely soluble in cold water to a clear fluid. It yielded with the utmost readiness all the reactions both of nitric acid and protoxide of tin. From the above experiments, I conclude that protonitrate of tin is an uncrystallizable salt, of a yellow color and syrupy consistency, soluble in cold water to a clear fluid; and that, upon being sufficiently inspissated, it is spontaneously decomposed into hydrated binoxide of tin and nitrous acid, that decomposition taking place with explosive violence. Thinking it a dangerous compound, I have not sent a portion of the syrupy liquid to the Academy. The aqueous solution of this nitrate (water 20 parts) remains clear at common temperatures for about a day; but afterwards it becomes cloudy, and after several days is entirely and quietly decomposed into hydrated binoxide of tin and free nitric acid.

Prepared antimony solution as described in previous paper. Evaporated a few drops on a thin watch-glass over sulphuric acid, and examined the dry residue by the microscope. It did not show any crystalline appearances except about the edges of the spot. The remainder of the spot had a reticulated appearance. The crystalline appearance was that of fine double lines.

Evaporated the main portion of the solution, under a bell-jar from which two-thirds of the air had been removed, over sulphuric acid, with some fragments of caustic soda placed upon the plate. After it appeared dry, I allowed several days to elapse to make sure that all free nitric acid was removed. The residue was of a yellowish-white color. Treated this residue with cold-water, and filtered. A portion remained insoluble. The insoluble portion consisted of antimonic acid, into which a portion of the dissolved teroxide had been converted during the process of evaporation. The filtrate was perfectly clear, and gave easily all the distinctive reactions of teroxide of antimony and of nitric acid. The portion dissolved must, therefore, have been a ternitrate of antimony.

Prepared arsenic solution as described in previous paper. Evaporated a few drops on a thin watch-glass over sulphuric acid until perfectly dry, and examined the dry residue by the microscope with a power of 100 diameters. It presented the appearance of bunches of crystals, of which the individual elements appeared to be rhombic plates of a white color, opaque, and very deliquescent, so much so that the crystals while being examined were dissolving, and in a short time were entirely fluid.

Evaporated the main portion of the solution, under the same conditions exactly as with the tin and antimony. Allowed to stand two weeks after it appeared to be dry, and then proceeded to examine. The substance was white, opaque, and very deliquescent. Applied every test for nitric acid, but could get no reaction. It will be remembered that, in my last paper, I stated that I had obtained the tests for pentoxide of arsenic, without mentioning whether teroxide were present or not. After evaporation to dryness in the cold, I find that teroxide of arsenic is absolutely absent, and in its stead I obtained all the peculiar and distinctive reactions for pentoxide of arsenic. I therefore conclude that, even if there be a nitrate of arsenic in a solution freshly prepared as previously described, it is probable that it cannot be isolated, for during evaporation, even in the cold, it is entirely converted into arsenic pentoxide.

APRIL 3.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-nine members present.

APRIL 10.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-five members present.

Papers entitled "On the Cambari of Northern Indiana," by Wm. F. Bundy, and "On Lavendulite from Chili," by E. Goldsmith, were presented for publication.

Remarks on the Yellow Ant.—Prof. LEIDY remarked that recently while seeking certain animals beneath stones in the woods of our vicinity, he had had the opportunity of observing the Yellow Ant, *Formica flava*, in possession of large numbers of other insects. This fact, in itself common enough, in one respect, was new and of special interest to him, and may be so to others. In one instance a comparatively small colony of the Yellow Ants had three different insects in their possession, consisting of a species of *Aphis*, a *Coccus*, and the larva of an insect, probably coleopterous. The Aphides were kept in two separate herds, and these were separated from a herd of Cocci. The larva was in the midst of one of the former herds. In a larger colony of the Yellow Ants, there was a herd of Aphides which occupied the under part of one margin of the stone and was almost ten inches long by three-fourths of an inch in breadth. The same colony also possessed a separate herd of Cocci, closely crowded and occupying almost a square inch of space. In both colonies the *Aphis* and the *Coccus* were the same. The *Aphis* is pale yellow with white tubercles on the dorsal surface of the abdominal segments. The *Coccus* is of a dark-red hue. Both Aphides and Cocci with few exceptions adhered to the under surface of the stones, and were not attached to roots. They appeared to be carefully attended by the ants, which surrounded them. The larva alluded to was almost six millimetres long, was covered on the back with a thick white cotton-like secretion. It was also carefully attended by the ants, which were frequently observed to stroke it with their antennæ. The Aphides and Cocci were all in good condition, but without visible means of subsistence excepting the neighboring grass roots partially extending into the earth beneath the stones, to which it is probable they were at times transferred by their masters.

On Cœcum of Capybara.—Dr. H. C. Chapman stated that in making a post-mortem examination of the Capybara (*Hydrochœrus Capybara*), which recently died at the Zoological Garden, his attention was particularly called to the size of the cœcum, which measured thirty-four inches in length, with a circumference of eighteen inches in its widest portion. Not only is the organ relatively enormous when compared with the size of the animal, but absolutely so when it is remembered that the cœcum in the horse and rhinoceros, while more capacious, attains, however, only a length of thirty and thirty-six inches respectively.

As regards the form of the cœcum, with the exception of the blind extremity being more obtuse than is usually seen in rodents, there was nothing peculiar. Noticeable, however, was its marked sacculated condition, due to the well-developed longitudinal bands.

Length of Capybara	38	inches.
" " small intestine	248	"
" " large intestine	48	"
" " cœcum	34	"

On Reflex Action in Turtles.—Dr. H. C. Chapman remarked that he took the opportunity of calling attention to the fact that decapitated turtles exhibit a responsive action to the application of acetic acid similar to that first observed by Pflüger in frogs. Not having at his disposition a frog, and wishing to demonstrate some of the phenomena of reflex action, he decapitated a turtle, and three hours afterward applied a drop of acetic acid to the anus. Almost immediately both the posterior extremities came from out of the shell, and, turning towards each other, with flexed toes made efforts to remove the acid. Twenty-four hours later he repeated the experiment, with the same result.

April 17.

The President, Dr. Ruschenberger, in the chair.

Forty-one members present.

A paper entitled "Report on the Brachiopoda of Alaska and the Adjacent Shores of Northwestern America," by W. H. Dall, was presented for publication.

The election of Dr. J. Gibbons Hunt as Professor of Histology and Microscopic Technology was announced.

On Intestinal Parasites of Termes flavipes.—Prof. Leidy remarked that in seeking small animals beneath stones and fragments of wood in our forests, observing the very common White Ant, *Termes flavipes*, he noticed that the intestine of the insect, seen in the translucent abdomen, was distended with brown matter. Feeling curious to learn the exact nature of this matter, he was surprised to find that it consisted largely of infusorial and other parasites, mingled with minute particles of decayed wood. In many instances the parasites are so numerous as to make up the greater portion of the bulk of the intestinal pulp. Every individual he had examined, of workers, soldiers, and winged forms, was infested with the parasites, which may be estimated by millions. As the discovery to him of this new world of parasitic life was recent, he had not yet had time to sufficiently examine scientific literature to ascertain whether the parasites had been discovered and described by others. M. C. Lespes, in a memoir on the organization of the *Termes lucifugus* of France, published in the *Annales des Sciences Naturelles* for 1856, remarks that the intestine is usually occupied by a kind of brown pulp, a living agglomeration of infusoria, and in another paper in the same volume, after describing a nematoid worm, *Isacis migrans*, infesting the Termes, he remarks that he had found in the intestine of the insect a great quantity of parasites, upon which he proposed to say something in future.

The parasites observed in our White Ant consist of five different kinds, of which three are animal and two vegetable in character. One of the latter consists of filaments of the algoid form he had once described under the name of *Arthromitus*, the other not so frequent is a *Spirillum*, probably *S. undula*.

The animal parasites, of which drawings were exhibited, are as follows:—

1. TRICHONYMPHA AGILIS.

This is a remarkable creature of obscure affinity, but probably related with the *Turbellaria* on the one hand and by evolution with the *Ciliate Infusoria* on the other. The animal is about $\frac{1}{300}$th of an inch long and about half the breadth of the length. It is fusiform, and is clothed with ciliate hairs of extraordinary length. The head is mammilliform; the posterior end of the body from subacute to obtuse according as it is narrowed or shortened by contraction. The cilia investing the body appear to consist of three sets: the shortest ones waving outwardly and downward from the head; a second set extending from the head the length of the body, incessantly waving downward and swelling outwardly; and the third set, the longest of all, extending from the head beneath the others in a longitudinal spiral manner far beyond the posterior end of the body, where they form a loosely twisted fascicle with divergent ends. The arrangement of the long cilia, clothing the body, reminded him of the nymphs in a recent spectacular drama, in which they appeared with their nakedness barely concealed by long cords suspended from the shoulders, and this arrangement has suggested the name applied to the parasite.

He was not positive whether he had been able correctly to interpret the interior structure of the animal, but it appeared to him to resemble more that of the *Rhabdocœla* than that of any of the *Protozoa*. No appearance of vascular or nervous system could be detected. The animal appeared to be capable of ingesting particles of solid food frequently observed in considerable quantity in the stomach occupying the posterior two-thirds of the body. The mouth apparently was a rounded pore at the summit of the head. From this a narrow tube expanded in a pharyngeal pouch communicating behind with the capacious stomach. An anal outlet may exist at the back end of the body, but was not detected. Opposite the conjunction of the pharyngeal pouch and the stomach, a granular nuclear body is constantly observed.

Trichonympha, though incessantly and actively in motion, usually remains stationary in position, but occasionally advances with feeble jerking propulsion. The chief movements consist in frequent retraction or shortening and bending of the cephalic end with rapid waving and swelling outwardly of the long ciliary hairs. The motion of the latter resembles the flowing of a thin sheet of water over the brim of a fountain vase or basin swayed to one side or the other by a current of wind. The longest cilia, extending beyond the back of the body in a loosely twisted fascicle, are the least active, but at times stretch outwardly and become more divergent at the ends, or they become more closely applied to the sides of the body. When the head is bent to one or the other side, with the summit directed forward, it gives rise to an appearance resembling the spiral peristome of a *Stentor*. Viewed on end, the parasite appears circular with long divergent cilia, and reminds one of the upper view of a *Vorticella*.

2. Pyrsonympha vertens.

The remaining two animal parasites are Infusoria. The larger of the two is often more abundant than the *Trichonympha*, and is about the $\frac{1}{200}$th of an inch in length. It is more delicate, less distinctly defined, and undergoes rapid dissolution after removal from the intestine of the Termite. It is elongated fusiform, or when shortened clavate or pyriform in outline. Like *Trichonympha*, it usually remains stationary in position, while actively moving, writhing, apparently twisting, and often bending in a waving manner from one extremity to the other. In motion, longitudinally spiral and parallel lines become more or less evident, and frequently cause serrated projections at the extremities, or at the prominence of the bends when produced at the lateral borders. These exhibit a rapid waving motion, strikingly resembling the movement of flames, and probably denoting the presence of minute cilia, though these were not positively seen. A narrow band extends the length of the body, sometimes projecting at one end, and moves in long, angular waves, flexing the body in accordance with its movement. The body appears to be composed of finely granular protoplasm, with but faint distinction of endo and ectosarc. A large oval or round granular nucleus occupies a position in advance of the middle of the body. The position of the mouth was not detected, though one is most probably present, as the animalcule is often replete with large particles of food, consisting of bits of wood. *Pyrsonympha* may be the larval condition of *Trichonympha*, though there is no evidence that such is the case.

3. DINENYMPHA GRACILIS.

A Ciliate Infusorian, the smallest and most abundant of the three animal parasites, about $\frac{1}{350}$th of an inch in length, is flattened, fusiform, and in motion often twisted. It is longitudinally and, in the twisted condition, spirally striated, and is invested everywhere with fine cilia. The animal usually, remaining like its companions nearly stationary in position, writhes from side to side, shortens and widens, or lengthens and contracts, and rotates in the long axis. The longitudinal lines of the body by contraction produce a serrated appearance at one end, or at the prominences of the lateral borders when the body is twisted. The interior of the body is finely granular, often with one or more large globules, probably consisting of a nucleus, and at times of contractile vesicles or vacuoles. No mouth could be detected, although one probably exists, as the animal often contains particles of solid food, sometimes comparatively of enormous size.

The great accumulation of parasites, apparently constantly existing in the White Ant, one of our most common insects, will afford a new and wonderful source of delight to our microscopists. They should be examined in a denser liquid than water, as this produces their rapid destruction. The white of egg thinned with water, Prof. L. finds to be a good medium in which to examine these and other minute parasites from the interior of animals.

The nematoid worm *Isacis migrans*, discovered M. Lespes, so abundantly existing within the *Termes lucifugus*, and also externally in the nest of this insect, in France, Prof. L. had occasionally found in the *Termes flavipes*.

On the Eucalyptus Globulus.—JOSEPH WHARTON remarked that about five years ago he wrote to London for seeds of the *Eucalyptus globulus*, and had them planted in his green-house in the early spring of 1872. The young trees throve well there, and, when transplanted, grew vigorously in the open air until the approach of winter led him to remove them to the green-house. By thus putting them in the open air every spring, and replacing them under glass during the winter, they continued to grow until in the fall of 1876 he gave several to the horticultural department of the Centennial Exhibition, and several to a friend; others he kept in his house as before. The plants at the Centennial Exhibition attained a height of about 20 feet, and were, when he last saw them, still flourishing, though rather too slim; those given to his friend were cut down on account of being too spindling, and are reported as being sturdy; those in his own hands grew out of doors as usual last summer, but, instead of being taken in on the approach of winter, they were laid down and covered with leaves and earth, in order to test their ability to resist in that way our winter climate. Upon taking them up this spring every one of them was found to be quite dead.

His object in raising these plants was to learn whether any chance existed of acclimating them here or in the swamps of New Jersey, and his experiments result in the conviction that there is no reason to hope for such a result; though several hard frosts late in the fall, with the thermometer as low as 25° F., had on several occasions produced no injury beyond the shrinking of leaves, the first attempt to winter them out of doors with all precautions, and after some maturity had been attained, ended, as has been said, in the death of his specimens.

Having read that Australia produces divers species of *Eucalyptus*, among them some that grow high up the hills, he wrote, in 1875, to Baron von Müller, the accomplished manager of the Botanical Gardens at Melbourne, for information as to the probable ability of any such species or varieties to withstand our winters, and also as to the power of these trees to banish such insects as the Jersey mosquito. He replied that the hill species were less valuable and important than the *globulus*, that some of them would be likely to survive here, and that he should not expect them to avail against troublesome insects.

As a green-house plant he found the *Eucalyptus globulus* in its early years decidedly attractive. Its foliage is of a peculiar color (hence its common name of blue gum), and the leaves are covered with a sort of bloom from the exudation of its aromatic resin. Its pungent and spicy or camphory odor was to him decidedly agreeable; that this odor is supposed to be health-giving, or destructive of malaria, another common name of the *Eucalyptus*, viz., fever-tree, sufficiently attests. There is not the slightest difficulty in growing the plants from seeds in an ordinary sand-bed in a green-house.

APRIL 24.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

Papers entitled "On the Evolution and Homologies of the Incisors of the Horse," by John A. Ryder, and "Synopsis of the

Fishes of Lake Nicaragua," by Theodore Gill, M.D., and J. F. Bransford, M.D., U. S. N., were presented for publication.

The Mineralogical Section reported its organization, and the election of the following officers :—

Director—Theo. D. Rand.
Vice-Director—Wm. H. Dougherty.
Conservator—Jos. Willcox.
Secretary—H. C. Lewis.
Treasurer—Wm. S. Vaux.
Recorder—H. C. Lewis.

Jos. G. Rosengarten, Edgar F. Smith, Ph.D., J. Marshall Stoddart, Jr., and Gertrude K. Peirce were elected members.

The following papers were ordered to be published :—

ON THE EVOLUTION AND HOMOLOGIES OF THE INCISORS OF THE HORSE.

BY JNO. A. RYDER.

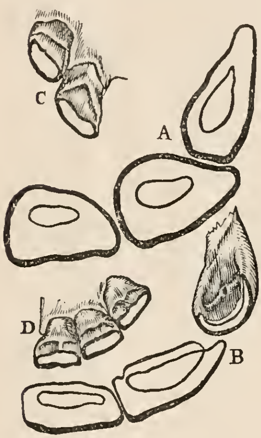
In the course of investigations made to determine the origin of the type of incisors found in the horse, it was noticed that the slightly worn third lower incisor from a horse, not adult, bore a very striking resemblance to the incisors in *Paloplotherium* and *Palæotherium*, which are regarded by Kowalewsky and others as ancestral forms of *Equus*. The tooth in question, which gave a foundation to this supposition, agrees remarkably in form with the incisors of the older genera mentioned, in the form of the posterior basal ridge, which seems to be destined to form the posterior wall of the central pit, or cul-de-sac—" mark" of horsemen. This posterior basal ridge in the third tooth in the state of development at the time of observation, occupied much the same relative position to the space between it and the worn surface in use at the anterior border of the crown, as the supposed homologous ridges in the aforementioned eocene and miocene forms. That the space between the posterior basal ridge and the worn surface functionally in use, is destined to become the central pit or cul-de-sac of the tooth is proved by the condition in which we found the third lower incisor under consideration, and the condition of the second alongside of it. The posterior basal ridge in the third has not yet been reached so as to be worn, and the second still retains marked traces in section of the lateral grooves. These seem to be the remains of the notches that once in bunodont forms separated the tubercles, which formed a festoon (cingulum) above the cervix of the tooth posteriorly, as observed in the upper inner incisor of *Dicotyles*.[1]

The posterior basal ridge in this outer lower incisor is also faintly marked off laterally, by a shallow longitudinal groove,

[1] Since writing the above we have had an opportunity of examining in the Zoological Gardens the incisors of a young female donkey, in which the condition of development had not reached the state detailed in the text. Even the inner incisor exhibits, when looked at from above, traces of the parentage of the hinder wall of the cul-de-sac, while the outer one is still more nearly like the same tooth in *Palæotherium*.

from the anterior portion of the tooth, and a slight notch is present in the middle of its crest.

The second incisor above, not yet protruded from the alveolus, has a marked groove running along the posterior face of the tooth longitudinally, a little more than .1 inch from its outer edge where the posterior wall (posterior basal ridge) of the central pit seems to be united with the anterior. There is also a central longitudinal groove in the posterior wall, the wall being slightly inflected along the course of the groove towards the centre of the pit. The posterior wall (posterior basal ridge) is also considerably shorter than the anterior in this tooth, which was observed to be the case in all of the incisor teeth before being protruded from the alveolus.



A. Right upper incisors of adult horse, fully worn, all traces of the basal ridges being obliterated as such, and now bounding the hinder borders of the pits.

B. Left lower incisors of young horse; the first tooth fully worn, the second partly worn, showing the points of junction of the basal ridge with the anterior part of the tooth, while in the third tooth the basal ridge is not yet worn.

C. Second and third upper incisors of *Palæotherium medium*, showing basal ridge. (After Gervais.)

D. Left lower incisors of *Paloplotherium minus* with basal ridges. (After Gervais.)

When the worn faces of the teeth are looked at from above, it is observed that the two edges of the enamel plates forming the anterior and posterior faces of the anterior and posterior walls are closer together in the posterior than in the anterior one, showing that the posterior has been the last to be brought under the influence of wear and that the posterior is likewise not as strong nor as fully developed, retaining, as it were, in its weakness, evidence of its later origin. In regard to the homology of the median groove and notch in the posterior wall of the central pit, there seems to be reason for believing that they are the remains of the space separating the lateral posterior oblique basal ridges of the incisors of such unspecialized forms as *Anthracotherium* and many others.

Amongst other perissodactyle mammals, as in *Tapirus*, in the upper incisors the posterior basal ridge is produced and almost as high as the anterior. The space between the two is sub-triangular, very shallow, convex from side to side, concave antero-posteriorly, and covered with a thick enamel layer. In *Palæotherium* there is a marked internal basal ridge on the canine, which is very slightly marked in the horse. In giraffe, the basal ridge seems to be developed in much the same way as in *Palæotherium*, in the third incisor at least, but has not advanced so high up the posterior face of the tooth.

These facts seem to point to but one conclusion, viz.: that these basal ridges are homologous, and that the space between the anterior wall, the primitive functional part, and the posterior wall (basal ridge), is the rudimentary cul-de-sac, and that sooner or later they are accelerated, becoming functional; or, are retarded, remaining rudimentary or disappearing altogether.

If we regard the dental system of *Equus* as an acceleration of the dental system of the primitive hippoid types, as has been shown by the results of the researches of Professors Leidy and Marsh, a clear explanation is at once afforded of the homologies of the parts of the teeth. The relatively short teeth of the earlier, and the relatively long ones of more recent forms, if we contrast the molars and incisors, seem to indicate that the acceleration was synchronous. The relatively short basal ridges of the early types were produced in a constant ratio with the production of the molar and incisive elements, culminating at last in the relatively complex incisive dentition of modern *Equus*. This view is verified by the embryological history of the teeth in the horse, where we actually have a sort of repetition of the forms of the incisors of earlier types.

REPORT ON THE BRACHIOPODA OF ALASKA AND THE ADJACENT SHORES OF NORTHWEST AMERICA.

BY W. H. DALL, SMITHSONIAN INSTITUTION.

Having during the last ten years had an opportunity of examining nearly all the known material, much of which is derived from the collections of myself and party during the period mentioned, I am able to present what appears to be a tolerably complete synopsis of the species inhabiting the northwest coast from Santa Barbara Channel, California, to the Arctic Ocean. To this I have added the results of some study of the general subject, regarding the relations of certain groups of species and a hypothetical explanation of certain very singular facts.

TEREBRATULIDÆ.

1. Terebratulina unguicula.

Terebratula unguicula, Cpr. P. Z. S. Feb. 14, 1865, p. 201, fig. 1-4. Cooper, Geogr. Cat. Cala. Moll. p. 3, 1866.

Terebratulina unguicula, Dall. Cat. Recent Brach., Proc. Phila. Acad. Nat. Sci., p. 177, 1872.

T. juniore "*Terebratulinæ capiti-serpentis*" simillima, sed latiore; costis conspicuis, interdum obtusioribus, aliis intercalantibus; testa adulta valva inferiore subelongata, inflata, marginem versus haud planata; umbone valde tumente, latiore, aperta; striis radiantibus conspicuis; marginibus granulatis, undulatis; intus amento majore, latiore, annulato, bisinuato, in testa juniore dorsaliter interrupto. Lon. 15 mm.; Lat. 12 mm.; Diam. 9 mm.

San Diego, Cal., to the Aleutian Islands. San Pedro, Cal., Cp.; Monterey, Cp.; Neeah Bay, W. T., Swan; Victoria, V. Id. Lord, J. Richardson; Port Etches; Shumagin Islands; Unalashka; Dall. Range, low water to 100 fathoms, those from deep water the largest, adhering to shells and stones. Thirty-eight specimens examined.

This species is readily separated from *T. caput-serpentis*, *T. Japonica* and other species, which strongly resemble it externally, by the broad loop which is usually open instead of being closed as the genus requires. However, it finally becomes closed in fully adult specimens which reach the size of *T. caput-serpentis*. In describing it from immature examples, Dr. Carpenter was led by this peculiarity to describe it as a *Terebratula*, and it was a number of years before I was able to find a fully developed specimen. All that I have seen from southern localities have been immature.

2. **Terebratella frontalis.**

Terebratula frontalis, Midd. Malak. Ros. III, p. 2. Sib. Reise. II, p. 241, pl. 18. fig. 9–11, 1847.

Terebratella frontalis, Dall. Cat. Rec. Brach, l. c. p. 184.

T. suborbiculari, solidula, calcarea, incrementi periodis irregularibus aspera, sordide lutescente; valvis convexitate æqualibus; linea marginali rectiuscula integerrima; valva dorsali postice producta, vix recurva, late truncata, foramine magno, latius aperto, interrupto; area cardinali augusta, utrinque interiora versus dente cardinali terminata; valva hæmali suborbiculari aut transversim ovali, sulco mediano nullo; apophysis "*Terebratellæ*" formis: Lon. 18 mm., Lat. 18 mm., Diam. ventr. 9 mm.

Western Aleutians from Atka Island westward; the Okhotsk and Japan Seas. Atka, Amchitka, Attu, Dall; Okhotsk Sea, Middendorf; Japan Seas, Capt. St. John. Range from low-water mark to forty fathoms. Sixty-five specimens examined.

The rude appearance, ashen color, and remarkably wide foramen distinguish this species from any other of the genus.

3. **Terebratella occidentalis.**

T. occidentalis, Dall, Proc. Cal. Acad. Sci., 1871, IV, p. 182, 1871, pl. I, fig. 7.

Waldheimia Grayi, of Cala. authors, not of Davidson.

T. transversa, rosacea aut miniata, costis radiantibus angulatis ornata; valvis flexuosis, convexiusculis lateraliter angulatis; margine cardinali lente curvato; apice vix eminente; foramine magno, interrupto, latius aperto; cardo et apophysis ut in "*Terebratella;*" area cardinali angusta, lata, conspicua. Lat. 18 mm., Lon. 12 mm., Diam. ventr. 5 mm.

San Francisco to Monterey, Cal. Pigeon Cove, Stearns; Monterey, Dall, Canfield, Cooper. Near low-water mark, to —? fathoms. Five specimens examined.

This rare species externally resembles, in its sharp ribs, transverse form, and deep crimson coloring, the above-named species from Japan, but it is a *Terebratella*, and authentic specimens of *T. Grayi* show that species to be, as it was described, a *Waldheimia*. The color and deeply notched margins distinguish it from the common northern *T. transversa*, the only species with which it is likely to be confounded. It is probable that careful search would reveal the habitat of this species, when it might be found more abundantly. Most of the specimens known have been picked up on the beach.

4. **Terebratella transversa.**

Terebratula transversa, Sby. Thes. Conch. 1, p. 261, pl. 72, fig. 114–115, 1846. Not of Gould, Proc. B. S. N. H. vii, p. 323, 1860.

Terebratella caurina, Gould, Proc. B. S. N. H. iii, p. —, 1850. Exped. Shells, p. 468, pl. 44, fig. 582.

Terebratella caurina, Gld. Otia Conch. p. 97, 1862. Cpr. Sup. Rep. B. As. p. 636, 1864.

Terebratella transversa, Dall. Cat. Rec. Brach. l. c. p. 185.

T. variabilis, fusco-cinerea, transversa, convexiuscula; costis angulatis numerosis interdum bifurcatis plerumque radiata; margine ventrali flexuoso; apice acuto, angulari; rostro brevi, curvato, foramine magno, interrupto; area cardinali elevata, lata, planata, margine carinato; apophysis curta, "*Terebratellæ*" aliis simillima. Lat. 25–40 mm., Lon. 16–25 mm., Diam. ventr. 5–15 mm.

Shumagin Islands to Oregon. Coal Harbor, Shumagins; Semidi Islands; Kadiak; Port Etches; Sitka Harbor; Dall. Victoria, V. Id., J. Richardson, Hepburn; Neeah Bay, Swan; Puget Sound, Kennerly; Oregon, U. S. Expl. Exped. Range from low-water mark to twenty fathoms. Sixty specimens examined, including Gould's type.

This abundant species is very variable in form and size; the northern specimens are the largest. Some are as transverse as a *Spirifer*. Gould's *T. transversa* from Japan was never figured, and cannot now be identified. It was not this species, which has in any case the priority. Sowerby's figure is sufficiently characteristic to render its identification with Gould's *caurina* tolerably certain.

The transverse form in most cases, the ashen-gray color and coarse ribs render its identification easy.

5. **Laqueus californicus.**

Terebratula californica, Koch, Kuster's Martini, viii, pl. 26, figs. 21–23.

Waldheimia californica, Gray, B. M. Cat. p. 60, No. 8, Cpr. Sup. Rep. Br. As. p. 568, 636.

Laqueus californicus, Dall, Am. Journ. Conch. vi, p. 123, 1870; pl. 7, fig. f., pl. 8, fig. 9–10. Cat. l. c. p. 186.

T. magna, rhomboideo-ovalis, valde inflata, tenuis, rufescente, striulis incrementi solum insculpta; valva hæmali ventricosa, sulco mediano nullo, margine postico vix angulato; valva dorsali posticè rostrata, foramine minimo, integro; rostro brevi valdè incurvato; apophysis ut in "*Laqueus*." Lat. 45 mm., Lon. 55 mm., Diam. 35 mm.

Port Etches, Prince William Sound, to Catalina Island, Cal. Port Etches, Dall; Victoria, J. Richardson; Catalina Id., Cooper. Range from fifteen to one hundred and twenty fathoms, the larger specimens generally from deep water. Twelve specimens examined.

This species may be recognized by its large size, smooth rufous exterior, and small and complete foramen. It somewhat resembles *Waldheimia venosa*, from Cape Horn, but has not the strongly marked venations, and is of a different form and color. It is everywhere rare, owing to its deep-water habitat.

6. **Megerlia Jeffreysi.**

Ismenia? Jeffreysi, Dall, Am. Journ. Conch. vii, p. 65, pl. xi, fig. 7–10, Mar. 1871.

Megerlia (*Ismenia*) *Jeffreysi*, Dall, Cat. l. c. p. 187.

Waldheimia cranium, jun., Friele (ex parte) Vidensk. Forh. p. 2, pl. i, f. 9 a–i, 1875.

Testa parva, lenticularis, tenuis, orbiculato-trigona, cinereo-alba; valva minor convexiuscula, suborbiculata, margine recto, apice inconspicuo, vix angulato; valva major convexior, apice truncato, brevi, recto, foramine modico, interrupto; area cardinali inconspicua; apophysis tenuissima, plerumque exilis, "*Megerliæ sanguiniis*," simillima. Lon. 10 mm., Lat. 10 mm., Diam. ventr. 4 mm.

Deep water, N. E. Atlantic; Semidi Islands to Victoria in the Pacific. N. E. Atlantic, 155–345 fathoms, Jeffreys, with *Waldheimia cranium*. Semidi Islands; Port Etches; Dall.; Victoria, V. Id., J. Richardson. Sixteen specimens examined. For so rare a shell this has an extraordinary range. It much resembles the young of the last species, but never attains much greater size than half an inch in diameter, and has an incomplete foramen. The color varies from ashy yellow to rufous. The specimens from the northwest coast were obtained in from fifteen to twenty fathoms water.

It is probable that it has frequently been taken for the young of other species, and that a careful examination of small specimens would much extend our knowledge of its distribution.

The septum is generally almost evanescent.

7. **Magasella aleutica.**

Magasella aleutica, Dall., Proc. Cal. Acad. Sci., Dec. 1872, p. 302, pl. I., fig. 6. Cat. l. c. p. 188.

T. parva, subinflata, solida, orbiculato-trigona, rosacea aut concentricè rubido-picta; valva minor convexa, suborbiculata, margine leviter sinuato, apice inconspicuo; valva major convexior, apice erecto, truncato, conspicuo, foramine amplo interrupto; area cardinali distincta, apophysis tenuissima, septum conspicuum munita. Lon. 10 mm., Lat. 9 mm., Diam. ventr. 4 mm.

Aleutian Islands to Port Etches.

Kyska Id.; Adakh Id.; Atka Id.; Unalashka Id.; Shumagin Ids.; Port Etches; Dall. Range from low water to ten fathoms. Fifty specimens examined.

This little species differs externally from the young of *T. frontalis*, only by its rosy color and neater proportions; from young *L. californicus* by its open incomplete foramen, and from the last species by its greater solidity, bright tints, loop, and prominent septum. It has somewhat the aspect of *M. inconspicua*, Sby., from New Zealand.

8. **Magasella radiata, n. s.**

M. testa minuta, cuneata, triangulata, radiato-costata; haud inflata; costis radiatis circa xvi. ornata; lineis concentricis sparsim striata; foramine aperto, interrupto; deltidium nullum; apice subacuto; testa lutea aut cinereo-alba. Lon. 0.5 mm., Lat. 5 mm., Lon. neural valve, 4 mm.

Shell small, nearly triangular, the greatest width near the anterior margin, which is gently rounded; somewhat flattened or compressed, with about sixteen moderately strong radiating ribs or costæ on each valve. These are continuous from the beak to the margin, not divaricating; some lines of growth well marked; foramen incomplete, large; apex rather acute; color waxy or ashy-gray. Interior as usual in this genus, with a strong septum. Shell quite solid and strong. Length 0.2 in.; of neural valve 0.17 in.; width 0.2 in.

Popoff Strait, Shumagin Islands; one specimen, with *M. Aleutica* adhering to stones at lowest spring tides.

This species is quite distinct from any other in the region. It is sculptured somewhat like *T. transversa*, from which it is sufficiently distinguished by its form, absence of median flexure, size, compression, and apophyses. It also recalls in some respects *M. Patagonica*, which has divaricating costæ, and is of a different shape.

RHYNCHONELLIDÆ.

9. **Rhynchonella (Hemithyris) psittacea.**

Anomia psittacea, Gmelin, Sys. Nat. 3348.
Hemithyris psittacea, D'Orb. Pal. Fran. Ter. Crèt. IV. p. 342, 1847.
Rhynchonella psittacea, Auct., Rve. Conch. Ic. pl. 1, fig. 2, a–c.
Hemithyris psittacea, Dall. Cat. l. c. p. 196.
Rhynchonella Woodwardi, A. Ad. Dav. P. L. S. 1871, p. 309.

T. subglobosa, postice acuminata, tenui, cornea, nigricante; valvis inæqualibus, radiatim concinne sulcatulis; linea marginali ex umbone declivi, demum ascendente et antice valde sinuata; valva dorsali postice acuta, recurva, antice deflexa, sulco mediano, lato, area cardinali inconspicua, deltidiis augustis, ad latera foraminis coalescentibus; valva hæmali, ventricosiore, dentibus cardinalibus internis ex umbone porrectis, recurvis duobus; margine valvarum integerrimo. Lon. 25 mm., Lat. 22 mm., Diam. ventr. 16.5 mm.

Boreal and Arctic Seas. On the northwest coast from Fuca Strait to the Arctic; Japan; North European Seas; everywhere abundant.

This well-known species is of circumpolar distribution, varying in depth from low-water mark to two hundred fathoms or more. In examining specimens from the shores of Alaska, I thought at first that by their coarser growth and grooving they were distinguished from Norwegian specimens. But after an examination of several hundreds of specimens, I have been forced to conclude that the differences noted were only individual or local peculiarities. I have observed in a few instances the brachial "arms" protruded from the shell in living examples.

LINGULIDÆ.

10. **Glottidia albida.**

Lingula albida, Hinds, Voy. Sulph. p. 71, pl. 19, fig. 4, 1844.
Glottidia albida, Dall. Am. Journ. Conch. vi. p. 157, pl. 8, fig. 1–6, 1870. Cat. l. c. p. 204.

T. oblonga, levi, complanata, anticè truncata, albida seu brunneo-maculata; valva major, intus laminis duobus ex umbonem divaricatis; valva minor, lamino uno, mediano, prope apicem munito; pediculo plerumque brevi. Lon. test. 25 mm., Lat. 10 mm., Lon. tot. 50 mm.

Monterey, Cal., southward.

Monterey, Dall.; Santa Barbara, Stearns, Newcomb; Catalina Island, Cooper; San Diego, Hemphill; ten to sixty fathoms, muddy bottom, rarely on tidal flats in mud at lowest water.

This species has not been found to the northward of Monterey, though it may yet turn up somewhere. It is usually not over three inches in length, peduncle included. Like other species of *Lingulidæ*, when young it is free, and burrows in the mud. Adult specimens, with favorable opportunity, often fasten themselves to a pebble or fragment of shell by the distal extremity of the peduncle. This has been also observed with *Glottidia pyramidata*, Stm., in Florida, by Mr. F. B. Meek, though that species had been supposed to be always free. It would seem probable, from information communicated to me by Mr. Meek, that these creatures are of rapid growth, and live at most but one or two seasons. It is the only species of the *Lyopomata* yet found on the northwest coast.

The following species, or supposed species, have been erroneously referred to the northwest coast, sometimes from mistaken identity and sometimes from other causes.

a. *Terebratulina caput-serpentis*, L., in error for *T. unguicula*, Cpr. Real habitat, North Atlantic.

b. *Waldheimia Grayi*, Davidson, by erroneous identification with *Terebratella occidentalis*, Dall. Real habitat, Japan.

c. *Terebratella Coreanica*, Ad. & Rve., by erroneous identification with *T. transversa*, Sby. Real habitat, Japan Seas.

d. *Terebratella pulvinata*, Gld. Erroneous habitat caused by confusion of U. S. Exploring Expedition labels. Real habitat, Tierra del Fuego and vicinity.

e. *Discina striata*, Schum., as *Orbicula Evansi*, Davidson, "Bodegas." Real habitat, Cape Palmas, W. Africa, and vicinity.

In this connection it may be allowable to call the attention of naturalists to certain facts connected with the group of arthropomatous brachiopods which have been with me for some years a subject of reflection. Not having been able to suggest any satisfactory explanation of the relations which appear to exist between certain groups of the *Terebratulidæ*, I desire to draw the attention of others to them, in the hope that some solution may be arrived at, and to place the facts on record. In 1871 I proposed the name of *Magasella* for a group of *Terebratulidæ*, mostly composed of small species, and characterized, among other things, by an incomplete foramen and a high septum, standing up from the middle of the brachial valve, and to which the loop is attached or appressed for a considerable portion of its length.

This section of the family has been recognized as valid by several competent naturalists. There are known, in all, about eleven well characterized species of this group, beside one doubtful species, *M. crenulata* Sby. Four of these species have been described by myself, and most of the others, not recently described, have but lately been discriminated from species of *Terebratella*, etc. In working over the group certain facts become prominent, which cannot be without significance when carefully considered. These facts may be formulated as follows :—

I. Each species of *Magasella* (with the exception of its generic characters of apophyses and foramen) has a more or less pronounced likeness to some species of another section of the *Terebratulidæ*. This likeness, in some cases, approaches identity when the generic characters and size are taken out of the question.

II. The species resembled are invariably members of a section of the family possessing a long or complicated loop, and usually a median septum. In fact most of them are Terebratellas.

III. The species resembled, usually though not invariably, inhabit the same faunal region as the particular species of *Magasella* which may be under consideration, and are often found living with the latter in the same localities.

IV. When there is an abundant species of *Terebratella*, for instance, on any coast, it is almost invariably accompanied by a species of *Magasella* of similar specific characters.

This law is so invariable in well explored regions, that I should feel hardly any hesitation in predicting the existence of a companion *Magasella*, in a region not thoroughly explored, when the prevalence in that region of a species of the section *Magasinæ* became known.

V. The genera *Terebratella* and *Waldheimia* being the most abundantly represented of any of the genera of recent brachiopoda, may be said to represent to some extent the most fully developed of the brachiopods; an inference borne out by the complication of the loop as compared with that of other groups. The loop of *Magasella*, being the most complicated of any (except the few species of *Megerlia*), may thus be the latest exhibition of evolution in this direction. The genus *Magas* (with which *Mannia* of Dewalque may perhaps be synonymous) is not very closely related to *Magasella*, and leaving it out of the question it may be added that, so far as known, *Magasella* occurs only in a recent state; another argument for its comparatively modern evolution.

In illustration of the above, the following parallel lists may be adduced showing the several species of *Magasella* with their companion species of other groups and the region to which they belong. Such as exhibit specially remarkable similarity in specific characters are marked with an asterisk; those exhibiting only a general resemblance are not so marked.

Magasella Adamsi, Dav.	?	Japan.
M. aleutica, Dall.	*Laqueus californicus*, Koch.	Alaska.
M. Cumingi, Dav.	?	New Zealand.
M. Evansi, Dav.	*Terebratella cruenta*, Dillw.	New Zealand.
M. flexuosa, King *	*Terebratella dorsata*, Gmel.	Patagonia.
M. Gouldii, Dall.	*Waldheimia Grayi*, Dav.	Japan.
M. inconspicua, Sby.*	*Terebratella rubicunda*, Sol.	New Zealand.
M. lævis, Dall.*	*Terebratella pulvinata*, Gld.[1]	Patagonia.
M. patagonica, Gld.*	*Terebratella dorsata*, Gmel.	Patagonia.
M. radiata, Dall.	*Terebratella transversa*, Sby.	Alaska.
M. suffusa, Rve.	?	Unknown.

With some hesitation I add also—

Megerlia Jeffreysi, Dall.*	*Wald. cranium*, Müll.	N.E.Atlantic.
Megerlia sanguinea, Ch.*	*Wald. picta*, Ch.	Indo-Pacific.

Of the three species queried, *M. Adamsi* resembles *Waldheimia Grayi*, jun., in a general way except in coloration; *M. Cumingi* is very peculiar, unlike any other recent species; and the habitat and probable companion of *M. suffusa* are alike unknown.

I have not included the section *Ismenia* (*Megerlia*) in my preliminary remarks, but the species, cited above, present, in a less

[1] A third, related to *pulvinata* as that is to *lævis*, is *Waldheimia venosa*, Sol.

marked manner, similar peculiarities. The companion of *Ismenia Jeffreysi*, on the Alaskan coast, would be *Laqueus californicus*, to which the Alaskan specimens show some similarity; while those from the N. E. Atlantic offer similarities which are very marked with the young *W. cranium*. Nevertheless, except a slight difference in color and solidity, there are no reasons other than geographical for separating the Atlantic and Pacific shells which I have called *I. Jeffreysi*.

With regard to *W. picta*, I can only judge from figures and the remarks of descriptive authors, who all point out its similarity to *T. sanguinea*. Both are Indo-Pacific in distribution, and have been reported from Japan. In this connection it may be noticed that the *Magasella* and its companion do not always occupy the same region at *all* points, but do usually meet at some common point in their distribution.

In the first portion of the list, the most striking instance of similarity is that which is shown by *Magasella inconspicua* and *Terebratella rubicunda*, jun. These appear absolutely without differential specific characters, though the generic characters of the individuals compared may be clearly marked.

It must be clearly understood and borne in mind, that the similarity between the *Magasella* and its companion is usually only remarkable when the *young* of the latter is compared with the *adult Magasella*. The adult companion shells frequently acquire characters belonging to maturity which, though too intangible to be of specific value, much obscure the original resemblance. At first the idea suggested itself, as a matter of course, that *Magasella* (and *Megerlia*) was an immature form, especially as it wants the median brachial coil as do the immature *Terebratellæ*.[1] The evidence against this hypothesis seems to me to have greater weight than that in favor of it; which latter chiefly arises, as far as *Magasella* is concerned, from the similarity of specific characters, and greater or less agreement in geographical range. Since the preceding portion of this article was written, I have been made

[1] This paper had been prepared and read before the Buffalo meeting of the Amer. Assoc. up to the above point, when the paper by Mr. Herman Friele, published in the Vidensk. Selskab. Forh. for 1875, was received from the author, and afterwards supplemented by a series of his specimens. The subsequent portion has since been recast to more fully present the whole subject.

aware that a species of *Megerlia* (subg. *Ismenia*) has been claimed as the young of *Waldheimia cranium* by Herman Friele. I will defer the examination of this special instance until the general case can be presented.

If *Magasella* be the young of the various forms herein denominated "companions," 1st, the distribution of any two species so related to each other should absolutely coincide; 2d, the young should all be *Magasellæ;* the adults (barring dwarfs), all of the "companion" genus; 3d, actual study of the embryology and young stages should be able to trace the edentulous stage into the *Magasella* stage, and that into the final "companion" stage.

Finally we should expect, with some show of reason, that the relations of the one to the other in development should be in harmony with the development of the group as a whole in geological time and organic differentiation. These expectations, though reasonable, from analogy in a multiplicity of other organisms, are not absolutely to be insisted on, while the three preceding propositions are absolute requirements.

What agreement exists between the facts and these requisites?

1st, as regards distribution: There is abundant evidence that the *Magasella* and its companion are not inseparable. For instance, *M. aleutica* and *Laqueus californicus* meet only about Port Etches, which is the southernmost limit of the first and the northernmost limit of the second. *M. aleutica* in that part of its district, where it is most abundant, has no associate brachiopod of its family except a *Terebratulina.* The same is probably true of *M. radiata*, which is found at the extreme northern limit of *T. transversa*, and is absent where the latter flourishes in abundance. In the second group, *W. picta* is reported from but one locality in Japan, while *Megerlia sanguinea* is rather common there; with regard to their joint occurrence at the Sandwich Islands I am a little suspicious that the *Megerlia* may have been taken for the *Waldheimia* by those unfamiliar with the apophyses, as I have seen large numbers of the former from that locality, but not a single *Waldheimia.*

Again *Megerlia Jeffreysi* appears to be common in the North Sea and North Atlantic, and is not rare in the southeastern portion of Alaska and British Columbia, reaching from the Semidi Islands to Puget Sound, while its Atlantic companion *Wald. cra-*

nium and the genus to which it belongs[1] are unknown in the Pacific district above described, and its Pacific associate has not been found north or west of Port Etches. It is impossible to say whether similar discrepancies occur in the distribution of the other species, as the regions they inhabit have not yet been investigated with any thoroughness.

2d. As regards the young and adult forms: Of several of the species of *Magasella*, the adults, or at any rate the largest specimens which have come to hand, are nearly or quite as large as the "companion" when also adult. This is especially true of the typical species of *Magasella*, *M. Evansi*, of which I have a specimen fully as large as the usual size of *T. cruenta*, and much larger than some of the younger specimens of *cruenta*, which have the typical loop of *Terebratella* proper. The same is true of *M. flexuosa* as related to *Terebratella dorsata;* and Pacific adult specimens of *Megerlia Jeffreysi* are as large as the usual size of *W. cranium* in the Atlantic. Nevertheless it is true that the *Magasellæ* are usually smaller than their "companions."

I have recently had the opportunity of examining a large series of young *Terebratella rubicunda* from New Zealand, and also a lot of *Magasella inconspicua* from the same locality. No two "companions" are more nearly identical in specific characters. In fact no one can separate them without examining the apophyses. Yet in the youngest stages of both (as well as the adults) the generic characters are clearly and unmistakably defined. Mr. Davidson has kindly informed me that he has had a similar experience with *T. cruenta*, and has come to an opinion that it is highly improbable that the *Magasella* is an immature form; in fact there seems to be no good reason for adopting that view of the matter.

Again, in this connection, attention must be called to the fact that sometimes two *Magasellæ* will have only one "companion" species between them, as *M. flexuosa* + *M. Patagonica* versus *Terebratella dorsata*, and one *Megerlia* has two *companions*, one in the Pacific and the other in the Atlantic.

There are also some whose "companions" are unknown, or which may be without companions, as *Megerlia truncata* in the Mediterranean (a sure case) and *Magasella cumingi* in New Zealand. Both of these are such remarkable forms that it is almost

[1] *W. cranium* has been erroneously accredited to Japan.

unreasonable to treat them as if possibly immature. In fact, in regard to all the better known species of *Magasella*, those who have studied them most will be the last to admit that they are anything but mature organisms, and, by analogy, it is natural to suppose that other species less known, but presenting equal marks of maturity, are adult also.

3d. In relation to the progressive development. Of course this is practically the test of the whole question, but it may be fairly claimed that it is a test which must be applied to each individual species before the question can be considered settled. Data are few and far between on this branch of the subject. Embryological material to a considerable amount is available, but mostly relating to the species with short apophyses, or belonging to other families. Morse has shown that the loop of *Terebratulina* begins as two spikes at the cardinal margin, and the two spikes increase in length, and finally coalesce in the median line. I have observed the same thing in *Terebratula cubensis*. It is self-evident that the loop of *Waldheimia*, when adult, is merely an extension and reflection of the ideal loop of *Terebratula*, and the inference therefrom would be that its development progresses in the same way. This opinion I am, at present, inclined to adopt. In the section *Magasinæ*, where all the species have the loop supplied with an additional support in the form of a septum, a different state of things is to be found. The septum is the first part of the skeleton to make its appearance.

In *Terebratella transversa* (*caurina*, Gld.) the youngest specimens, a twentieth of an inch in diameter, showed a septum bifurcate at top and notched on the anterior edge. The anterior part of the loop is completed or nearly so, before the lower longitudinal processes are complete from the hinge to the septum. In *Magasella aleutica* the fry has a strong septum, entire and not bifurcate, before any of the remainder of the loop is developed. In *Megerlia Jeffreysi* the youngest specimens I have seen ($\frac{1}{10}$ of an inch in diameter) have the loop well developed, and (whether this is an abnormal feature or not, I am not prepared to say) laterally compressed so that the longitudinal parts of the loop are proportionally closer together (in most cases) than in larger specimens, and the septum is proportionally stronger and larger. In a large proportion of the well-grown specimens of this species, there seems to be a tendency for the septum and other delicate portions of the loop to become abortive, but this I shall further discuss later. In all the *Magasellæ* the septum is the strongest and most permanent part of the skeleton.

In *Terebratella spitzbergensis* we have a species which seems to have just stopped short of being a *Magasella*, and *Wald. Davidsoniana*, Seq., seems to have a tendency in the same direction, while the strong septum of *Wald. septigera* only needs a pair of transverse processes to make it a *Terebratella*.

I have not seen very young specimens of *Laqueus californicus;* the youngest *Terebratella frontalis* which I have seen agree in the development of septum and loop with *T. transversa*, Sby.

It seems, therefore, that the early development of some of the "companion" species is incompatible with the idea of their young stages agreeing with *Magasella.* If we assume that what is true for two species of *Terebratella* is also true for the rest, six species of the seven *Magasellæ* known to have "companions," will have been taken out of the doubtful category. I feel sufficiently certain that *M. aleutica*, on geographical grounds, cannot possibly be the young of *Laqueus californicus.*

There are then remaining one species of *Magasella* and two of *Megerlia*, which have *Waldheimia* "companions." Of the younger stages of *Waldheimia* we have yet no positive information.

Mr. Friele in his paper previously referred to, and which I know by the plates only, as it is in the Norwegian language, which I have not attempted to translate, appears to have primarily assumed that the *Megerliæ* were the young of *Waldheimia cranium*, because of their external resemblance and co-ordinate distribution as far as known to him. But on the examination of a good series of young *Megerlia* he found a state of things which seemed to confirm his first assumption.

Mr. Friele found the smaller specimens conforming to the general type of *Megerlia.* Those with a pronounced septum he referred to *W. septigera*, but my own impression is that these merely exhibited not unusual individual peculiarities. To me, in examining the specimens, the transition from the one to the other, as regards the septum, seemed very gradual. He found larger specimens, in which the upper processes connecting the reflexed portion of the loop with the longitudinal bands of the loop, were abortive. In this case the loop remaining was generically that of *Terebratella.* In others, again, the septum had ceased to be connected with the transverse processes, and the latter in some cases had become disconnected from one another. In this stage only the remnants of the transverse processes remained to distinguish the loop from that of a *Waldheimia*. Hence he very naturally concluded that he had before him the stages of development of a *Waldheimia*, which must necessarily be either *cranium* or *septigera*, no other species being known from that region. The result was his paper. I am far from denying that this may possibly be the case. At any rate, Mr. Fricle is entitled to great credit for calling attention to these very interesting facts.

Thanks to his kindness, I have been enabled to examine a series of nineteen specimens of *Megerlia* of different ages, which, with a number in my own collection from the northwest coast, enabled me to make a pretty thorough study of them, and incidentally to confirm the general accuracy of his rather formal, but still characteristic figures.

It seems to me, however, that another hypothesis will explain them, if not equally well, yet in greater harmony with the analogies of the case, and, taking the geographical distribution of *Megerlia Jeffreysi* into account, with greater probability of accuracy.

In the first place it is to be noted that the specimens offered to me an absolute gap between the long characteristic loop of *W. cranium* and the broad, elevated, rather short loop of the *Megerlia*. Even in the absence of the missing parts the loop was totally unlike that of *W. cranium*,[1] and if adult would as a *Waldheimia* be specifically distinct from *W. cranium*. Secondly, all the specimens showed a remarkable weakness and tenuity of the loop even where complete; it seemed as if the abortion of part of the loop was caused by an absence of lime; or as if the specimens, growing rapidly, and necessarily being obliged to dissolve the loop and redeposit it on a larger scale (a process constantly going on), had been unable to make the latter part of the process keep pace with the former. There was nothing to indicate that the loop was not rather an unfinished *Megerlia* than one in a process of metamorphosis. Some Alaska specimens in the National Museum are much larger and stouter in every respect, than the largest of the supposed metamorphic specimens, and also quite equal to the

[1] Except a few specimens, which differed from the rest, and were undoubted young (but not smallest) specimens of *W. cranium*.

smallest typical *W. cranium*, but they show no degradation of the *Megerlia* type of loop.

I have examined this subject in a good deal of detail, because I believe that in it lies the key to some important generalizations. Certainly if one may have transformations including three now accepted sections or genera in the life of one individual, it will necessitate some changes in our systematic arrangements. I do not think we have in this case, yet it is none the less possible, and would not be the first instance among invertebrates.

ON THE CAMBARI OF NORTHERN INDIANA.

BY WILL F. BUNDY.

Accompanying the collection of fishes made by Messrs. Cook and Levette, a report on which has been recently published in the Proceedings of the Academy, was a small collection of craw-fishes. They were forwarded to me for determination by Professor Jordan.

The following are the species and localities:—

Cambarus immunis, Hagen, Long Lake, Kendallville, Ind.

Not distinguishable from specimens from Central Illinois. The young have lateral thoracic spines.

C. obesus, Hagen, Long Lake, Kendallville, Ind.

A few young females were found in the collection from this locality. The most common species in the West. A female caught in the mouth of a tile ditch at Mechanicsburg, Ind., on New Year's day, 1875, had her abdominal legs loaded with eggs nearly ready to hatch.

C. virilis, Hagen, Long Lake, Kendallville, Ind.

A few individuals apparently belong to this species, but the cephalothorax is but slightly depressed, and nearly smooth above. The inner ramus of first abdominal leg of male is not transversely flattened, and the hands and fingers are less tuberculate.

C. propinquus, Girard, Elkhart River, Rome City, Ind.

C. virilis, Hagen, Elkhart River, Rome City, Ind.

C. propinquus, Gir., Deep Lake, Northern Indiana. Exact locality not given.

The largest of this species I have ever seen measured $7\frac{1}{2}$ decimeters from tip of rostrum to that of telson. Two females present unusual variations. In one a second annulus appears between the third thoracic legs, somewhat similar in shape, but smaller in size than the normal organ. Another has hooks developed on the third thoracic legs, precisely as in males of the first form. There is also in these craw-fishes a tendency manifested toward multiplication of the lateral thoracic spines, there being in some individuals two, and in others three of these on each side.

A considerable number of this species, from an unknown locality, differ in having wider, more gaping hands, thicker at the base, as in *C. placidus*.

C. sloanii, Bundy, Bulletin No. 1, Mus. Ill. Nat. Hist., 1876, page 24.

Rostrum wide, excavated, margins nearly parallel, straight, or nearly so, acumen triangular, acute, toothed at base; cephalic carinæ short, near margin in front; antennæ shorter than body; laminæ longer than rostrum, moderately wide, external margin curved, swollen, apical tooth long, acute; epistoma wider than long, excavated narrower in front, emarginate; maxillipedes hairy on inner faces, naked below; cephalothorax subovoid, dorsum depressed, carapace finely granulated; lateral spines acute; anterior border of cephalothorax distinctly angulated; areola wide, posterior spatium wider than anterior; chelæ short, conical, wide, swollen toward base, nearly smooth below, finely granulated above, inner margin provided with two rows of inconspicuous teeth; outer finger wide at base, nearly straight, furrowed above on outer and inner margins, punctate above and below, inner margin with a row of small tubercles; inner finger curved, inner and outer margins tuberculate or serrate, more punctate above than below, incurved tips of both fingers brown, horny; third joint of third pair of thoracic legs hooked; first abdominal legs of male bifid, parts of nearly equal length, flattened, outer one nearly straight, apex directed outward; inner part slightly recurved, separating from outer part, and ending with acute points turned inward; tubercles at inner basal angle small, legs when folded under thorax reach to coxæ of second thoracic legs.

In the second form male, the chelæ are smaller and shorter, hooks on third legs smaller, first abdominal legs articulated between node and base, tips swollen, not brown horny.

The annulus of female has the anterior border scarcely separated from fourth venter, posterior border elevated, posterior angle prominent, bituberculate, the tubercles encroaching on fossa, lateral angles acute.

This species is very similar to *C. obscurus*, but on comparing it with types of this species I find the following points of difference: The rostrum is somewhat wider and more punctate above, the areola is wider, the fingers less gaping at base, the branches of first abdominal legs are round and slender in *C. obscurus*, and straight, while in *C. sloanii* they are flattened, and bent outward and backward. The annulus of female is also decidedly different in the two species. In *C. obscurus* it is divided by a cruciform furrow into four tubercles, of which the anterior pair are largest.

Length of largest male I have seen, $3\frac{1}{2}$ inches. This species inhabits streams in Southern Indiana and Kentucky. Dr. Sloan, who has studied its habits in its native streams, says of it: "I think his habit of burrowing is peculiar. He commences on the bank of the stream, burrows below the bed, and has an opening two or more feet out in the stream, where he sits watching for anything that may turn up, with a safe retreat. He can only be caught in that position by thrusting the net deep in the mud, so as to cut off his retreat."

Cambarus spinosus, Bundy, sp. nov.

Rostrum quadrangular, long, excavated, smooth above, toothed at apex; margins parallel, curved; acumen long, slender; cephalothorax depressed, punctate above, granulated on sides; lateral spines long, acute; cephalic carinæ parallel, black acute teeth in front; areola present; transverse suture not sinuous; antennæ slender, very long, reaching beyond tip of telson; laminæ as long as rostrum, narrow, tapering toward long, sharp, outward-directed apical teeth; long acute tooth at base; external margin incurved; epistoma wide, emarginate in front; maxillipedes hairy within, naked below; chelæ large, thick at base, smooth below, punctate above, inner margin finely serrate; fingers slender, curved, slightly gaping, costate above, smooth below, tuberculate and hairy on contiguous margins, of equal length, banded with black on distal half; outer margin of outer finger with a black stripe reaching on hand to carpus; two or three black spots on hand at base of movable finger; carpus with a sharp curved spine on inner margin, one on superior and two on inferior front margin; two rows of teeth on lower border of brachium, outer row with only two teeth; third joints of third pair of legs of male hooked; first pair of abdominal legs of male strongly bifid, tips of equal length, very slender, straight, separating at node; anterior margin with a tooth or projecting angle about midway from base to extremities; apical forming a very obtuse angle with basal half.

The second form male has hooks on third legs smaller, first abdominal legs longer, external part longer than internal, and slightly recurved, both tips much thicker, no tooth on anterior margin, articulated below node and narrower at base. The female has smaller, narrower hands, straighter fingers, not gaping at base. The annulus is directed obliquely backward, transversely elliptical, a large tubercle on posterior angle and two smaller ones in front separated by a furrow continuous with nearly straight, well-defined fossa.

The longest male I have ever seen measured $3\frac{3}{4}$ inches from rostrum to tip of telson. The length of areola is contained twice in the distance from transverse suture to base of apical teeth of rostrum, thus giving the animal a peculiarly short-waisted appearance.

I have seen nineteen specimens of *C. spinosus*, of which seven were second form males and eleven females.

Habitat.—Etowah, Oostanaula and Coosa Rivers, in the vicinity of Rome, Georgia, where it is extremely abundant, in company with *C. extraneus.* From the collection of Prof. D. S. Jordan.

SYNOPSIS OF THE FISHES OF LAKE NICARAGUA.

BY THEODORE GILL, M.D., AND J. F. BRANSFORD, M.D., U. S. N.

During the spring of 1876, Dr. Bransford devoted some attention to the fishes of Lake Nicaragua while engaged in official duties under instructions from the Secretary of the Navy. The result of his labors was a collection of twenty-one species, of which seven are new to science, and several others have been for the first time definitively added to the fauna. The following article is an enumeration of the species collected as well as those otherwise known as inhabitants of the lake. The responsibility of the determination of the species rests chiefly with Dr. Gill.

Lake Nicaragua is distant from the Atlantic Ocean, at its nearest point, some sixty-five miles in an air line; while in the neighborhood of Rivas it approaches within ten miles of the Pacific. It extends in a northwest direction from its outlet at San Carlos, about a hundred and ten miles, with a maximum width of forty. A depth of 125 feet was obtained by Com'dr Lull's survey.

Except in the valley of the San Juan, the land between the lake and the Atlantic is higher and rougher than between it and the Pacific Ocean. Mean high water in the lake is above high tide in the Pacific—103.14 feet; and above mean tide in either ocean 107.63 feet. The lowest summit elevation on the west side is 43.78 feet above mean high water in the lake. This is about five miles from the lake, on the Rio Lajas route. A surface of eight thousand square miles is drained into this basin, which discharges at a minimum in the dry season 113.90 cubic feet per second, through its only outlet the San Juan River. The river is 119 miles long, and has five series of sharp rapids. The lake furnishes the inhabitants of its shores with water excellent for drinking. It is stocked with fish of great variety, from the little *Chirostoma* up to the shark and sawfish.

Most of the fish are excellent for table use. They are usually taken with a cast net, frequently at night, or with a hook and line. The sardines, as they are called, the *Chirostomæ* and *Pœciliæ*, are taken in weirs made of the branches of trees; and sometimes girls sitting on the rocky shore scoop them in with twigs as the swell throws them into the pools and passages among the rocks. Squier thus describes the fisheries in the neighboring lake of Managua:[1] "At one point bushes were planted in the lake, like fish-weirs, between which women were stationed with scoop-nets, wherewith they laded out myriads of little silvery fishes, from the size of a large needle to that of a shrimp, which they threw into kettle-shaped holes, scooped in the sand, where, in the evening light, leaping up in their dying throes, they looked like a simmering mass of molten silver. These little fish are called sardinas by the natives, and are cooked in omelets, constituting a very excellent dish." "The first travellers in Nicaragua mention this novel fishery as then practised by the aborigines, and it has remained unchanged to the present hour."

Crabs are abundant along the banks of the lake; and turtles come ashore in great numbers, at certain seasons, to deposit their eggs.

Six years after the discovery of Nicaragua by Gil Gonzolez de Aviola, the old Spanish Chronicler Oviedo resided for some time in this region, and a few years later wrote a most valuable account of the country, its inhabitants, and productions. The following is a somewhat free translation of extracts relating to fish from his work:—

"There are in this lake (or these lakes, if you think there are several) many and good fish. But I believe it to be one single lake, and there is a good reason for it, which is that it contains very large sea fish, and from the sea they come into it, such as sharks and many alligators and cockatrices. And what confirms and affirms my belief that it is only one lake and in communication with the sea, is that in the year 1529 I found on the coast of this lake, lying on the beach, in the Province of Nicaragua, a dead fish that the waters must have thrown out, and which no man ever saw or caught but in the sea; it is called the sword fish, the one that carries a high snout at the extremity of the upper jaw; that ferocious sword full of sharp-edged teeth (on both edges) closely spaced. And this one I found dead, out of the lake, must have come into it by said outlet, and, although over 12 feet long, it was small, because the sword was small, not more than one palm and three fingers long, and not wider at the root, the widest part,

[1] Squier's Nicaragua, v. I, p. 412.

than two fingers. There is a great variety of fish, and the water is good and healthy, not very light nor heavy." (Vol. iv. page 63.)

"The common food of the Indians, and one they are very fond of, is the river and sea fish; they are very skilful in fishing and in the artifices they use for the purpose. And as some use fishing rods in Spain, the Indians in the same way fish with long and flexible poles well adapted for the purpose, and with line and bows, and more commonly with well-made cotton nets; and also with inclosures and partitions built in the shape of palisades, and from their canoes or boats. And they also employ a certain herb called *baygua*, which, thrown in the water, intoxicates the fish and after a short time they come to the surface lying on their backs asleep or stunned; and the people take them with their hands in large quantities. This baygua is similar to bexuco."

"But besides the fish thus taken from the rivers, they catch large quantities of them in the manner I stated hereinbefore. And it is my belief that these fishes from this country are healthier than those from Spain, because they contain less phlegm, but they are inferior in taste, though here are some very good; such as small and large *lisas*, *jureles*, *bemujuelas*, *mojarras*, *guabinas*, *palometas* *bihabacas*, *sávalos*, *robalos*, *parquetas*, *caçones*, *sardinetus*, *cornudas*, *pulpos*, *tollos*, *corbinitas*, *agujas*, *linguados*, *açedias*, *salmonades* (I do not mean salmons), *hortias* (oysters), *almejas* (clams), and shell-fish of many kinds; *langostas* (lobsters), *cancrejos* (crabs), *jaybos*, *camurones* (shrimp), *rajos*, many and in some places very large; *anguilas* (eels), *morenas* (murænas) numerous and very large; *tiburones* (sharks), *lobos marinos* (sea lion), etc." (Vol. i. p. 424.)

"They fish with poles, in imitation of the fishing rod used in Spain, and with lines. I say they learned this way of fishing from the Christians, because the Indians had no fish-hooks. Leaving out these two ways of fishing from those I have mentioned, they used to fish constantly in other manners, and also with *judrias* and with a kind of trap, in the rivers." (Vol. i. p. 425.)

The worthy chronicler must not be judged too harshly for his assumptions respecting the communicability between the sea and lake, because of the presence of sawfish and other marine types. In our days naturalists have based hypotheses and classifications upon even less data and in spite of known facts.

The earliest of the historians of Nicaragua was also the most full and satisfactory in his account of its fishes. Later travellers have not added materially to the ichthyography of the country, and the allusions to the fishes made by Belt, Stout, Boyle, etc., it is unnecessary to recapitulate; they have chiefly adverted to the presence of sharks in the lake; the existence of the sawfish has even by Squier been regarded as apocryphal.

Almost all of our knowledge of the fish fauna of the lake has in fact been gained within the last twelve or thirteen years. With the exception of vague allusions to the fishes referred to, nothing had been published respecting them till the year 1864.

In 1864, in the fifth volume of the "Catalogue of the Fishes in the British Museum" (page 125), Dr. A. Günther described a species of Siluria under the name *Pimelodus nicaraguensis* (= *Rhamdia nicaraguensis*) presented by Capt. J. M. Dow.

In 1864, also, in a "Report of a Collection of Fishes made by Messrs. Dow, Godman, and Salvin, in Guatemala" (Proc. Zool. Soc., London, for 1864, pp. 144–154), Dr. Günther introduced four new species, viz.: *Eleotris longiceps* (= *Philypnus longiceps*), *Heros citrinellus*, *Heros nicaraguensis*, and *Heros Dovii*, all of which had been obtained by Capt. Dow from the lake.

In 1866, in the sixth volume of the "Catalogue of the Fishes in the British Museum," Dr. Günther made known two species of Cyprinodonts, viz.: *Gambusia nicaraguensis* and *Pœcilia Dovii*, both of which, like all the previously described species, were due to Capt. Dow.

Finally, in 1868, in "An Account of the Fishes of the States of Central America, based on collections made by Capt. J. M. Dow, J. Godman, Esq., and O. Salvin, Esq." (Trans. Zool. Soc. London, v. 6, pp. 377–494, pl. 63–87), Dr. Günther introduced still another new species of *Heros*—*Heros longimanus.*

In the same memoir (p. 405) Dr. Günther also gave a full list of the fishes so far received from the lake, which then numbered nine species, and contrasted them with those from other hydrographic basins, viz.:—

"E. *Lake of Nicaragua.*—Also the fishes of this lake are, with two exceptions, peculiar; like Lake Managua, it appears to have been part of a marine channel.

Eleotris longiceps.	*Heros labiatus* (Lake of Managua)
Heros longimanus.	*Pimelodus nicaraguensis.*
—— *citrinellus.*	*Gambusia nicaraguensis.*
——*dovii.*	*Pœcilia dovii* (in common with Lake Amatitlan)."
—— *nicaraguensis.*	

The element of especial interest in connection with the ichthyic fauna of the lake, is the association of forms that we are in the habit of regarding as characteristically marine with those that are at least as exclusively fresh-water types. Thus, with the species of Cichlids and Characinids, of which no representatives have been found in marine waters, we have a species of *Megalops*, a shark, and a sawfish. The association of the Plagiostomes in fresh water is not, however, unique. As has long been known, a similar instance of combination occurs in the Philippine Islands. "Near Manila," says Mr. W. W. Wood,[1] "is the Laguna de Baij, a large sheet of water some ninety miles in circumference, divided by an island and two peninsulas, from which it is often spoken of as the lakes. This lagoon receives the waters of the small rivers of the provinces of the Laguna and Morong, and its only outlet is the river Pasig, which flows with the bay between the military city and suburbs of Manila." "The water of the lake is quite fresh, and, after settling, perfectly potable." In this lake are found a sawfish, which, according to A. B. Meyer,[2] is specifically identical with the *Pristis Perotettii* of the sea, and a shark which has not been specifically identified, but which is said to be "a small species of dog-fish, and quite harmless." It is also known to naturalists that sharks frequently ascend to a considerable distance up rivers, and that in large rivers, especially several in South America, species of rays, not known to occur elsewhere, are found.

The *Megalops* has not hitherto been known to occur in bodies of fresh water so isolated from the sea as is Lake Nicaragua.

These instances, supplemented as they are by many others, are sufficient to convey a caution against too extensive generalization of the physiographical conditions hinted at by fossil remains of aquatic types.

The why and wherefore of such combinations of species are not entirely apparent. They may have resulted (1) from the intrusion of the salt-water types into the fresh waters, or (2) from the detention and survival of the salt-water fishes in inlets of the sea that have become isolated and gradually become fresh-water lakes. On the whole, it appears more probable that the latter is the case. By the uplift of the land, an inlet of the Pacific Ocean might have been shut off from communication from

[1] Nature, xiii. p. 107, 1875. [2] Nature, xiii. p. 167, 1875.

the ocean, and the character of the water would be soon changed by the copious showers of that tropical country. The shark, saw-fish, megalops, and other species mostly found in the sea, had, however, time to accommodate themselves to the altered conditions, and in this connection it must be remembered too, that most of the types in question are known to voluntarily ascend high up streams and even into fresh water. The numerous rapids of the river discharging from the lake discourage, however, the idea that the species enumerated have voluntarily ascended that river and entered the lake. The concurrence of the fresh-water fishes with the others and their entrance into the lake from the surrounding streams would be merely a question of time.

With these remarks we close, and preface the descriptive portion with a list of the species enumerated.

GOBIIDÆ.
 Philypnus longiceps.

CICHLIDÆ.
 Heros rostratus.
  longimanus.
  labiatus.
  citrinellus.
  basilaris.
  Dovii.
  nicaraguensis.
  balteatus.
  centrarchus.
 Neëtroplus nicaraguensis.

ATHERINIDÆ.
 Chirostoma guatamalensis.

CYPRINODONTIDÆ.
 Gambusia nicaraguensis.
 Pœcilia Dovii.

CLUPEIDÆ.
 Opisthonema libertatis.

ELOPIDÆ.
 Megalops ——.

CHARACINIDÆ.
 Chalcinopsis dentex.
 Bramocharax Bransfordii.

SILURIDÆ.
 Rhamdia nicaraguensis.

PRISTIDÆ.

Pristis antiquorum ?

GALEORHINIDÆ.

Eulamia nicaraguensis.

GOBIIDÆ.

Philypnus longiceps.

Eleotris longiceps, Gthr., Proc. Zool. Soc. London for 1864, p. 151.

——— ——— Gthr., Trans. Zool. Soc. London, vol. vi. p. 440, 1868.

Two specimens were obtained, agreeing well with Günther's description of the species in question.

CICHLIDÆ.

Heros rostratus.

The form is that of the *Helleri* type. The back declines rather rapidly to the tail, and in front of the dorsal is slightly gibbous.

The height is contained two and one-third times in the extra-caudal length. The caudal peduncle is one-third higher at its base than long. Its greatest height bears to its length the ratio of 10 to 8. The head is acutely pointed, and the snout above, rectilinear. The length of the snout exceeds half that of the head. The inter-orbital area is nearly flat. The preoperculum and cheeks are very oblique. The buccal scales are in six rows. The jaws are normally developed. The superior maxillary terminates at a vertical a little nearer the eye than the snout, and the articulation of the lower jaw is also notably in advance of the eye. The lips are moderately developed, and the lower ones separated by a broad frænum at the middle.

The dorsal fin is well developed; the anterior spines are rapidly graduated, the rest subequal; the soft rays, when bent back, extend a little beyond the basal third of the caudal. The anal fin commences under about the twelfth dorsal spine; its first four spines rapidly increase, and its last two moderately; the soft part, when bent back, extends a little beyond the basal fourth of the caudal. The caudal enters four and one-third times in the extreme length, and is subtruncate, but slightly emarginated in the middle. The pectoral fins are well developed, and extend about as far backwards as the first anal rays. The ventral fins have filamentary rays which extend backward to the last anal spine.

The color is a bronzed olive indistinctly crossed, at least in the young, by two bands, one under the dorsal, and the other below its last rays; later, these fade out more or less, leaving, of the first, only a rather indistinct dorsal saddle under the median spines, and of the second, a distinct black spot below the lateral line. A black spot also exists at the base of the caudal fin, mostly above the lateral line. The breast and lower surface of the head bronzed or blackish towards maturity.

The dorsal at its spinous part is dusky and immaculate, but in its soft portion diversified by dusky areas in three or five rows, separated by narrow light interspaces. The anal is more nearly uniform, but still has a few light spots. The caudal is reticulated by bright interspaces on a dusky ground. The pectorals are spotless. The ventrals dusky.

This species is quite characteristic in the extension of the rostrum, and is thus readily distinguished from at least any of the Nicaraguan species, if not from any yet made known. It is apparently most nearly related to the *Heros affinis* (Günther), of Lake Peter. Eleven specimens of various sizes were obtained by Dr. Bransford.

Heros longimanus.

Heros longimanus, Gthr., Trans. Zool. Soc. London, v. VI. p. 453, pl 72, fig. 2, 1868.

But one half-grown specimen was obtained by Dr. Bransford.

Heros labiatus.

Heros labiatus, Gthr., Proc. Zool. Soc. London, for 1864, p. 27, pl. 4, fig. 1, 1864.

Heros labiatus, Gthr., Trans. Zool. Soc. London, v. VI. p. 456, 1868.

Heros citrinellus.

Heros citrinellus, Gthr., Proc. Zool. Soc. London, for 1864, p. 153, 1864.

Heros citrinellus, Gthr., Trans. Zool. Soc. London, v. VI. p. 459, pl. 71, fig. 1, 1868.

Four specimens were obtained, which apparently belong to this species, although none exactly agree with the description or figure published by Dr. Günther.

Heros basilaris.

The form is that of the *Margaritifer* and *Citrinellus* type. The back declines moderately to the tail, and is regularly decurved in front of the dorsal fin; the height is contained two and one-third times in the extra-caudal length; the caudal peduncle is not much higher at its base than long, and it decreases very gradually to the fin; the head is normal, and the snout above convex and blunt in front, the length of the snout is little more than a third the length of the head; the interorbital area is slightly raised; the preoperculum is nearly vertical; the buccal scales are in four rows; the jaws are normally developed; the supra-maxillary terminates at a vertical, very little in advance of the orbit; the lips are moderately developed, and are free all around; the teeth of the outer row are of rather large size; the dorsal fin is moderately developed; the anterior spines are normally graduated, the rest subequal; the soft rays when bent back extend nearly to the terminal third of the caudal; the anal fin commences under the thirteenth dorsal spine, its first three spines are rapidly, and the succeeding moderately, graduated; the largest soft rays, when bent back, reach the second third of the caudal; the caudal enters four and a third or four and a half times in the extreme length, and its margin is convex-truncate; the pectoral fin extends to the vertical of the third and the ventral fin to that of the fourth or fifth anal spine.

D. xvi. 12. A. vii. 8.

The color is bronzed-olive, with (in the young, at least) seven bands; in the fourth band is developed a distinct blackish spot just under the lateral line, and on the base of the caudal fin, above the lateral line, is another, but smaller, blackish spot; the dorsal and anal fins are dusky, but the soft parts much darker at the base than on the rest of their fins and surface; the caudal fin is also much darker at its basal third than behind; the pectoral and ventral fins are dusky and uniform, save that the filamentary rays of the ventrals are darker.

The species is quite nearly related to a number of species, and, among the Nicaraguan ones, next to the *Heros longimanus*, but its combination of characters sufficiently differentiates it as a distinct species from any previously well characterized. It is one of the most abundant species of Lake Nicaragua.

Heros dovii.

Heros dovii, Gthr., Proc. Zool. Soc. London, for 1864, p. 154, 1864.

Heros dovii, Gthr., Trans. Zool. Soc. London, v. VI., p. 461, pl. 73, fig. 4, 1868.

No specimens were obtained by Dr. Bransford.

Heros nicaraguensis.

Heros nicaraguensis, Gthr., Proc. Zool. Soc. London, for 1864, p. 153, 1864.

Heros nicaraguensis, Gthr., Trans. Zool. Soc. London, v. VI., p. 465, pl. 77, fig. 1, 1868.

No specimens are in Dr. Bransford's collection.

Heros balteatus.

The form is that of the *Godmanni* type; the back declines rather slowly, and in a gentle curve to the tail, and in front of the dorsal is boldly decurved to the forehead; the height is contained rather more than two and a half times in the extra-caudal length; the caudal peduncle is little higher than long, and gradually diminishes to the tail; the head is abbreviated and the snout convex above and almost sub-truncated in front; the length of the snout enters two and a half times in that of the head; the inter-orbital area is flat; the preoperculum mostly vertical, but convexly protuberant at the angle; the buccal scales are in five rows; the jaws are normally developed; the supra-maxillary terminates at a vertical in front of the orbit; the lower lip is indicated by an obsolete fold wanting towards the symphysis; the teeth in the outer row are moderately enlarged; the dorsal fin is slightly developed; the anterior spines are rather slowly graduated, and the rest subequal; the longest soft rays, when bent back, extend to the terminal half of the caudal; the anal fin commences under about the fourteenth dorsal spine; the spines at first rapidly and then gradually increase in length backwards; the longest soft rays, when bent back, reach the second third of the caudal fin; the caudal fin enters four and a third times in the extreme length, and is slightly emarginated; the pectoral fins reach backwards to the vertical of the third anal spine, and the filamentary rays of the ventral fins extend to the fourth or fifth anal spine.

D. xviii. 10. A. vii. 7.

The color (in spirits) is yellowish-orange; a rather broad black band extends from the post-ocular region across the operculum and shoulder, along the flanks to the spot at the base of the caudal fin. The back in front of the dorsal has also a blackish spot, and under the base of the dorsal fin are more or less defined dark areas or spots; the dorsal fin is dusky and immaculate, as are also the anal and caudal; the pectoral fins are yellowish at the base and dusky beyond, and the ventral have the outer rays dusky (but with the edge of the external lighter) and the inner yellowish; the branchiostegal membrane below is orange or yellowish, and the breast slate-colored.

This is also an abundant and characteristic species. Of the previously known Nicaraguan species it seems to most resemble the *Heros nicaraguensis*, but is so decidedly distinct as to need no special comparison.

Heros centrarchus.

The form is of the *Multispinosus* type; the parts above and below the longitudinal axis are nearly equally balanced; the back declines moderately in a curve towards the tail and in front of the dorsal is slightly, but regularly decurved towards the forehead; the height is contained twice in the extra-caudal length; the caudal peduncle is very short, its height at the root being twice as great as it is long, and it comparatively rapidly narrows to the caudal; the head has the forehead slightly gibbous, and the snout is rectilinear and pointed in front; the length of the snout is little more than a fourth of that of the head; the interorbital area is slightly raised; the preoperculum is nearly vertical and at the angle boldly rounded; the buccal scales are in five rows; the jaws are normally developed; the supramaxillary terminates at a vertical about a pupil's length in advance of the eye; the lips are moderately developed and the lower is interrupted in front; the teeth of the outer row are rather strong; the dorsal fin is moderately developed; the dorsal spines increase in a regular, bold curve from the first to the sixth, and the following are nearly equal; the longest rays bent backwards extend for the length of the basal half of the caudal; the anal fin is very long and commences under the ninth dorsal spine; the spinous portion is not much less than three times longer than the soft; the first three spines are rapidly graduated and the following ones nearly equal; the longest soft rays reach backward to the terminal half of the caudal; the caudal fin forms a quarter of the extreme length, its angles are round and the posterior margin slightly emarginated; the pectoral fin extends backwards nearly to the vertical of the fifth or sixth anal spine; the ventral fins also reach to nearly the same point.

D. xvi. + 8; A. x. + 9.

The color is bronze-olive, with seven indistinct cross-bands; at the base of the tail is a faint spot chiefly above the lateral line; the fins are dusky and emaculate.

The species is related to the *Heros multispinosus*, but is distinguished sufficiently by the characters specified in the description. The specimen preserved at least is entirely destitute of the distinct longitudinal band which characterizes the *H. multispinosus*, and is also distinguished by a slight gibbosity above the orbit which contrasts with the straight profile of the older species.

But one specimen was procured. Both in physiognomy and in the number of the anal spines it resembles the genus *Centrarchus* of North America, and, hence, the name is very appropriate, inasmuch as it serves to recall this resemblance as well as to indicate the great number of spines. The group of which it is a representative may receive the subgeneric name of *Archocentrus*.

Neëtroplus nicaraguensis.

The form is almost entirely that of *Neëtroplus nematopus;* the back declines equally slowly backwards, but in front of the dorsal falls in a more regular convex line to the forehead; the height equals two-fifths of the extra-caudal length; the caudal peduncle is slender, and its length equals the height; the head is short, and the snout convex forwards and subtruncated in front; the length (or depth) of the snout equals nearly half that of the head; the interorbital area is convex; the preoperculum moderately oblique; the supra-maxillaries terminate at a vertical about a pupil's length in advance of the orbits; the lips are moderately developed, the lower interrupted by a broad isthmus in front; the dorsal spines increase in a bold curve from the first to the fifth and the rest are subequal; the soft rays, when bent back, reach nearly to the terminal half of the caudal; the anal fin commences about under the fourteenth dorsal spine; the first three spines rapidly increase, the succeeding slower; the longest rays reach to the second third of the caudal fin; the caudal fin forms about a fourth of the extreme length and its posterior margin is truncated; the pectoral fin extends to about a vertical with the anus; the ventral fin to about the third or fourth anal spine, the filament of the external ray being moderately produced.

D. xviii. + 11; A. vii. + 7.

The color is olive-brown, and almost uniform. The fins are also uniform save that, perhaps, the soft portion of the dorsal and anal are darker at the base.

The species is very closely related to the type and hitherto only known species of the genus *Neëtroplus* (*N. nematopus*), but is distinguished by the simple convex forehead, and the more truncated snout, the truncated caudal, the less elongated ventral filaments, and the uniform color of the operculum. Three specimens were obtained.

ATHERINIDÆ.

Chirostoma guatemalensis.

Atherinichthys guatemalensis, Gthr., Proc. Zool. Soc. London, for 1864, p. 151, 1864.
Gthr., Trans. Zool. Soc. London, v. VI., p. 443, 1868.

Nine specimens were obtained which doubtless belong to this species, although they do not entirely agree with the description, which, however, is too brief.

CYPRINODONTIDÆ.

Gambusia nicaraguensis.

Gambusia nicaraguensis, Gthr., Cat. Fishes B. M., v. VI., p. 336, 1866.
Gthr., Trans. Zool. Soc. London, v. VI., p. 483, pl. 82, fig. 3 (fem.), 1868.

Known only through the description and figure published by Dr. Günther.

Pœcilia Dovii.

Verified Synonymy.

Pœcilia Dovii, Gthr., Cat. Fishes B. M., v. VI., p. 344, 1866.

Possible Synonymy.

Gambusia plumbea, Troschel, Reise Mex. von Müller, v. III., p. 106.

Five specimens were obtained.

CLUPEIDÆ.

Opisthomena libertatis.

Meletta libertatis, Gthr., Proc. Zool. Soc. London, for 1866, p. 603, 1867.
Clupea libertatis, Gthr., Cat. Fishes B. M., v. VII. p. 433, 1868.
Gthr., Trans. Zool. Soc. London, v. VI., p. 487, 1868.

Two small specimens were obtained.

ELOPIDÆ.

Megalops ——.

The Megalops is a most beautiful fish, with olive-green back, and sides frosted with silver. The specimen, of which only two scales were preserved, sprang upon the deck of the river steamer while going down the Toro Rapids—the first set after leaving the lake.

While here in 1873, one that weighed 62 lbs. sprang into our boat. In March, 1873, while encamped at the head of the Toro Rapids, every evening, just before sunset, one of these magnificent fish came close under the grassy bank to play in the deep swift current. It would make its appearance, and, turning on its side, slowly sink and rise again. One evening I stood in wait with a harpoon, the blade of which, about eight inches long, was armed with four or five barbs, about an inch in length. On the fish's approach the harpoon was hurled and buried six inches in the flesh behind its shoulder. The terrified animal rushed down stream in a style that made our hands burn as the long line spun through. Three men were required to hold it, but in five minutes it was apparently exhausted and allowed itself to be hauled up near the bank. Two Indians were sent out in a canoe to land it, but when touched, it gave a convulsive spring, tearing away and leaving chunks of flesh on each barb. The flesh of this fish is rather coarse, but much eaten by the natives. (Bransford.)

CHARACINIDÆ.

Chalcinopis dentex.

Brycon dentex, Gthr., Proc. Zool. Soc. London, for 1860, p. 240.
Chalcinopsis dentex, Gthr., Cat. Fishes B. M., v. V. p. 337, 1864.
Gthr. Trans. Zool. Soc. London, v. VI. p. 478, pl. 82, f. 2, 1864.

The height of the body is contained three and one-third times in the total length without the caudal; the length of the head is a little less than four times; the maxillary extends to a vertical with the front of the pupil of the eye; the snout is about as long as the eye; the interorbital space is convex, its width is nearly half as great again as the length of the snout; the dorsal fin has its origin nearer the base of the caudal than the extremity of the snout, and its posterior is above the anal; the free portion of the tail is considerably longer than high; the caudal fin is deeply forked; the pectoral fin extends nearly as far backwards as the base of the ventrals. The color is olive-brownish on the back, and silvery on the flanks and abdomen; the scapular arch is bordered with blackish; the dorsal fin is dusky; the anal fin forwards is also dusky towards the free margins.

Two specimens were collected, which, as will be seen from the above description, agree essentially with *Chalcinopsis dentex*, of Günther; but one of them is distinguished by a remarkable deviation from the type in the development of the preopercular and buccal bones of one of the sides.

On the right side, the preopercular bone extends backwards over the interoperculum, and has an oblique posterior margin; the enlarged inferior, or buccal, suborbital bone is more than twice as long as high, and its posterior margin is oblique and parallel with that of the preoperculum; the post-orbitals are well developed and nearly contiguous. On the left side, the homologous bones present essentially the characteristics attributed to them in the figure published by Günther.

Genus BRAMOCHARAX.

Body elongated, compressed—fusiform, and with the belly, in front of the ventrals, rounded. Scales of moderate size, with entire margins, but very distinct radiating striæ on their exposed surfaces; lateral line moderately decurved and complete; head moderate, with a pointed slender snout and slightly incurved profile; sub-orbital bones well developed, and with the buccal and combined post-ocular ones subequal and enlarged; nostrils close together and separated only by membranous partition; mouth with the cleft moderately oblique and deep, extended at least below the anterior borders of the eye; teeth uni-serial on the jaws; those in intermaxillary, as well as dentary, being compressed and conical; those of the former moderate, and those of the latter enlarged, especially on each side of the symphysis; teeth of supra-maxillary extending along almost its entire edge, and small, compressed, and muticuspid or denticulate; branchial apertures ample, the branchiostegal membrane being deeply cleft and free from the isthmus; dorsal fin short and sub-median, being above the space between the ventrals and anal; anal fin moderately long, and restricted to the posterior half of the fish's length; pectorals moderate; ventrals abdominal, and inserted at nearly a head's length behind the head.

The genus thus defined, is, in brief, characterized by the physiognomy of an *Astyanax* or bream, combined with characteristics of the genus *Cynopotamus*, and technically, at least, it approaches nearest to the last-named group. Its distinctive features are found in the association of characters enumerated, especially the form, size of scale, dentition, moderately elongated anal, and position of the ventrals.

Bramocharax Bransfordii, Gill.

D. 11, A. 2 + 26, P. 16, V. 1 + 8.

The height is contained about two and three-quarters times in the length, exclusive of the caudal.

The head enters three and two-thirds times in the same length.

The eye is large, its diameter equalling a quarter of the head's length. The snout is somewhat longer than the eye, is attenuated, and projects slightly beyond the lower jaw. The superior maxillary bones are much decurved, and extend somewhat behind the centre of the eye.

SILURIDÆ.

Rhamdia nicaraguensis.

Pimelodus nicaraguensis, Gthr., Cat. Fishes B. Museum, v. V., p. 125, 1864.

No specimens were secured by Dr. Bransford.

PRISTIDÆ.

Pristis antiquorum.

A saw of the species of *Pristis* inhabiting Lake Nicaragua has been sent to the Smithsonian Institution by Dr. Flint, of Granada. It essentially agrees with those of the *Pristis antiquorum* in the collection of the Institution, although quite well marked individually. The lake-dweller may still prove to be a form differentiated specifically from its marine congener; there is, however, no sufficient reason for its determination from the saw.

GALIOSHINIDÆ.

Eulamia nicaraguensis.

The snout is short and obtusely rounded; the distance between the mouth and the extremity of the snout is considerably less than (about four-fifths of) the interval between the inner angles of the nostrils; no labial fold is superadded to the groove at the angle of the mouth; the teeth are rather larger and less numerous than usual, *e.g.*, $\frac{25}{25} = \frac{12+1+12}{12+1+12}$; the upper of these are nearly regularly triangular, scarcely notched on the posterior margin, and with both margins distinctly serrated; those in the lower have a broad two-rooted base, but narrow cusps which are very finely serrated on the margins; the first dorsal commences just behind the vertical from the inner axil of the pectoral fin, and its vertical height about equals the snout at the line of the nostrils, and is considerably higher than long at its base; the second dorsal is somewhat larger than the anal, its base is about two-fifths as long as that of the first dorsal, while its height is about a third of that of the first; the pectoral fins are moderately developed, the greatest extent being considerably less than twice the height of the dorsal.

The shark of Lake Nicaragua cannot be identified with any of the previously-described forms, although closely related to *Eulamia Milberti* and the kindred species. The specimen described, when freshly caught, measured 6 feet 4 inches in length. The skin and jaws were preserved. Although, as indicated in the introductory remarks, it has long been known that a shark was an inhabitant of the lake, the relations of the species have been previously unknown, and the spoils obtained by Dr. Bransford are the first that have been subjected to scientific examination.

Larger specimens than that obtained might have been procured, but Dr. Bransford took the first caught. There are numerous well-authenticated cases of people having been killed by these sharks, and the natives are very careful to keep out of their way. Some six months before Dr. Bransford's arrival a man was bitten by one near the place where this specimen was taken. A great portion of one thigh and buttock was cut away, and he died from the effects. Repeated tales are told of similar incidents. Squier says: "Sharks abound in the lake. They are called tigrones from their rapacity. Instances are known of their having attacked and killed bathers within a stone's throw of the beach at Granada."[1] They are found throughout the length of the river San Juan, of sizes varying from a foot to over six feet in length. Sivers thinks that they come up the river from the sea.

[1] Squier's Nicaragua, vol. i. p. 196.

ON LAVENDULITE FROM CHILI, S. A.

BY E. GOLDSMITH.

In some of the huge blocks of cobalt ore from Chili, which were on exhibition in Fairmount Park last year, blue irregular veins of a mineral were observed; this blue mineral was supposed to be the Lavendulan of Breithaupt.

The Lavendulan was first found at Annaberg, Saxony, but only in very small quantities, insufficient for the making of a quantitative analysis. Prof. Plattner as well as Mr. Lindacker—the latter found the second locality somewhere in the Austrian Empire—agree that it is composed of the oxides of arsenic, copper, cobalt, nickel, and water.

I found in the Lavendulite from Chili the same elements, besides some impurities, as lime, oxide of iron, and insoluble matter which were impossible to separate mechanically.

It occurs in a gray rough rock which seems to be Trachyte, and it is associated with Erythrite, the latter sometimes finely crystallized. Although the lavender blue mineral seems to be, in some specimens, the most conspicuous, it is, nevertheless, on close examination found to be intimately mingled with the gray granules of Trachyte in which it is found. This circumstance makes it very tedious and difficult to separate the pure substance for analysis. The best or purest which I could obtain was but 77.58 per cent.

I noticed with the lens that the substance is an aggregation of very minute crystals, the length being in some of the thin veins equal to the thickness of the vein. Its hardness I could not determine, because the fragments separated from the rock were too small for observation. The specific gravity I did not take on account of the impurities present. Prof. Breithaupt found for the Lavendulan from Annaberg: $H = 2.5 - 3$, and $S. G. = 3.014$.

Color lavender-blue; the powder produced is paler.

The lustre is slightly resinous, almost dull; its fracture is indeterminable in the small fragments I possessed. If a fragment is held in the flame of the Bunsen burner, it fuses readily, coloring the flame green and changing the blue color of the mineral to black.

Heated in the closed tube it affords water.

On charcoal with carbonate of soda it gives copper and a strong alliaceous odor indicating arsenic.

With borax in O. F. a blue glass is obtained.

In water it seems to be insoluble.

Hydrochloric acid dissolves it easily if heated, and affords a green solution.

The following is the quantitative result of an examination of all the elements:—

$\dddot{\text{A}}\text{s}$ =	36.38	per cent.
$\dot{\text{C}}\text{u}$ =	31.11	"
$\dot{\text{C}}\text{o}$ =	1.95	"
$\dot{\text{N}}\text{i}$ =	1.05	"
$\dot{\text{H}}$ =	7.09	"
F =	6.38	"
$\dot{\text{C}}\text{a}$ =	3.23	"
Insol. =	11.61	"
	98.80	"

On subtracting the impurities from the sum found, there remained 77.58 per cent.; this is considered the quantity of pure substance contained in the mixture, which, as remarked before, could not be had any better. If we resolve the remainder to a hundred, the numbers will then stand thus:—

$\dddot{\text{A}}\text{s}$ = 46.89	per cent.	contains	16.30	of oxygen.	
$\dot{\text{C}}\text{u}$ = 40.10	"	"	8.27	"	} = 9.08
$\dot{\text{C}}\text{o}$ = 2.51	"	"	0.53	"	}
$\dot{\text{N}}\text{i}$ = 1.35	"	"	0.28	"	}
$\dot{\text{H}}$ = 9.13	"	"	8.11	"	

The oxygen ratios of

$$\dddot{\text{A}}\text{s} : \dot{\text{R}} : \dot{\text{H}} = 5.4 : 3.02 : 2.7,$$

or, adopting for it 5 : 3 : 3, it will afford the formula:—

$$\dddot{\text{A}}\text{s}\,(\dot{\text{C}}\text{u},\dot{\text{C}}\text{o},\dot{\text{N}}\text{i})^3 + \dot{\text{H}}^3.$$

This formula would require these values:—

$\dddot{\text{A}}\text{s}$ = 44.04 per cent.

Assuming only

$\dot{\text{C}}\text{u}$ = 45.61 per cent.

$\dot{\text{H}}$ = 10.30 "

The respective equivalents of the oxides of cobalt and nickel being lower than the equivalents of the oxide of copper, in the last theoretical quantities, the $\dot{\text{C}}\text{u}$ is necessarily greater. The specimens for analysis were furnished by the curators of the Academy.

May 1.

The President, Dr. Ruschenberger, in the chair.

Forty-one members present.

A paper entitled "Notes on the Natural History of Fort Macon, N. C., and Vicinity, No. 3," by Dr. H. C. Yarrow, was presented for publication.

May 8.

The President, Dr. Ruschenberger, in the chair.

Thirty-seven members present.

A paper entitled "On the Brain of Chimæra Monstrosa," by Burt G. Wilder, was presented for publication.

On the Placenta of a Monkey.—Dr. H. C. Chapman remarked that as it is comparatively rare for monkeys to breed in confinement, and as the opportunity does not often present itself of examining the placenta in these animals, a few remarks on the character of that structure in the *Macacus nemestrinus* might not be considered superfluous. The young monkey, which was born dead in the Zoological Garden, measured 13 inches from snout to tip of tail. As in the case of almost all the old world monkeys or Catarrhines, there were two placentæ, which measured in their largest diameters 3 and $3\frac{1}{2}$ inches respectively, and were discoid in shape. The umbilical cord was $7\frac{1}{2}$ inches in length, and contained one umbilical vein, and two umbilical arteries. Curiously enough in the South American monkeys, while there are two umbilical veins, as well as two arteries in the cord, the placenta is single.

On the Earthy Oxides of Samarskite.—Prof. J. Lawrence Smith made some remarks on the anomalous properties of the earthy oxides of samarskite belonging to that class of the earths which are precipitated by a cold concentrated solution of sulphate potash, or sulphate of soda. He gave his reasons for believing that these oxides contain but little if any cerium oxide, and that there is a strong probability of the bulk of it being a new earth. He expressed these views with much caution, because more thorough investigation on larger quantities might possibly prove them to be inaccurate.

On Marbleized Iron.—Mr. Wm. H. Dougherty reported the results of his examination of a new article of enamelled iron-ware called "Marbleized Iron," which had recently been extensively sold in this city for cooking and other domestic purposes.

Some of this ware having been introduced into his own household, and hearing reports of the enamel having much lead and arsenic in its composition, he had made the following experiments:—

A pint of good ordinary so-called "White Wine" vinegar was poured into a new dish of this ware, and slowly evaporated nearly to dryness—distilled water was then added, and treated with hydro-sulphuric acid—the resulting precipitate of sulphide of lead was then dissolved in nitric acid, and reprecipitated with sulphuric acid in presence of alcohol as sulphate of lead, and weighed 183 milligrammes, or over $2\frac{3}{4}$ grains, which result was further confirmed by reducing it to metallic lead with the blowpipe.

This result would indicate that the vinegar had dissolved out of the enamel enough lead to make about *three* grains of acetate of lead.

Into another dish of the same ware was put an ounce of citric acid, dissolved in a pint of distilled water, and boiled for some time, and then treated precisely as the vinegar in the first experiment, resulting in a precipitate of sulphate of lead, weighing somewhat less than that obtained by the vinegar, but showing that the citric acid had dissolved out a corresponding amount of lead from the enamel, as in the first experiment.

These two acids, acetic and citric, were used preferably as those most likely to come in contact with this ware in domestic uses—the first in vinegar, and the other (citric acid) occurring not only in the orange family, but being also present in the free state in gooseberries, currants, cherries, and in the potato and onion.

A can of tomatoes in an acid condition was digested in another dish of this ware and filtered—the filtrate treated as in the former experiments showed slight but positive evidences of the presence of lead.

Arsenic is said to be present in this enamel, but none had been found after repeated trials, both by wet and dry tests.

The stronger acids and caustic alkalies decompose this enamel. A portion of which, detached with considerable trouble, and fused with carbonate of soda in the usual way, yielded about as follows:—

Oxide of lead	12 per cent.
Silica	47 " "
Alumina, Iron, Lime, Potash, Soda	41 " "
	100 " "

May 15.

The President, Dr. Ruschenberger, in the chair.

Twenty-seven members present.

Remarks on Gregarines.—Prof. Leidy remarked that his recent study of the Rhizopods had led him once more to make an examination of some of the Gregarines, regarded as pertaining to a nearly related class.

The Gregarines are especially parasites of the Articulata, most of the known forms having been found in insects, crustaceans, myriapods, and annelides. Most of those observed by himself were found in vegetable and dirt feeders. They frequently occupy the alimentary canal, but in some animals occupy other organs or the perivisceral cavity. With few exceptions, the Gregarines at maturity consist of a comparatively large nucleated cell, which for convenience may be named the body cell, continuous at one pole with a small non-nucleated cell, which in like manner may be viewed as the head cell. Both cells are filled with fine globular granules, which in mass give the Gregarines a milk-white appearance. No mouth or trace of intestinal organs exists. The outer wall of the cells is a thick, structureless, contractile endosarc; and within this, in the body cell, there is often perceptible, as in *Gregarina larvata* of our common *Julus*, a well-marked longitudinally striated and apparently muscular layer.

The motions of the Gregarines consist of a kind of peristaltic action of the wall of the body cell proceeding from one to the other end.

In the Gregarines, so common in several species of our earthworms, the head cell is absent, and therefore is very properly viewed as of a different genus from the more ordinary *Gregarina* under the name of *Monocystis*. The *Monocystis agilis* is sausage-like in form, and is usually from $\frac{1}{3}$ to $\frac{3}{4}$ of a millimetre in length. In movement its contractions may commence at one end and proceed towards the opposite end, or it may commence at both ends proceeding towards the middle, or may commence in the latter position and proceed towards the ends.

From the researches of Lieberkühn and others, it appears that the Gregarines of earthworms assume a globular form and become encysted, and the granular contents are in a greater measure resolved into navicula-shaped germs, which have been named pseudo-naviculæ or navicellæ or psorosperms. Lieberkühn was led to consider the amœboid perivisceral corpuscles of the earthworm, as amœba-like embryos derived from the navicellæ, but it is very doubtful whether there is any relationship whatever between the two. Both Gregarines and navicella-cysts are met with in the intestine of our common earthworm, but the cysts are to be found most frequently and abundantly in the sperm vesicles. In the six vesicles of an earthworm Prof. Leidy had counted 1540 mature navicella-cysts, together with a number of groups of immature cysts. The mature cysts, readily visible to the naked eye, as minute pearly-white globules, by transmitted light have a peculiar pale blue hue. They measure about $\frac{1}{4}$ of a millimetre in diameter. A cyst burst open spread its navicellæ over a millimetre square, and was estimated to contain about 2500. These were quite uniform in size, and measured 0.0133 mm. long and 0.00665 broad.

E. Van Beneden has clearly traced the development of the *Gregarina* of the Lobster from Amœba-like embryos, so that it is not improbable that similar embryos may be derived from the navicellæ.

The Gregarines are usually viewed as constituting the lowest class of the Protozoa, and hence the lowest of animals. From their structure and mode of development, Prof. L. considered them as holding a higher rank than Rhizopods, and occupying a position intermediate to these and the Infusoria.

Prof. L. further stated that in a large earthworm, *Lumbricus terrestris*, from the yard of his residence, the posterior pair of sperm vesicles alone contained upwards of a thousand navicella-cysts, besides several thousand Gregarines, *Monocystis agilis*, exhibiting the varieties of condition, such as have been represented by Schmidt, Lieberkühn, and others. Many of the Gregarines were invested with motionless cilia, while other actively contracting individuals possessed no trace of these appendages. Some of the Gregarines further exhibited transition stages towards transformation into navicella-cysts. The latter differed from those previously mentioned in having but a single thin membranous layer for their wall instead of many layers.

Prof. L. added that our earthworms, which appear to be the same as the common European species, likewise appear to be infested with the same variety and kind of parasites. Among the latter he had repeatedly observed the infusorian *Anoplophrya lumbrici*, and also several different nematoids. One of these, which he had found in the sperm vesicles, appeared to be undescribed. It was certainly different from the *Dicelis filaria* found in the same organs by Dujardin. It appears nearly related with *Anguillula*, and may be regarded as such with the name of *A. melancholica*. Its characters are as follows: Body cylindrical, tapering at the ends, distinctly annulated. Head truncated, with the vertex convex, and perforated centrally by the mouth, and defined from the sides by an elevated annulus. Tail conical, and ending in a short, thick conical process. Mouth a minute round pore, unarmed; pharynx a short narrow tube; œsophagus long, cylindroid, widening posteriorly, and rather abruptly narrowed at the anterior extremity; gizzard wider than the œsophagus, cylindrical and rounded at the extremities; intestine straight, intensely black or blackish brown. Length from 3 to 4 millimetres; thickness at middle 0.15 m. Length of œsophagus 0.5 m., of gizzard 0.125 m., thickness 0.075 m., thickness of intestine 0.05 m., length of tail from anal aperture 0.175 m. Color black, with the anterior end white. All females. Sometimes upwards of a dozen found in the sperm vesicles of a single earthworm.

May 22.

The President, Dr. Ruschenberger, in the chair.

Forty-three members present.

The death of Matthew Baird was announced.

On Chilomonas.—Prof. Leidy remarked that while strolling along the sandy beach at Cape May, N. J., he observed that in a number of places, where the water of hollows had sunken away in the sand, a thin yellowish-green film colored the surface. A portion of this green matter scraped up was put in a bottle with sea water. The heavier sand subsided, and the green matter remained in suspension, giving the water an olive-green color, reminding one of the colored turbid liquor decanted from a jar of stale preserved olives. The color was suspected to be due to the presence of diatomes, but on microscopic examination it proved to be caused by multitudes of a greenish Monad, probably pertaining to the genus *Chilomonas.* The minute flagellate infusorian is discoid-oval in form, with a slight emargination laterally a short distance posterior to the fore extremity. The emargination apparently indicates the position of the mouth, and from it projected a single delicate flagellum, scarcely distinguishable. At times the little creature assumed a more circular shape, or became reniform. It moved actively forward, rolling over from one side to the other, and rapidly vibrated the flagellum. Under a high power the animal appeared transparent and colorless or faintly bluish, with two or three large balls of a yellowish-green hue, and several transparent, colorless, and well-defined globules. In size the monad ranged from the $\frac{1}{4000}$th to $\frac{1}{2400}$th of an inch in length. An average-sized individual measured 0.008 mm. long, 0.006 broad, and 0.004 thick.

On Enstatite.—Dr. George A. König placed on record the occurrence of *Enstatite* as one of the associates of corundum in Georgia. The material came to Dr. A. E. Foote from a dealer in that State, with other specimens, showing the characteristic associations of corundum, spinel, and chlorite. At first sight the mineral appears like fibrolite, altering into damourite, so well known from corundum localities.

It occurs in tabular aggregations with eminent cleavage, parallel to the prism of 93°, to the clinopinakoid, and decidedly, but less distinct, to the base. Enstatite is *Orthorhombic*, according to Kenngott and Descloizeaux. The specimen under examination, however, is *Monoclinic*, by the pronounced cleavage parallel to the base; the form is therefore closely that of pyroxene, with the exception that in the latter mineral the plane passes through the main axis and the clinodiagonal intersects the acute angle of prism (87°), whilst in the present case this plane intersects the obtuse prismatic angle (93°). This relation was noticed on a number of cleavage fragments. In a plate parallel to the clinopinakoid (principal cleavage plane), no polarization takes place. Owing to the fibrous structure the speaker was not able to prepare an optical section parallel to the basal plane or at right angles to the main axis, and the optical constants could not be ascertained. Lustre vitreous on prismatic faces, pearly on the pinakoid. Color slightly yellowish olive-green to colorless. Chromite in small grains is noticed in the mineral. Hardness 5.5. Sp. gr. = 3.235 (20° C.).

B. B. Infusible. Manganese reaction with fluxes.

Decomposes with sulphuric acid slowly.

Composition:—

			O.
SiO_2	=	57.70	30.75
MgO	=	35.82	14.32
FeO	=	4.96	1.10
MnO	=	0.20	
Al_2O_3	=	0.91	
H_2O	=	0.78	
		100.44	

$\ddot{R} : \ddot{S}i = 1 : 1.994.$ RO, SiO_2.

Fe : Mg : Si : O = 1 : 12.33 : 13.84 : 41.8.

The empirical formula is, therefore:—

$$FeMg_{12}Si_{14}O_{41}.$$

May 29.

Wm. S. Vaux, Vice-President, in the chair.

Thirty-eight members present.

On Painted Turtles.—Miss S. P. Monks stated that our common painted turtle, *Chrysemys picta*, Herm., is distinguished from the western species, *Chrysemys oregonensis*, Harl., by its smaller size and uniform yellow plastron.

Ch. oregonensis has a dark lyriform blotch extending the length of the plastron.

About the middle of April she found, in a marsh near Cold Spring, N. Y., a *Ch. picta* about two and a half inches long which had a black mark on its plastron. The mark, each side of the central line, is irregular, about a quarter of an inch wide, and beginning at the anterior part of the anal shield extends an inch and ends on the posterior portion of the pectoral shield.

It may not be rare to find eastern turtles marked so, but she had never seen one, either smaller or larger than this specimen, among all the specimens she had examined.

On Flukes infesting Mollusks.—Prof. Leidy remarked that our common fresh-water mollusks, especially the gastropods, were much infested with flukes. These appear to be prevalent during the latter part of the year and absent during the earlier part. Drawings were exhibited of the sporocysts and cercariæ of two species of flukes infesting *Planorbis parvus*.

The species were named and described as follows:—

Monostoma (Glenocercaria) lucanica.

Sporocyst bright orange colored, cylindroid in form, with obtusely rounded extremities. Pharynx globular, from which is suspended a long cylindrical pouch-like stomach, black in hue, extending two-thirds the length of the body. Body cavity distended with cercariæ in various stages of development. *Cercaria* white; with a compressed ovoid body emarginate behind; tail cylindro-conical, pointed, as long or longer than the body, often constricted so as to appear more or less moniliform. Eyes two, black; with an intermediate black pigment spot looking like a third eye, and a number of smaller pigment spots scattered in the vicinity of the eyes. No acetabulum. Pharynx globular; intestine bipartite. A distinct pore situated ventrally near the root of the tail.

Length of sporocysts from $\frac{3}{4}$ to 1 mm. Length of cercariæ $\frac{1}{2}$ mm.

The sporocyst is quite active, elongating and shortening; retracting and projecting the pharynx. It also exhibits strong peristaltic movements, in which the body becomes constricted tightly just back of the pharynx or in any position beyond. The contraction gradually extending backward and dividing the body cavity into two compartments, the cercariæ are suddenly slipped through the constriction, one after the other from the posterior to the anterior compartment. The movements of the cercaria, liberated from the sporocyst, consist mainly in elongation and narrowing and shortening with widening of the body. Elongation of the body causes it to exceed the length of the tail. At times the lateral extremities of the posterior emargination of the body are prolonged into short conical appendages.

This fluke occurs abundantly beneath the muscular tegument, among the lobes of the liver, and folds of the intestine of *Planorbis* *parvus*. Upwards of fifty of the sporocysts distended with cercariæ have been removed from a single Planorbis.

DISTOMA (GYMNOCEPHALA) ASCOIDEA.

Sporocyst white. Head distinct from the body, campanulate, varying in the proportion of length to breadth, according to the degree of contraction. Body cylindroid, with a pair of lateral conical appendages, beyond which it extends as a cylindro-conical tail-like prolongation. Pharynx globular, encircled with six equidistant organs (undetermined in character, probably teeth? or perhaps ganglia). Stomach a flask-like pouch extending but a short distance from the head into the body cavity, and not reaching the middle of the latter even in its most shortened condition; bright brown in color. Body cavity distended with numerous cercariæ; the immature ones occupying the tail-like prolongation. An orifice at the extremity of a blunt conical snout communicates with the body cavity just back of the head. *Cercaria*, white; with an obcordate, or when elongated a clavate body, and a long, narrow, cylindro-conical pointed tail. Cephalic end triangular, and slightly constricted from the rest of the body; posterior part broadly emarginate. A ventral acetabulum near or posterior to the centre of the body, and between it and the root of the tail an oval pore. Eyes none. Pharynx globular; gizzard small; divisions of the intestine extending about two-thirds the length of the body.

Length of sporocysts of different ages, from $\frac{1}{8}$ to 1 mm. Length of cercariæ $\frac{1}{4}$ to $\frac{2}{5}$ mm.

In motion the sporocysts contract the head so that it may be of nearly equal length and breadth, and it may be extended so as to be double the length of the breadth. The body also elongates and shortens in the same manner. Cercariæ were observed in several instances escaping from the snout-like projection of the body cavity back of the head. The cercariæ in movement elongate excessively, and the body may be extended so as to be almost as narrow as the root of the tail. The ventral disk is often protruded into a conical appendage or expanded into a broad cup. The tail becomes longer, narrower, and more pointed, or shorter, wider, and beaded.

This fluke occupies a similar position in the Planorbis as in the former, and has been found in equal numbers, but the two species have not been found associated in the same individual. The distoma form of the ascoid fluke, encysted, was also observed in *Planorbis parvus*, without any traces of the generative organs being obvious.

A free swimming cercaria, identical in character with that of the ascoid fluke, has been observed in water, which contained many individuals of *Planorbis parvus*, and *Limnæa elodes*. The free cercaria agrees with the description of the *Cercaria minuta*, Nitzsch, found with various fresh-water mollusks of Europe.

Prof. L. further exhibited drawings of a Distoma, the *Rhopalocerca tardigrada*, Diesing, from the mantle of *Anodon fluviatilis;* a second the *Heterostomum echinatum*, Diesing, from the oviduct of *Paludina decisa ;* and a third from *Helix arborea*, thus described :—

DISTOMA APPENDICULATA.

Translucent white, band-like, widest in front and rounded at the head, tapering behind and truncate at the end. Pharynx and ventral disk large and nearly equal and about $\frac{1}{8}$ mm. diameter. The gizzard comparatively large and oval. Intestine bifurcate with the branches parallel, and with an intermediate pouch-like appendage extending nearly half way to the position of the ventral disk. A posterior opening communicates with a pouch and a water vascular system. No traces of a generative apparatus observable. Length 1 mm.

Andrew C. Craig, William John Potts, John E. Cook, Chas. Zentmayer, Samuel L. Fox, Shippen Wallace, and Jos. D. Schoales, M.D., were elected members.

S. Fisher Corlies was elected a member of Council for the unexpired term of Dr. J. G. Hunt, resigned.

The following papers were ordered to be published :—

NOTES ON THE NATURAL HISTORY OF FORT MACON, N. C., AND VICINITY. (No. 3.)

BY H. C. YARROW.

In the Proceedings of the Academy of Natural Sciences for 1871 a series of papers was commenced, by Dr. Elliott Coues, with the above title, and it was determined to continue them from time to time until the fauna and flora of the locality—so far as had been observed—should be described, but owing to unavoidable circumstances the publication of certain of the papers has been delayed until the present moment. It is now proposed to continue them under the joint authorship of Dr. Coues and the writer.

FISHES.

It will readily be seen, upon a perusal of a foregoing article describing the situation of Fort Macon, Beaufort harbor, and the adjoining waters, that the circumstances of its position render it peculiarly attractive and interesting to the student of Ichthyology, affording an admirable field for obtaining specimens, the following list showing that one hundred and seven species of fishes have been secured by Dr. Coues and the writer during the short period of their residence at that point.

In the identification of the specimens thanks are due for assistance to Prof. S. F. Baird, Prof. Theo. Gill, Prof. F. W. Putnam, and Prof. G. Brown Goode. The classification and names given are those adopted by Prof. Gill in his Catalogue of the Fishes of the East Coast of North America, Smithsonian Miscellaneous Collections, No. 283, 1873. Local names are given whenever known, but these names are mostly those used by the inhabitants of the region under discussion. Species marked with C. represent those secured by Dr. Coues, with Y. by Dr. Yarrow, C. and Y. by both.

Chilomycterus geometricus (Linn.), Kaup.
Spiny Toad-fish. Sea Porcupine.

Tolerably common; found in nets and taken with hook from wharf. Size from four to six inches. Is not eaten. C. and Y.

Tetrodon lævigatus (Linn.), Gill.
Puffer. Smooth Puffer.

Found in small streams running through salt marshes; but few seen. Found in nets, and is taken with the hook. Never eaten, being considered poisonous. Size, from three to six inches. Y.

Chilichthys turgidus (Mitch.), Gill.
Puffer. Balloon-fish.

Common; found in same localities as preceding species, and, like it, is generally found in nets, but will also take the hook. Not eaten. Y.

Lactophrys trigonus (Linn.), Poey.
Camel-fish. Box-fish.

Prof. Gill states that the appearance of this fish on the coast is accidental. Two specimens were found on the beach at Fort Macon after a southeast gale.

Alutera cuspicauda, De Kay.
File-fish.

Is probably rare, as but a single specimen was taken. C.

Ceratacanthus auriantiacus (Mitch.), Gill.
File-fish. Devil-fish.

Tolerably abundant, generally taken on outer beach in mullet nets. Specimens vary in size from three to eleven inches. Is not eaten. C. and Y.

Stephanolepis setifer (Bennett), Gill.
File-fish. Fool-fish. Devil-fish.

This species is more abundant than either of the two preceding species, and is taken in same localities and in same manner. Is not eaten. C. and Y.

Hippocampus hudsonius, De Kay.
Sea-horse. Horse-fish.

Specimens seen were very small, and the species is doubtless rare, as several were presented to the writer by the fishermen as great curiosities. The occurrence of this fish at Fort Macon increases its southern distribution by nearly one hundred and fifty miles, its limits, according to Gill, extending from Cape Cod to Cape Hatteras. C. and Y.

Syngnathus peckianus, Storer.
Pipe-fish.

Few specimens seen; of small size; taken in nets and by dredging on Bird Shoal (the home of *Lingula*), between Fort Macon and Beaufort. None seen after July. Size from two to six inches. C. and Y.

Fistularia tabaccaria (Linn).
Trumpet fish.

Uncommon. One specimen was taken on the beach Sept. 25, 1871, 12 inches in length, another smaller one in November of the same year. Y.

Plagusia plagiusa (Linn.), Gill.
Flounder.

Abundant on shoals in Beaufort Harbor. Will take the hook freely, but is generally captured by spearing after nightfall. Is esteemed a valuable food fish. C.

Achirus lineatus (Linn.), Cuv.
Flat-fish. Flounder.

The same remarks will apply to this as to preceding species, except regarding abundance, the fishermen considering it rare. Y.

Pseudopleuronectes americanus (Walb.), Gill.
Flounder. Flat-fish.

Rare as compared with other species of this family, few specimens being seen.

Lophopsetta maculata (Mitch.), Gill.
Spotted flounder. Plaice. Fluke.

Exceedingly abundant from early in the spring until late in the fall on sand shoals and beach inside of inlet. Is taken in nets, and by hook and spearing at night. It is a peculiarity of the flounders to approach the shore at night and bury themselves in the sand, leaving only the snout and eyes exposed, and the fishermen being aware of this fact are enabled to capture very many in the following manner. A canoe is prepared with a grating or pan in the bow to contain fat pine, which, being lighted, the boat is propelled slowly by a person in the stern while another, armed with a spear, stands in the bow behind the fire. The craft is made to approach the shore closely, and as the eyes of the fish reflect back the fire-light they are easily seen, and the spear is driven into the sand a few inches behind the point where they appear. Hundreds of fishes are taken in this manner. In some instances the fisherman simply walks along the shore carrying in his hands a torch and spear. This species is considered excellent food. Size from one and a half inch to twenty-eight and a half inches, the size of a specimen obtained in Sept. 1871. C. and Y.

Chænopsetta occellaris (De Kay), Gill.
Chænopsetta dentata (Linn.), Gill.
Flounder. Flat-fish.

Both species tolerably abundant. C. and Y.

Chænopsetta oblonga (Mitch.), Gill.
Four-spotted Flounder. Fluke.

Not so abundant as preceding species, but is occasionally taken of large size. From this locality it is recorded as its farthest southern distribution. Y.

Urophycis regius (Walb.), Gill.
Spotted Codling.

Apparently rare, but one specimen having been secured. C.

Ophidium marginatum, Mitch.
Cusk.

Single specimen only observed. C.

Zoarces anguillaris (Peck), Storer.
Eel-pout.

In May, 1871, two specimens were taken by hook from the Fort Macon wharf; these were small in size; none seen thereafter. Y.

Blennius fucorum, Cuv. and Val.
Sea-weed fish.

A single specimen seen, which was found in refuse of net. Y.

Hypleurochilus punctatus (Wood), Gill.
Spotted sea-weed fish.

Tolerably abundant. C. and Y.

Batrachus tau, Linn.
Toad-fish. Oyster-fish.

Exceedingly numerous in small marshy creeks, and are a great nuisance to anglers. In April, 1871, a female was discovered watching her eggs, which had been deposited in an old boot-leg; the tide had receded, leaving her in about four inches of water, and, although attempts were made to drive her away, she preferred to remain, and was consequently captured. Eggs have also been discovered in old tin cans. The size of individuals seen varied from four to eight inches. C. and Y.

Astroscopus anoplus (Cuv. & Val.), Brevoort.
Star-gazer.

Rare, but a single specimen taken. C.

Prionotus punctatus (Bloch), Cuv.
Spotted flying-fish. Sea Robin.

Prionotus carolinus (Linn.), Cuv. and Val.
Flying-fish.

Both species tolerably abundant during spring and summer. Are taken in nets and by hook. Size six to ten inches. C. and Y.

Tautoga onitis (Linn.), Gthr.
Black-fish.

Apparently rare, as but few specimens were seen. Y.

Chœrojulis grandisquamis, Gill.

But one specimen secured. Y.

Xiphias gladius, Linn.
Sword-fish.

Not seen, but reliable information received of its occasional appearance near Cape Lookout. Y.

Trichiurus lepturus, Linn.
Sword-fish. Hair-tail.

Not abundant, the few secured being taken just inside the surf in mullet nets. Have seen them in company with Gars swimming on surface of the water near the wharf feeding on small fishes, at which time they would snap at a baited hook, but none were captured. Are called "sword fish" by the fishermen, from their resemblance to the blade of a sword. Size averages from 30 to 40 inches; one specimen of 48 inches secured. C. and Y.

Sarda pelamys (Linn.), Cuv.
Bonito.

Tolerably abundant near Shackleford Banks. Y.

Orcynus secundi-dorsalis (Storer), Gill.
Bonito. Albicore. Sun-fish. Horse Mackerel.

First noticed in May, after which time it became tolerably abundant. A number of specimens were taken on the beach, upon which they had leaped from the water. Is frequently found in company with blue fish in September, and its appearance within the inlet is regarded by the fishermen as a sure indication of rough weather outside. Is not eaten. Size from four to twenty-four inches. Y.

Cybium maculatum (Mitch.), Cuv.
Spanish Mackerel.

Very abundant in latter part of August and September, and is frequently found with blue-fish. A favorable locality is near the southern point of Shackleford Banks, and it is there taken in nets and by hook; a great many are also taken near Cape Lookout in gill nets in September. Is highly esteemed as food, but is not often eaten fresh, being generally salted. Size from ten to thirty inches. C. and Y.

Cybium regale (Bloch), Cuv.
Spotted Mackerel. King-fish.

Not abundant, a single specimen only being seen. Y.

Vomer setipinnis (Mitch.), Ayres.
Horse-fish. Sun-fish.

Abundant in the fall, numbers being taken on outer beach in company with mullet. C. and Y.

Selene argentea, Lac.
Moon-fish. Sun-fish.

Same remarks apply as to the preceding species. C. and Y.

Argyriosus vomer, Lac.
Moon-fish.

Argyriosus capillaries (Mitch.), De Kay.
Moon-fish.

Not so abundant as the preceding species; are found in their company, and it will be seen that the fishermen of the locality recognize no specific differences, calling them all either moon- or sun-fish. First appear in Beaufort Harbor about May. C. and Y.

Paratractus pisquetos (Cuv. and Val.), Gill.
Yellow Mackerel.

A single specimen seen in September, 1871. C. and Y.

Carangus hippos (Linn.), Gill.
Horse Mackerel.

Carangus chrysos (Mitch), Gill.
Yellow Mackerel.

Not abundant, a few seen in early fall, and one specimen fourteen inches long taken May, 1871.

Blepharichthys crinitus (Akerly), Gill.
Moon-fish. Shoemaker.

A few individuals taken in summer and fall; largest seen twelve inches long. Y.

Trachynotus carolinus (Linn.), Gill.

Pompano. Sun-fish.

Abundant in fall, and is taken in the mullet nets. Considered an excellent food-fish. C. and Y.

Naucrates ductor (Linn.), Raf.

Pilot-fish.

No specimens secured, but the appearance of the fish was so accurately described by several fishermen as to remove all doubts regarding its occasional occurrence. Y.

Halatractus zonatus (Mitch.), Gill.

Rudder-fish.

A single specimen observed. Y.

Poronotus triacanthus (Peck), Gill.

Not abundant. C. and Y.

Cynoscion carolinenis (Cuv. and Val.), Gill.

Speckled Trout.

Very abundant from February to June, April being considered the best month; are taken at this time in nets only, as they will not take the hook until September, upon their return from the northward. The roe in female specimens was found to be quite large in April. Size from six to thirty-six inches; one specimen, taken September, 1871, with hook, measured twenty-four inches in length and weighed three and three-quarters pounds. In 1872 the species first appeared January 9th, which was considered unusually early. C. and Y.

Cynoscion regalis (Bloch), Gill.

Weak-fish. Sea Trout. Gray Trout.

Not so abundant as preceding species, appearing with them in early spring; tolerably abundant in summer; taking the hook freely. Size ten to thirty inches. Y.

Pogonias chromis, Laup.

Drum.

Exceedingly abundant, resident, and is taken both within and outside of inlet. This species runs in schools in early spring, but in the fall is generally found alone, and will take the hook. A very large specimen was taken in September, while trolling for blue-fish. Is not considered a good table fish, the flesh being coarse, rank, and stringy. Size ten inches to five feet. C. and Y.

Liostomus xanthurus, Lacep.
Yellow tail.

Abundant in fall. Y.

Liostomus obliquus (Mitch.), De Kay.
Robin. Pin-fish.

Very abundant. C. and Y.

Bairdiella punctata (Linn.), Gill.
Yellow-finned Perch.

Occasionally seen. C.

Sciænops ocellatus (Linn.), Gill.
Spotted Sea Bass.

Not abundant; a few seen in fall. C. and Y.

Menticirrus alburnus (Linn.), Gill.
Whiting.

Menticirrus nebulosus (Mitch.), Gill.
King-fish. Whiting.

Menticirrus littoralis (Holbr.), Gill.
Sea Mullet.

These species are all more or less abundant in the fall, when they are found in company with the mullet on sea-beach. C. and Y.

Micropogon undulatus (Linn.), Cuv. and Val.
Croaker. Crocus.

Abundant, and can be taken from March until August. Size four to eight inches. C. and Y.

Lagodon rhomboides (Linn.), Holbr.

Not abundant. C. and Y.

Archosargus probatocephalus (Walb.), Gill.
Sheepshead.

Abundant in early spring; will not take the hook until later in season. In 1871 large numbers were taken in the bight of Cape Lookout in nets. Size eight to twenty-four inches. A small specimen was taken January 30, 1872; an early arrival. Y.

Stenotomus argyrops (Linn.), Gill.
Scup. Porgy.

Abundant. C. and Y.

Prof. F. W. Putnam, to whom is due the identification of the specimens collected by Dr. Coues, states that in the collection he found an individual resembling *S. argyrops*, but which differed in several essential particulars, having a well-marked black blotch on the tail immediately posterior to the dorsal fin, a very fine margin of black on the membrane of the spine of the dorsal fin, the ventrals dusky. D. xii. 14; A. iii. 13.

Hæmulon arcuatum, Cuv. and Val.
Hog-fish. Grunts.

Very abundant in early spring and summer, and are generally found in the marshy creeks inside of inlet. Size four to eight inches. Y.

Orthopristis fulvomaculatus (Mitch.), Gill.
Spots.

Abundant; resident in same localities as preceding species, and may be taken at all seasons of the year. Size four to eight inches. The young of this species found in company with young mullet in January, 1872. C. and Y.

Ephinephelus morio (Cuv.), Gill.
Grouper.

Very rare; one specimen only seen. Y.

Centropristis atrarius (Linn.), Barn.
Sea Bass. Black Bass.

Numerous off Shackleford Banks, in the vicinity of Cape Lookout. C. and Y.

Roccus lineatus (Bl. Schn.), Gill.
Striped Bass. Rock. Rock-fish.

Full-grown specimens seldom seen in the immediate vicinity of Fort Macon, but the young are abundant. In the New River, one of the affluents of Beaufort Inlet, adults are numerous, and in the Neuse they are exceedingly plenty. Y.

Morone americana (Gmelin), Gill.
White Perch.

No specimens seen in Beaufort Inlet, but they abound in the New and Neuse Rivers. Y.

Parephippus faber (Cuv.), Gill.
Horseman. Moon-fish. Pogy.

Not abundant; a few specimens taken from mullet nets in September. C. and Y.

Pomatomus saltatrix (Linn.), Gill.
Blue-fish. Tailor. Snapping Mackerel.

This species appears in Beaufort Inlet in early spring, but is taken only in nets. In June it commences to take the hook, but the months of August and September are the best for trolling. At this time enormous numbers may be found in schools, swimming alongside shoals in tolerably rough water. On the 23d day of September, 1871, four persons, in four hours, took by trolling 660 Blue-fish. During the latter part of this month, in the same year, enormous schools were noticed in and near the ship channel, feeding upon the red-billed Gar, so-called, *Hemiramphus unifasciatus*, Ranz. The stomachs of individuals taken were literally crammed with these fishes. The very large specimens of blue-fish occasionally met with in the markets in January never enter Beaufort Inlet; they are taken on the beach from Cape Lookout northward, the run lasting sometimes two months, occasionally only a week or ten days. During the last week of December, 1871, large schools of young blue-fish were noticed in Beaufort Inlet swimming from the southward, apparently making for the sea; their size about four inches. C. and Y.

Elacate canadus (Linn.), Gill.
Crab-eater.

The fishermen speak of a fish which is supposed to be this species; none were seen.

Leptecheneis naucrates (Linn.), Gill.
Sucker.

Uncommon; two specimens seen. C. and Y.

Echeneis remora, Linn.
Sucker.

Uncommon; a few specimens seen, which were taken by the fishermen on Shackleford Banks. They stated that these fish were found ? in the mouths of sharks. Size of specimen six inches. Y.

Sphyræna borealis, De Kay.
Barracuta.

Uncommon; a few taken occasionally near Cape Lookout.

Mugil lineatus, Mitchell.
Striped Mullet. Mullet.

This species is the most abundant of the locality, and affords sustenance and employment to thousands of persons on the coast of North Carolina. From the month of May, when small-sized individuals appear, fishing continues during the entire summer with gill and small draw nets, and in the latter part of August, as the fish commence to school preparatory to migration, the regular seine fishing commences, and continues frequently until November. The schools appear to come from the northward through Albemarle, Pamlico, and Cove Sounds, gradually working their way to the southward. Their departure through the various inlets seems to depend upon a favorable state of the wind, which should be from the northward, for it has been noticed frequently that when the wind hauled, the schools of mullet already without the harbor have suddenly turned, re-entering the inlet, and pursued their course southward through Bogue Sound. Their movements through the water are quite slow, and a person without exertion may keep pace with them walking upon the beach. The numbers taken are simply enormous, sometimes as many as 500 barrels being secured at a single haul. It was estimated by competent observers that not less than 12,000 barrels of mullet were captured on the coast of North Carolina Friday, September 22, 1871. Regarding the spawning grounds of *M. lineatus* considerable uncertainty exists. At the time of their arrival at Fort Macon, in August and September, the females are enormously distended with roe, some, however, being more so than others, and it is supposed that the process of oviposit takes place from July until December, many remaining in the sounds for the purpose. Many schools of young mullet have been seen in Beaufort harbor during December and January, which could have been but a few weeks old. These young fishes suffer from a curious disease, which is characterized by the presence of a gradually increasing film upon the eyes, which finally destroys the sight, and myriads perish from this cause. They also suffer from parasites, one of which is long and thread-like, with a stellate head, the other, called by the fishermen "sea-louse;" these parasites have never been noticed by the writer upon adults. Size from one and a half inches to thirty. C. and Y.

Chirostoma notata (Mitch.), Gill.
Silver-sides. Smelt.

Atherina carolina, Val.
Sand-smelt.

Rather uncommon, a few specimens only seen. C. and Y.

Belone longirostris (Mitch.), Gill.

Bill-fish. Gar.

Is quite abundant; appearing in Beaufort Inlet in February. At this time it swims in schools, and many are taken in nets. When swimming near the surface of the water it will readily take the hook. Is eaten by poor fishermen and negroes, and the flesh is said to be good. The largest specimen seen measured twenty-four inches in length. C. and Y.

Exocœtus melanurus, Val.

Flying-fish.

Occasionally seen. Y.

Hemirhamphus unifasciatus, Ranzani.

Red-billed Gar.

Abundant during latter part of August and entire month of September. This species appears to feed along the beach in shallow water, and may be readily taken at night with a torch and scoop net. It is also found in the channel and along the edges of shoals where blue-fish congregate, this fish devouring enormous numbers. The small fry of fishes appear to be attracted by the bright red caruncle on the end of the lower mandible of *H. unifasciatus*, and, swimming near to it, lose their lives as a penalty for curiosity. C. and Y.

Scomberesox scutellatus, Lesueur.

Skipper. Sea-pike.

First observed in June, 1871, and in August of the same year several were taken with hook and line inside the inlet. Are not eaten by the fishermen, who declare them poisonous. Size twenty-four inches in length. Y.

Cyprinodon variegatus, Lac.

Minnow.

Fundulus pisculentus (Mitch.), Val.

Mummichog. Minnow.

Hydrargyra majalis (Walb.), Val.

Hydrargyra swampina, Lac.

Minnow.

These four species are exceedingly abundant in the marshy creeks, and are all called by the residents "Minnows." C. and Y.

Albula conorhynchus, Bloch and Schneider.
Lady-fish.

Not observed by Dr. Coues or the writer, but is admitted to the list upon the authority of a reliable fisherman of the locality, Capt. A. Guthrie.

Elops saurus, Linn.
Sea-Pike.

Occasionally noticed. C. and Y.

Megalops thrissoides (Bl. and Sch.), Günth.
Jew-fish. Tarpum.

Said by fishermen to be very rare. None observed.

Brevoortia menhaden (Mitch.), Gill.
Menhaden. Mossbunker. Fat-back. Yellow-tail.

Very numerous in August and September; large numbers are netted and used for oil and manure. C. and Y.

Alosa sapidissima (Wilson), Storer.
Shad.

Not abundant in vicinity of Fort Macon, but in the Neuse are excessively so. C. and Y.

Opisthonema thrissa, Gill.
Hairy-back. Thread Herring.

This species, as a rule, appears early in June, and is regarded as the avant-courier of the herring, so-called, *P. pseudoharengus;* it is abundant, but is not eaten to any extent. Size ten to twelve inches. Y.

Pomolobus pseudoharengus (Wilson). Gill.
Herring. Blue-back. Alewife.

Not abundant except in Neuse River, and the sounds further to the northward. In fact its scarcity near Fort Macon is such that no regular fishing is followed with a view to its special capture. Y.

Pomolobus mediocris (Mitch.), Gill.
Hickory Shad. Hicks. Fall-Shad.

Abundant; first noticed in March, 1871. Y.

Engraulis brownii (Gmel.), Val.
Smelt.

Several specimen secured, but the species is not common. Prof. Putnam, after an examination of specimens sent him, states as follows: "Mitchell's description of *Clupea vittata* does not differ from Günther's of *E. brownii*, but Günther's description of *E.*

mitchellii differs in anal rays and in length of maxillary, which does not agree with my specimens from Fort Macon."

Ælurichthys marinus (Mitch.), Baird and Girard.
Fork-tailed Catfish.

Ariopsis milberti (Val.), Gill.
Sea-Cat. Catfish.

Both species are occasionally met with near the Fort Macon wharf, but are by no means abundant. C. and Y.

Anguilla bostoniensis (Les.), De Kay.
Eel.

Very abundant in marshy creeks. C. and Y.

Acipenser oxyrhynchus, Mitch.
Sharp-nosed Sturgeon.

Acipenser brevirostris, Lesueur.
Short-nosed Sturgeon.

Both species said to be abundant in the North, New, and Neuse Rivers.

Ceratoptera vampirus (Mitch.), Gill.
Devil-fish.

None observed, but the fishermen state they are occasionally seen.

Ætobatis narinari, Müll. and Henle.
Sting-Ray. Lady-Ray.

Very common, sometimes growing to a large size. C. and Y.

Pteroplatea maclura, Müll. and Henle.
Sand-Skate. Butterfly Ray.

Very common in fall outside of inlet. Nov. 5, 1871, a specimen was captured five feet in width four feet in length. C. and Y.

Trygon centrura (Mitch.), Gill.
Sting-ray. Whip-ray. Stingaree.

Very common. Migration takes place southward in latter part of October. In July, 1871, a very large specimen was found expiring upon the beach; upon dissection the liver and gall-bladder were found filled with worms. C. and Y.

Torpedo occidentalis, Storer.
Cramp-fish. Torpedo. Electric Ray.

None observed; fishermen state they are rarely seen.

In this connection it may be mentioned that Capt. Absalom Guthrie, an intelligent fisherman of Shackleford Banks, stated to the writer that upon a certain occasion, in removing fishes from his net, he received a very perceptible electric shock from a fish resembling the common toad-fish, *B. tau*, and upon repeating his examination of the animal he experienced the same sensation a number of times; when touching the head, the fish appeared to advance this organ as if eager to discharge the electric fluid. Expressing incredulity, a number of fishermen were called who corroborated Capt. Guthrie's statement in every particular. Some three or four specimens had been found in the net at this time, since which none have been seen, although a large reward was offered for living specimens.

Raia lævis, Mitch.
Skate. Winter Skate.

Common. Y.

Pristis antiquorum (Linn.), Lath.
Saw-fish.

Not observed in the immediate vicinity of Fort Macon, but is abundant in the brackish rivers emptying into Bogue and Cove sounds. It is frequently taken in the New River, and attains a considerable magnitude, the writer having secured a so-called "saw" five feet in length from an individual over sixteen feet long which had been captured in this river. The fishermen state that this species is exceedingly hostile to the porpoise, and will fight it whenever opportunity occurs. Y.

Isuropsis dekayi, Gill.
Mackerel-shark.

Very rare, a single skeleton having been seen. Y.

Eugomphodus littoralis, Gill.
Sand-shark. Shovel-nose.

Tolerably abundant both within and outside of inlet. Y.

Sphyrna zygæna (Linn.), Mull. and Henle.
Hammer-head Shark.

But a single individual seen. Y.

Reniceps tiburo (Linn.), Gill.
Shovel-head Shark.

Uncommon. Y.

A few other species of this family were noticed, but not identified.

Branchiostoma caribæum, Sundevall.
Lancelet.

This curious speeies, so far as known, is to be obtained in but one loeality, near Fort Macon, viz., on Bird Shoal, whieh lies to the southward of Beaufort city; some dozen or more speeimens were obtained by dredging. Y.

A number of speeies of fresh-water fishes have also been obtained from the rivers contiguous to Fort Maeon, but it has been deemed advisable to confine this list to the marine forms almost exelusively. It should be mentioned that the inquiries regarding the preeeding species of fishes were made at the suggestion and under the direetion of Prof. S. F. Baird, U. S. Com. of Fish and Fisheries.

ON THE BRAIN OF CHIMÆRA MONSTROSA.

BY BURT G. WILDER, M.D.

Introduction.—At the close of a paper upon the brains of the fish-like vertebrates presented before this Academy on the 4th of April, 1876, I exhibited a fairly preserved adult male example of *Chimæra monstrosa*,[1] together with a drawing of the brain as then partly exposed. After calling attention to certain peculiarities which apparently had not before been observed, I expressed the intention of preparing a full description of it with figures for presentation to the Academy at a future meeting.

In the present paper this intention is fulfilled so far as I have been able, in view of the limited material at my command, and the difficulties of interpretation which now embarrass all students of fishes' brains.

The extent of these difficulties becomes apparent when I state that, since Gegenbaur has lent the weight of his high authority to Miklucho-Maclay's new interpretation of the parts commonly called cerebellum and optic lobes, *no region of the brain is clear as to its homology throughout the series of fish-like vertebrates.*

For the complete solution of these homological problems it is evident that simple and embryonic brains are primarily more useful than those of adults, or those which present peculiar characteristics. Hence I am availing myself of every opportunity for preparing and figuring, both as wholes and in sections, the brains of *Myxine*, *Petromyzon*, *Menobranchus* (or *Necturus*), and embryo sharks. But it is not likely that an embryo *Chimæra* will soon be available, and it seems hardly advisable to longer defer the publication of facts, some of which, at least, appear to be new and important, simply on account of doubts respecting the terms which should be employed for the designation of parts. Moreover, notwithstanding its special peculiarities, the brain of *Chimæra* presents certain features which may enable us to connect brain-forms which have hitherto failed to be reconciled with each other, or with the ideal, or typical brain, as now commonly accepted.

[1] Kindly placed at my disposal by Mr. Alexander Agassiz, Curator of the Museum of Comparative Zoology at Cambridge, Mass.

Again, as will be shown in the following historical sketch, the brain of *Chimæra* has not hitherto been accurately figured or fully described.

This fact alone would have led me to welcome an opportunity of adding to our knowledge of its structure; but an additional incentive lay in the consideration that the three species of *Chimæra*, with the single species of *Callorhynchus*[1] have always been regarded as peculiar, and not readily assignable to a place among the fish-like vertebrates.

In 1834 Johannes Müller (23, 74) united the two genera under the title Holocephala, regarding this group as an order of the class Pisces.

Some zoölogists have adopted Müller's view; but the Holocephala are often included with the sharks and skates under the name Selachians, or Elasmobranchiata.

So far as I am aware the structure of the brain has never been appealed to for the purpose of ascertaining the taxonomic relations of the Holocephala. I say the *structure*, because in the arrangement proposed by Mayer (5), little more than the external form of the brain seems to have been considered.

Historical Sketch.—So far as I am aware, the earliest account of the brain of *Chimæra* was by Valentin, in 1842. He states (1, 25) that his specimen was "well-preserved in alcohol;" but, judging from the figures, its condition was that of most fish-brains which are not exposed to the action of alcohol very soon after death of the animal. The principal features, however, are shown in so far as the brain was exposed; but it is evident from both the figure and description that only the hinder region of the brain was examined, and that Valentin failed to discover the olfactory lobes, the "hemispheres," and the greatly elongated mesothalamic crura, which are characteristic of this type of brain.

He does not state whether the brain was removed from the skull by himself. The channel connecting the hinder part of the brain-cavity with the front part is so narrow that the existence of

[1] Günther (19, viii. 349-352) recognizes the following species of *Chimæra*, viz.: *monstrosa*, coasts of Europe, Japan, Cape of Good Hope; *colliei*, west coast of North America; *affinis*, coast of Portugal. He also admits but a single species of *Callorhynchus*, *antarcticus*; but Duméril (29, 692) enumerates five. References are here made to a list of works at the close of this paper.

the latter might well be overlooked by an assistant. Still the general aspect of the regions examined by Valentin differs so much from that of any other entire brain that it is not easy to see how he could have stated his determinations without some qualification.

The short portions of the crura which were retained with the hinder regions of the brain, were regarded by Valentin as the olfactory nerves, and they are figured of considerable thickness, although in my specimen they are thin and ribbon-like. The rounded optic lobes he named hemispheres. The overhanging cerebellum was interpreted as the thalamus, or *lobus ventriculi tertii*, and the remaining parts as cerebellum and medulla. On pages 32 and 33 Valentin speaks of the cavity of the optic lobes ("Sehlappenhöhlung"), and designates it on fig. 4 (*s*) ; but neither the figures nor the description indicate distinctly the parts which he regarded as the optic lobes themselves; they must certainly have been very small in comparison with the supposed thalamus, since all the other conspicuous portions are otherwise interpreted.

Valentin's opinion as to the taxonomic significance of the brain is expressed in the following passage.

"Peculiar as the brain of *Chimæra* appears at first sight, it nevertheless proves to be intermediate between the brain of the Cyclostomes [Myzonts], on the one hand, and that of the Plagiostomes on the other." (1, 39.)

The following year, in his Report upon the progress of Anatomy (2), Johannes Müller commented as follows upon the paper of Valentin:—

"Of the brain of *Chimæra* we had before no figures, so that these by Valentin, with his description, supply a real deficiency. In the designation of the parts, however, and therefore also in the comparison with other brains, some things prove to be otherwise.

"The description and figures make it very probable that a part of the medulla oblongata is taken for the cerebellum. This remark of R. Wagner I find to be confirmed by the examination of a well-preserved specimen of the brain of *Chimæra.*

"What is called cerebellum belongs to the medulla, whilst that which the author calls 'the hammer-formed body' and compares with the lobus ventriculi tertii of Cyclostomes is the cerebellum.

The cerebellum and medulla with *Chimæra* closely resemble those of all genera of sharks whose brains are known to me."

"The brain of *Chimæra* has no resemblance to that of Cyclostomes, but much to that of sharks. Yet it differs greatly therefrom in the front part, because the optic lobes and the hemispheres are fused together, which is not the case with the sharks and skates. The olfactory nerves, as usual, enlarge behind the olfactory folds into a bulb. The small swelling from which they spring is the only representative of the great median masses of sharks which are probably the hemispheres."

I have been unable to find the observation of R. Wagner, above referred to, elsewhere recorded, but the foregoing passages lead me to infer that both he and Müller, like Valentin, believed the entire brain of *Chimæra* to be included in what was really only the posterior portion. It will be seen farther on that Gegenbaur attaches a different signification to Müller's remarks; but after careful re-examination of the passage I find myself obliged to adhere to the interpretation above offered.

In 1848, Busch published (3) figures of the brains of *Chimæra* and of *Callorhynchus;* the latter, however, represents only the posterior region. I am informed that a copy of this work has been obtained for the American Museum of Natural History in New York; but the library of which it forms a part has not yet (April, 1877) been placed upon shelves, and I have not been able to examine it.

These figures of Busch were reproduced in 1864 by Mayer (5). Like many other figures upon the plates of this author, the general aspect of these is good, but they are unsatisfactory in respect to details.

Mayer's description (5, 24, and 25) of these brains is in the form of a classification. The Holocephala are included under "Pisces Proëncephali," characterized as having "the olfactory lobe developed into an olfactory hemisphere or cerebrum." This group includes all the fish-like forms excepting the Teleosts which he designates (5, 27) as Pisces Mesencephali, the optic lobe being the hemisphere.

The brains of the Proëncephali are further characterized as follows: "The olfactory lobe is two to four times greater than the optic lobe, presents folds or lobes upon its upper surface, and in the middle two open lateral cavities with swellings within them."

"The optic lobe is small, spherical, without superficial commissure of the two hemispheres, or without *corpus callosum*,[1] and is separated from the olfactory hemisphere by an anterior prolongation of the *crus cerebri*. The basilar lobes [hypoaria?] are little developed. The cerebellum varies in size, so as to form a series. There is a chiasma."

Mayer subdivides the "Proëncephali" into three suborders and includes the Chimæræ in the Macroëpiencephali corresponding with Selachians, or Plagiostomes and Holocephali. The characters are as follows: "The optic lobe contains a rudimentary ventricle, which is afterward united with the third ventricle, but no inner swellings. The chiasma is broad. The cerebellum consists of an anterior and posterior median mass and anterior and posterior convoluted lateral lobes more or less developed."

The "Macroëpiencephali" are subdivided into two families, the Raiæ or Skates, in which the hemisphere mass is "as broad as it is long;" and the sharks and Holocephali, in which it is an "elongated oval."

Finally, this "family" forms two groups, in one of which "the cerebellum is very large and covers part of the hemisphere," while in the other it "reaches only to the middle of the optic lobes." In this group are included, *Galeus canis*, *Scymnus lichia*, *Carcharias glaucus*, *Scyllium catulus*, *Scyllium borealis*, *Callorhynchus*, and *Chimæra monstrosa*.

In a note (p. 25) Mayer says, "The hemisphere is particularly slender and long in *Scymnus lichia* and *Chimæra*. Valentin's figure cannot be employed for a different interpretation of the parts. At any rate what Valentin calls the *lobus ventriculi tertii* is really the cerebellum."

The foregoing description indicates that Mayer's attention was directed chiefly to the form and general aspect of the brain, and that many of his determinations were based upon analogy rather than homology.

By implication Mayer ascribes lateral ventricles to all the Proëncephali; but he makes no special mention of them in the Holocephali, and neither the figures nor descriptions indicate the existence of the large "foramina of Monro," and the swellings therein which are described by me farther on.

[1] Alluding to certain structures, which he regards as representing the *corpus callosum*, with the Mesencephali.

The brains of Holocephala are not mentioned by Hollard, or Vulpian (4).

Owen copies (6, I, 276, fig. 179) Busch's figure of the brain of *Chimæra monstrosa*, and does not appear to have examined the brain itself. The olfactory lobes are united with the succeeding lobes (not separated as in Mayer's figure), and their necks appear to be connected by a thick transverse commissure, which has no existence; in the original figure this appearance may have been due to an unintentional exaggeration of shadow.

According to the plan of the work, the author's views of the Chimæroid brain are given in connection with his account of its separate divisions. The laminæ at the sides of the medulla are regarded (p. 276) as developments of the restiform columns. The optic lobes are mentioned (277) as smaller than either the cerebrum or cerebellum. The "cerebral crura" (called by me *mesothalamus*) are said (281) to "advance some way before they expand into the prosencephala." The latter are described (282) as "large, elongated, and smooth." On the same page it is said that neither the cerebellum nor the optic lobes are so large as the "prosencephalon;" but on page 288, the cerebellum is said to be "large."

In 1869, Gegenbaur published (8) an extract from a letter from Miklucho-Maclay relating to some peculiarities of the Chimæra's brain, adding remarks upon their morphological and taxonomic significance.

"The brain of *Chimæra*, as presented in the figures and description of Valentin, offers so many peculiarities that it was impossible to discuss it alone, or in connection with the other series of fish brain-forms.

"Miklucho found that the above-mentioned representation agreed in part with the results of his investigations of the brains of Selachians, but in other respects was wholly dissimilar. That representation showed a Zwischenhirn,[1] which is similar to that of Selachians. Valentin took it for the hemisphere. From it proceed a pair of swellings which were supposed to be the olfactory lobes. Then follows a portion corresponding to the Mittelhirn

[1] This is the common German term for the Thalamencephalon, or lobi ventriculi tertii; but Miklucho and Gegenbaur apply it, incorrectly, as I believe, to the optic lobes or Mittelhirn, and give this latter name to the cerebellum. This question will be discussed hereafter.

[really the cerebellum], which Valentin named Zwischenhirn; then a cerebellum with a medulla oblongata, which, interpreted as such by Valentin, present the characteristics of these parts with Selachians.

"So the greater part of the brain agrees with that of the Selachians, but where is the Vorderhirn?

"In Messina Herr Miklucho found the opportunity for investigation of the brain of *Chimæra*, and writes as follows: 'In the first place, I learn that the representation of Valentin is quite correct in some minor points. But the part which Valentin calls the olfactory tract, I ask myself, is not this the *Hirnstiele?* I extended the opening of the cranium, and, true enough, far forward lay the large and handsome hemispheres connected with the Zwischenhirn by elongated cerebral peduncles.'

"This Vorderhirn therefore corresponds to the part described by J. Müller (2) as the swelling of the olfactory nerves lying behind the olfactory folds. Since, moreover, there is a swelling which gives off olfactory nerves, there can be no doubt respecting the above-mentioned interpretation.

"The peculiarity of the Chimæra's brain consists, therefore, especially in the remarkable extension of the brain-stem, and the concomitant separation of the Vorderhirn from the Zwischenhirn. In the same degree in which the Vorderhirn is moved forward, the olfactory tracts are abbreviated, so that the swellings of the olfactory nerves are in contact with the Vorderhirn itself.

"The brain of *Chimæra* therefore resembles that of Selachians much more closely than was supposed by J. Müller, although the great similarity of the hinder regions was by no means unknown to him."

Gegenbaur does not mention the figures of Busch, which, like the copies of Mayer and Owen, present all the features whose discovery he seems to ascribe to Miklucho.

On the other hand he credits Müller with being acquainted with the existence of these parts. As already stated, I cannot find, in Müller's remarks, any evidence of such knowledge. On the contrary, he distinctly says that "the lobi-optici and lobi-hemisphærici are closely united."

Miklucho-Maclay, in 1868 and 1870, published two papers (7 and 10) upon the brains of fishes, but in neither do I find any reference to the brain of *Chimæra*.

The paper of Panceri and de Sanctis (9) is known to me only through a brief abstract in the Zoological Record for 1872, p. 86. It does not appear to treat especially of the brains of the Holocephala.

Duméril, who describes (21, I, 65–73, pl. 2) somewhat at length, though apparently not from original investigations, the brains of Plagiostomes, makes no reference to those of Holocephala; neither are they alluded to in the Manuals of Van der Hoeven or Rolleston.

In 1871, Huxley included the Holocephala among the Elasmobranchs, and left it to be inferred (13, 118) that their brains resemble those of sharks and skates.

More recently, in his paper (16) upon the brain, the skull, and the pectoral fins of *Ceratodus*, Huxley makes some very suggestive remarks (pp. 30, 41, 45, 57) concerning the taxonomic relations of *Chimæra*. These will be referred to hereafter. I do not see, however, that he anywhere implies that the brain differs essentially from the plagiostome type, and in the summary (p. 41) of the characters upon which he is inclined to base the opinion that the Holocephala should be regarded as a primary subdivision of fishes, the brain is not even mentioned.[1]

In April, 1876, the following note was added while my paper on the brains of N. A. Ganoids (17) was passing through the press:

"Just as this goes to press I am enabled, through the kindness of Mr. Alex. Agassiz, to expose and examine the brain of a well-preserved male *Chimæra* in the Museum of Comparative Zoology. The cerebellum is very large and covers the optic lobes, but is not folded transversely as in most, if not all, adult sharks and skates. The crura thalami are very long and thin, and united ventrally by a delicate membrane, apparently only pia mater. Anteriorly each crus expands into a prothalamus, the dorsal border of which is thin and slightly everted. This prothalamus, however, instead of forming the principal anterior mass as in Ganoids, is overlapped outside by a large and elongated hemisphere about 8 mm. in height and 15 mm. in length. On the hinder third of the mesial surface is a large rounded foramen of Monro, 4 mm. in diameter. The lateral ventricle extends forward into the olfactory

[1] This paper was known to me only through a brief abstract in "Nature" for Jan. 6th, 1876, until Nov. 1876, when a copy was kindly loaned to me by Prof. S. F. Baird.

lobe. Into the foramen, and occupying its entire area, projects a thickening of the outer wall of the hemisphere which may represent a primordial corpus striatum. Just in front of the foramen the ventral borders of the hemispheres are connected by a transverse commissure. I greatly regret not having been able to examine this brain before presenting this paper. It seems to furnish an actual form intermediate between the apparently distinct types represented by the brains of Selachians, Ganoids, and Dipnoans. If I correctly interpret the appearance of a partial subdivision of the elongated mass behind the olfactory lobe, the Chimæra's brain presents a more equal proportion of hemisphere and prothalamus than exists in Ganoids or Teleosts, where the former seems to be reduced to a rudiment hardly recognizable as such."

Remarks to the same effect were made before the Academy on the 4th of April, as already mentioned.

The brain itself, with most of the drawings here published, was exhibited and remarked upon by me at the meeting of the American Association for Advancement of Science, Aug. 25th, 1876, in connection with a paper on the brains of certain fish-like vertebrates (24).

Prof. Huxley's comments (25) upon that paper referred mainly to the question of the homology of the optic lobes and cerebellum of Selachians, which will be more fully discussed hereafter.

The general aspect of the Brain of Chimæra.—The brain of the adult[1] *Chimæra* presents three regions of nearly equal length, viz., a complex high mass behind, a pair of elongated masses in front, and an intervening pair of slender bands.

The height and complexity of the hinder mass remind one of the corresponding region with sharks and skates. In general form, the anterior masses resemble the hemispheres of Dipnoans; but the slightness of their union by a transverse commissure is a characteristic of Ganoids and Teleosts; while the length of the crura, and the size and position of an orifice upon the mesial surface of each anterior mass are features not hitherto observed, so far as I know, in the brain of any other fish-like vertebrate.

In general, therefore, it may be said that the brain of *Chimæra*

[1] From analogy we may infer that in very young examples the interval between the anterior and posterior regions is much less; also that the lobes of the medulla are less folded, and the cerebellum smaller.

presents certain features peculiar to itself; it also combines features more or less characteristic of the brains of Ganoids and Plagiostomes. The significance of these resemblances will be considered farther on.

THE TYPICAL BRAIN.—Notwithstanding great differences in the relative size and complexity of the principal subdivisions, and in the number of the accessory parts, the brains of all Mammals, Birds, Reptiles, and Batrachians may be referred to a single type. The reduction to this type may be made either by comparing many forms as intermediate stages of an ideal transition, or by tracing back the development of the brain of a single form to its earliest and simplest condition.

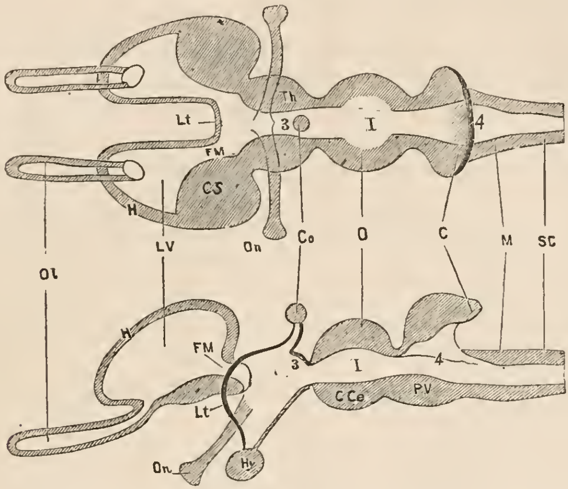
Among the remaining groups of fish-like vertebrates the lamprey eels (Petromyzontidæ) seem to possess brains closely resembling those of Batrachians. The Myxinoid brain has not yet been satisfactorily homologized with that of *Petromyzon*, but may prove to be a degenerated form thereof. As figured by Owen (20, and 6, I, fig. 186, p. 282), the brain of *Protopterus* seems to closely resemble that of the tailed Batrachians; but Huxley (16, 30) finds in *Ceratodus* (which is regarded as a Dipnoan) a feature which is characteristic of the plagiostome brain, so that the matter is still in doubt. The brains of Ganoids, and Teleosts, and Plagiostomes are not yet satisfactorily homologized with the typical brain; the same is the case with the Holocephala (17).

The typical brain comprises the following parts: *Medulla* and *fourth ventricle; Cerebellum* with its *ventricle; Optic lobes* with their *ventricles; Thalami*, with the *third ventricle*, *the conarium* above, and *hypophysis* below; *Hemispheres*, containing the *lateral* (first and second) *ventricles*, which communicate with the third through the *foramina* of *Monro; Olfactory lobes* with their *ventricles.*

Thickenings of the lower or outer walls of the hemispheres constitute the *corpora striata;* and these are joined by the *anterior commissure* which is a specialization of the anterior boundary of the third ventricle, the *lamina terminalis.*

The thalami are united posteriorly by the *posterior commissure*, and between their central portions may be formed the *middle* or *soft commissure.* The *fornix* seems to result from a thickening of the vertical fibres of the lamina terminalis in front of and above each foramen of Monro, and from the subsequent union of the two series of fibres across the median line.

The *pons Varolii* is a band of transverse fibres upon the ventral side of the medulla, connecting the lateral regions of the cerebellum. The *corpus callosum* is a transverse commissure uniting the contiguous faces of the hemispheres. The corpus callosum and the pons Varolii seem to be confined to the mammals.



Diagrams (slightly altered from Huxley) representing the type of vertebrate brain. *S C*, spinal cord; *M*, medulla oblongata; 4, fourth ventricle; *O*, optic lobes; *I*, optic ventricle, or iter a tertio ad ventriculum quartum; *C Ce*, crura cerebri; 3, third ventricle; *Th*, thalami; *Co*, conarium; *On*, optic nerve; *F M*, foramen of Monro; *L V*, lateral ventricle; *H*, hemisphere; *C S*, corpus striatum; *Ol*, olfactory lobe; *Hy*, hypophysis.

Figures and descriptions of the typical brain are given by Huxley (13, 56–59); his figures were reproduced by me with slight modifications in a former paper (17, plate 3), and they are herewith presented again from a conviction that an understanding of it, and of the brains of Amphibia which most nearly embody the type, is essential to the successful study of the many and complex modifications which exist among the other vertebrates.

Enumeration of Parts.—Accepting, provisionally, the type of vertebrate brain as figured and described by Huxley, it is desirable to ascertain how far its subdivisions are recognizable in the brain of *Chimæra*.

Respecting the following parts there can be no doubt: The spinal cord (*S C*), the optic nerves (*o n*), and chiasma (*o c*), and the olfactory lobes (*Ol*).[1]

But none of the intermediate regions have yet been determined satisfactorily as to their limits, and as to their correspondence with the subdivisions of the typical brain.

The cerebellum lies between the medulla behind, and the optic lobes in front. If the cerebellum, therefore, can be determined the other two parts will naturally follow.

The existence of a cerebellum is doubtful in the Myxinoids, and among the other fishes it presents very great diversities of size, form, and complexity. Thus in *Petromyzon* and the Dipnoans it is a narrow bridge; in *Lepidosteus* it is an inflated vesicle; in *Morrhua* it is retroverted, in *Pimelodus* anteverted. In skates, that which has been usually regarded as the cerebellum is a somewhat elongated and flattened mass which is distinctly single and median, although it may present a longitudinal median furrow. With many sharks this part is deeply furrowed transversely as in birds.

Prior to the year 1868, so far as I know, this region of the plagiostome brain was universally recognized as the cerebellum. But Miklucho-Maclay (7 and 10) has proposed to call this the *Mittelhirn* (optic lobes), and to restrict the term cerebellum to a narrow band (figs. 2 and 8, c′) between it and the medulla. The region commonly called optic lobes he names *Zwischenhirn* (thalami).[2]

Now there is certainly some ground for this view. The transverse lamina of sharks and skates is apparently identical with

[1] For obvious reasons the determinations of Valentin are not here considered.

[2] I feel constrained to protest against the introduction of the terms Vorder-hirn, Zwischen-hirn, Mittel-hirn, Hinter-hirn, and Nach-hirn, and of their English equivalents fore-brain, etc. If the conventional and universally understood terms medulla, cerebellum, etc., are to be discarded for descriptive names derived from one modern language, what is to prevent the anatomists of Spain, or Russia, or any other country from employing other descriptive titles derived from their own languages? Such substitutions would soon cause morphological science to revert to the chaotic condition in which descriptive zoölogy was found by Linnæus.

The region designated by thalami has already received the following names: Zwischen-hirn, between-brain, inter-brain, diencephalon, deutencephalon, lobus ventriculi tertii.

the visible cerebellum of Amphibia, Myzonts, and Dipnoans; it seems to represent the simple and primordial form of the organ. Nor is it easy to account for the sudden interpolation between it and the optic lobes of the greatly expanded or inflated mass commonly called cerebellum in other vertebrates.

But it is worth bearing in mind that, with some Ganoids, as *Acipenser*, and *Lepidosteus* (Wilder, 17, 181, fig. 7), the anterior border of the apparently simple cerebellum is continued forward into the cavity of the optic lobes. Why then may we not imagine that an eversion of this fold has given rise to the inflated or convoluted mass of sharks and skates? This would give us two distinct portions of the cerebellum; the posterior lamina, and the anterior vesicle.

To Maclay's interpretation assent has been given by Gegenbaur (12, 549; 14, 524). But neither of these anatomists has as yet published facts or arguments which warrant the abandonment of the older view, while several others have questioned the validity of their conclusions. Amongst these are Jackson and Clarke (15, 77); Balfour (26, 560); Huxley (16, 31–25); and myself (17, 172, and 24). In a letter to me, Prof. Rolleston has also expressed his non-acceptance of Maclay's view.

In his paper on *Ceratodus* (16, 31) Prof. Huxley says: "I cannot accept the views of Miklucho-Maclay, whose proposal to alter the nomenclature of the parts of the Elasmobranch's brain appears to me to be based upon a misapprehension of the facts of development."

My argument (24) against the view of Maclay was based upon the fact that in the brain of a large shark (*Carcharias obscurus*) the fibres of the optic tracts are distinctly traceable to the optic lobes and the thalami, and not at all to the cerebellum as should be the case if the cerebellum be really the optic lobes.

In commenting upon the paper just mentioned, Prof. Huxley (25) repeated the opinion expressed in the paper on *Ceratodus*, and called attention to the fact that wherever the fourth nerve (trochlearis or patheticus) has been identified among vertebrates, its apparent origin has invariably been between the optic lobes and the cerebellum. This point seems to have been considered by J. Müller,[1] and it is briefly discussed by Maclay and Gegenbaur,

[1] Vergl. neurologie der Myxinoiden, 1838, p. 215.

who, however, regard it as not constituting an insuperable objection.

There is one other consideration which appears to have been overlooked hitherto. Among the air-breathing vertebrates, from frog to man, the roof of the optic ventricle is complete, while that of the third ventricle is only partial. Posteriorly the dorsal borders are united by the posterior commissure, but anteriorly the true nervous tissue is absent, and the ventricle is covered only by the lining membrane and the overlying pia mater. According to the new interpretation, the thalami of fishes lack the feature which characterizes them throughout the series of air-breathing vertebrates, and assume the peculiarities of the optic lobes.

Should Maclay and Gegenbaur insist upon the correctness of their interpretation, the matter will need to be treated in full hereafter; but as, for obvious reasons, the material for its elucidation must be derived from sharks and skates rather than from *Chimæra*, I trust that in adhering in the present paper to the commonly accepted view I shall not be held to disregard the earnestness of Maclay, or the high authority of his distinguished teacher.

For reasons which will be presented farther on, I have designated the parts between the optic and the olfactory lobes as follows: the slender bands as the *mesothalamus;* their posterior enlargements as the *basithalamus;* their anterior enlargements as the *prothalami;* and the remainder of the elongated mass on each side which incloses a ventricle, as *hemisphere.*

THE SPINAL CORD (S C).—For at least 3 cm. behind the medulla the cord[1] is of uniform size and shape. Its greatest transverse diameter is 4 mm., and its vertical diameter 3 mm. As seen in the cross-section (fig. 22), its greatest width is ventrad of the centre, and the sides of the ventral median fissure (*v*) slope outward more gradually than those of the dorsal (*d*).

The nerves have been separated from the cord, but along the dorsal lateral line (fig. 1, *d l*) is a series of slight elevations about 2 mm. apart, which may indicate the points of origin of the dorsal roots of the spinal nerves; the ventral lateral line (fig. 4, *v l*) presents no such elevations. The lateral tract (*l c*) between the dorsal and ventral lateral lines is slightly elevated above the dorsal and ventral tracts (*d c* and *v c*), and, when first exposed, presented a darker color which disappeared in a few days.

[1] The remainder of the cord was not exposed.

The structure of the cord, and the homologies of its parts with those of the human spinal cord, should be determined by microscopic sections of better preserved specimens.

The Medulla Oblongata.—The medulla consists of two parts, the *medulla proper* or continuation of the spinal cord, and two pairs of lobes which may be provisionally called *dorsal* and *lateral.*

The medulla may be said to commence at a point about 4 mm. behind the posterior end of the lobes, and about 3 mm. behind the angle of the fourth ventricle. At this point the cord begins to change its form and to increase in size.

The dorsal border preserves nearly the same direction as that of the cord itself, but the ventral border inclines ventrad, so that just behind the lobes the dorso-ventral diameter is 4 mm. At a point 4 mm. farther forward the ventral border is 2 mm. lower than the ventral border of the cord, and it remains at this level until suddenly deflected ventrad beneath the cerebellum.

The width of the medulla also increases so as to be about 6 mm. just behind the lobes. In front of this point the width becomes about 8 mm., on account of the prominent lateral lobes.

The dorsal lateral line (*d l*) begins to be deflected downward at the point of transition from the cord to the medulla; but its deflection is more rapid than that of the ventral border; the dorsal tract (*d c*) not only increases in width, but is slightly elevated above the lateral column. The distinctness of the dorsal lateral line (*d l*) ceases just in front of the posterior end of the lateral lobe, but the elevated ventral margin of the lobe follows the same general direction. The slight elevations which indicate this line upon the cord do not appear upon the medulla. The ventral lateral line (*v l*) gradually disappears at about the middle of the length of the medulla, as seen in fig. 4; the ventral median furrow (*v*) ends rather abruptly just behind the downward deflection of the ventral surface under the cerebellum; it does not present the bifurcation which is figured by Valentin, 1, fig. 3, *F.*

The dorsal fissure (*d*) widens into the fourth ventricle about 3 mm. in front of the point where the enlargement of the medulla begins, and about 1 mm. behind the superjacent dorsal lobes. The posterior angle of the ventricle is covered by the ligula (fig. 3, *l.*)

The fourth ventricle is quite long, but, as seen in figs. 19–22, its cavity is nearly obliterated by the development of its various walls. The hinder part of the floor presents three rounded tracts upon each side. Suggestions as to the homologies of these tracts are offered by Jackson and Clarke (15, 79), but I refrain from doing more than indicate their appearance and relative position.

Close to the median line is a rounded tract (*m t*), which is traceable anteriorly to the cerebellum ; it is about 0.7 mm. in diameter. Just outside of the posterior half of this is a depressed triangular surface, the exposed border of an intermediate tract (*i t*). Outside of this, and apparently the forward continuation of the posterior border of the fourth ventricle, is a tract (*n t*) of which the mesial border, projecting over the intermediate tract, presents a series of transverse furrows with intervening nodules, on account of which I have called it the *nodular tract.* It is apparently what Owen (6, I, 273) calls the "vagal tract." The whole extent of these parts can only be seen after raising the lateral lobe, which may be done without, apparently, causing a rupture of fibres, although the attachment is quite intimate. It is then seen, as in fig. 19, that the four nodules are ganglia of origin of as many nerve roots, which, however, do not in this example project beyond the surface of the medulla.

As already stated, the lobes of the medulla are two pairs, *lateral* and *dorsal.* (See figs. 1, 2, 3, 20, 21.) These terms are here employed in a descriptive sense. The lobes may perhaps be homologized with parts of the medulla of man and of other vertebrates, but the interpretations of Owen and Valentin do not wholly coincide, and I forbear adding to the synonymy until the structure and development of these lobes have been examined among the sharks and skates; *Torpedo* and its allies would probably be very instructive.

The lateral lobe (*l l*) seems to be an enlarged continuation of the dorsal tract of the cord. Its dorsal surface is in contact with the ventral border of the dorsal lobe.

The outer surface of the dorsal lobe is somewhat rough, and, as seen from the side or from the mesial surface, presents the form of an elongated triangle with its apex backward; seen from above the apex appears rounded. The mesial surface is vertical, and closely applied against that of its lateral homologue.

As seen in fig. 20, the posterior portion of the dorsal lobe is wholly separate from the lateral lobe and the medulla; but a section farther forward, as in fig. 21, shows a line of union between its ventral margin and the mesial border of the lateral lobe.

Anteriorly, both the dorsal and the lateral lobes develop a series of folds (*d m′* and *l′*), which are continuous with each other, and through the transverse lamina (*c′*) with the cerebellum.

These folds are so complex that a complete description would be very long and difficult to follow; it seems better, therefore, to wait until their type can be ascertained from a young brain, or from comparison of the parts with those of sharks and skates.

THE CEREBELLUM (C and *c′*).—As with most Plagiostomes the cerebellum of *Chimæra* consists of two quite distinct portions, an anterior and a posterior. The anterior is a prominent inflated mass (C), the posterior is a transverse lamina (*c′*) which lies behind the other, and is only visible after dissection, as in figures 2 and 8. This posterior cerebellum is what Maclay regards as representing the entire organ, the anterior inflated portion being, in his opinion, the optic lobes.

As already intimated (page 231), the lamina may prove to be the true homologue of the simple cerebellum of Amphibia, Dipnoa, and Myzonts. Its position is well shown by Valentin (1, fig. iv. *i*), but his figure does not present one peculiarity: just upon the median line the thickness of the lamina becomes greatly diminished, as shown in my figures 2 and 8.

The anterior cerebellum (C) is an inflated oval mass resting upon the medullary lobes behind and the optic lobes in front. As seen from the side the short handle of the "hammer-formed body" is formed by upright crura (*c*), which join the base of the brain at nearly a right angle.

This portion of the base of the brain (*c c*) presents no peculiarities to distinguish it from the regions immediately in front and behind. The exposed surfaces are rounded and smooth; there is no sign of a transverse ventral commissure, or *pons Varolii*. The ventral outline of the base of the brain changes its direction at this point, and, as seen in fig. 2, its vertical thickness diminishes rapidly as it extends forward beneath the optic lobes.

The crus or peduncle of the cerebellum (*c*) measures about 3 mm. in antero-posterior width, and is 4.5 mm. high. Its hinder border is slightly overlapped by the anterior lamina of the lateral lobe. In this alcoholic specimen the exposed surface of the peduncle readily detached itself as a lamina thickest in the centre and thinner at all the borders; the plane of separation is indicated by the line upon the section represented in fig. 8. The surface exposed by the detachment of the lamina is irregular.

As shown in the horizontal section (fig. 8), and the median vertical section (fig. 2), the peduncle of the cerebellum consists of an anterior and a posterior vertical lamina, which are in close apposition, and continuous by their outer borders. The anterior lamina is 2 mm. in thickness at its junction with the horizontal portion or cerebellum proper, but below becomes very thin, forming a sort of "valve of Vieussens," which is continuous with the hinder border of the optic lobes. The posterior lamina is more complex. On the middle line it is very thin; the cut surface of this median thin portion is shown in fig. 2. But on each side of the middle line it becomes suddenly very thick, as is best seen in fig. 8 (*c p*). Posteriorly the lamina becomes continuous with the vertical lamina (*c′*), which Maclay regards as representing the entire cerebellum.

Upon the exposed surface the dorsal limit of the peduncle is indicated by a curved line with its concavity looking ventrad; this also marks the line of separation of the superficial lamina already referred to.

Dorsad and in front of this is a second furrow which extends obliquely dorsad and backward from the ventral border of the cerebellum. Excepting these, and the median furrow to be presently described, the exposed surfaces of the cerebellum and its peduncles are smooth.

The expanded portion of the cerebellum is 13.5 mm. in length; about 8 mm. lie in front of the centre of the peduncle. The anterior portion also has a slight downward inclination, so that, to employ Valentin's comparison, the posterior portion is the striking part of the hammer, and the anterior is the claw.

The greatest width of the cerebellum (7.5 mm.) is just over its peduncle; it tapers quite regularly to an obtuse point before and behind, giving the whole an oval outline. Seen directly from above the posterior extremity is the sharper; but when the brain is tilted backward, as in fig. 5, the anterior extremity is more pointed.

The dorsal aspect of the cerebellum presents a median longitudinal furrow, 5.5 mm. long. Its centre lies over the centre of the peduncle. In Valentin's figure the furrow extends nearly the entire length of the cerebellum.

The ventricle of the cerebellum (*c v*) has the same general form as the organ itself, as shown in the median section (fig. 2), the transverse section (fig. 10), and the horizontal section (fig. 11).

The cerebellum of *Chimæra* presents some interesting features. It is large and its walls are thick, yet its form is simple, while those of many sharks and skates, in the adult state, are much folded. The median furrow occurs in some Plagiostomes, but is a rare feature of the cerebellum of other vertebrates.

The Optic Lobes (O).—Reference has already been made (p. 230) to the view of Maclay and Gegenbaur respecting the nomenclature of these parts.

As is usually the case the form of the optic lobes is quite simple. Their size is moderate, and when the brain is viewed from above they are wholly concealed by the overhanging anterior portion of the cerebellum, as shown in figs. 1 and 3. In fig. 5 the parts are seen from above and in front so as to expose the optic lobes. The difference between the outline of the lobes in figs. 5 and 6 is thus accounted for.

The optic lobes are borne upon the crura cerebri (*c c*) already described as forming an obtuse angle with the medulla. The outer surface of each crus presents a distinct rounded elevation or protuberance (*t*), rather nearer the ventral than the dorsal border. It is shown, somewhat exaggerated, by Valentin (1, figs. 1 and 3), and called by him "*tuber cruris cerebri*."

Measured in the direction of their greatest length, nearly parallel with the crus, the optic lobes are 8 mm. long; taken together, their greatest transverse diameter is 7 mm., which is reduced to 3.5 mm. near their hinder and more rounded end, and to 2.5 mm. near their front and compressed extremity. The median furrow, which marks the division into two lateral lobes, extends their whole length. The size and form of the ventricles and the thickness of different parts of the walls are shown by the sections represented in figures 2, 8, and 9. The cavity is smaller than in the brains of many other fishes, but not, as with mammals, contracted into an " aqueduct of Sylvius."

As seen in fig. 9 the ventricle presents four well-marked regions: two median, the upper broad and the lower narrow; and two lateral, and compressed, one upon each side, extending upward and slightly outward into the elevations upon each side of the median furrow. The lower compressed portion of the ventricle is wider behind and in front than at the middle; hence the sides may be not improperly called the lobes of the optic ventricle (figs. 2 and 9, *o v l*). But these swellings are not necessarily to be regarded as homologous with the thickenings or involutions of the posterior walls in some Reptiles and Amphibia.

The parts already described constitute a series of median masses which may, without difficulty, be regarded as formed by the modification of a corresponding number of primary cerebral vesicles. But it is not so easy to understand how the remaining portions of the Chimæra's brain have been developed from the single anterior vesicle which, with birds and mammals, has been found to give rise to all the parts in front of the optic lobes.

These parts are the *thalami*, the *hemispheres*, and the *olfactory lobes*.

Could we trace the development of the Chimæra's brain, or had we full acquaintance with the brains of all living Plagiostomes, and of some apparently transitional fossil forms, it is probable that little difficulty would be experienced in assigning the proper limitations and names to these parts. At present our determinations and nomenclature must be largely provisional.

Concerning one pair of lobes, however, there can be very little doubt, so that it may be well to commence with them.

The Olfactory Lobes (O l).—These parts, whatever their size or form, have always been identified among vertebrates by one or both of two criteria: their continuity, either direct or by crura, with the hemispheres behind; and their connection, through the olfactory nerves, with the nasal cavities in front.

In *Chimæra* the nasal cavities receive numerous nerves from the anterior surface of the most anterior pair of lobes, which may therefore be called the *olfactory lobes*.

Each lobe is a sub-quadrate mass, about 7 mm. high, and 4 mm. both in width and in its greatest antero-posterior dimension. Its junction with the hemisphere is marked by a decided constriction, which becomes a cleft at the ventral border.

With this alcoholic specimen the lobe may be readily detached from the hemisphere in a plane which is, at first, a continuation of the cleft dorsad and forward, but becomes nearly vertical at about the middle of the height of the lobe. The two facets thus exposed are slightly sunken below the border of the lobe. At about the centre of the dorsal facet is a very slight circular depression (fig. 16, *o l v*); this coincides with the anterior extremity of the lateral ventricle (figs. 12, 14, 18, *l v*), and may therefore be regarded as a very rudimentary olfactory ventricle.

The mesial surface of the olfactory lobe is flat, and continuous with that of the hemisphere. The outer surface has less antero-posterior extent, because the anterior surface looks obliquely outward. The outer surface is rounded, there being a very decided depression between its most prominent portion and the most anterior elevation of the hemisphere.

The anterior surface is not only oblique, as above stated, but also divided into three distinct regions, as shown in figs. 12 and 17. The dorsal and ventral regions are nearly circular, though the transverse diameters are slightly greater than the vertical, and covered by the filaments of the olfactory nerves. Between them is a narrow, depressed area, which is devoid of these filaments. The olfactory lobes are wholly distinct from each other.

THE HEMISPHERES (H).—The parts called hemispheres with man, birds, reptiles, and batrachians have the following features, constant and common to all: 1. They are lateral masses. 2. They contain each a lateral ventricle, which communicates posteriorly with the median third ventricle through a "foramen of Monro." 3. They have no direct nerve prolongations, being connected only with the thalami behind, and the olfactory lobes in front. 4. The posterior extremities of their mesial walls are united by the anterior wall of the third ventricle—the *lamina terminalis*.

Of these four characters the first three certainly apply to the anterior three-fourths of the elongated mass, which, with *Chimæra*, lies just behind each olfactory lobe; but respecting the fourth character some qualification may be required. According to the second and fourth tests the posterior fourth of the mass cannot be regarded as a true hemisphere; the same is the case with the whole of the second pair of lobes, with Ganoids and many Teleosts, which have been usually called hemispheres, but which contain no lateral ventricle, and have, therefore, no true mesial wall.

To these pseudo-hemispheres, I have given the name *prothalami* (17, 179); and the same term may be applied to the posterior fourth of the elongated lobes of the Chimæra's brain.

Strictly speaking, the term prothalamus should be applied to the region as a whole; each lateral moiety would then be a *hemi-prothalamus*. But the shorter word may generally be used without the risk of misconception.

The length of each lobe is about 11 mm.; its height is 6 mm., and its greatest thickness 4 mm.

I am unable to determine the precise boundary line between the prothalamus and the true hemisphere. The external surface is divided by two transverse depressions into three elevated regions, of which the middle is the larger. The hindermost elevation may be said to correspond with the prothalamus.

The mesial surface presents three features which, so far as I know, have never been described—an aperture, an elevation, and a commissure. The region occupied by these corresponds very nearly with the middle elevation upon the outer surface; see figs. 1, 2, 13, 14, and 15.

The commissure is designated as *l t* upon figs. 13 and 14, but upon fig. 2 it is not marked at all. It is a flat fibrous band connecting the mesial surfaces of the two hemispheres. It was torn during the extraction of the brain, but appears to be about 3 mm. wide at its middle, and nearly twice as wide at either end. Its thickness is about 0.5 mm., the anterior and posterior borders being distinct and rounded. Its plane is slightly oblique, the anterior margin of the attachment being near the middle of the height of the hemisphere, about 4 mm. behind the olfactory suture, while the posterior margin is near the lower border. It seems safe to conclude that this commissure represents a remnant of the primitive lamina terminalis, but I am not prepared to say that it corresponds to the anterior commissure of higher vertebrates. It may be homologous with the commissure of the prothalamus in *Lepidosteus*, figured by me in 17, plate 2, but its relations to the foramen of Monro are not the same, as will now appear.

The foramen or aperture already referred to is the posterior termination of the lateral ventricle. From the section shown in fig. 15 it is seen that near the anterior termination, at the olfactory lobe, the inner and outer walls are of nearly equal thickness. But the cavity gradually approaches the mesial surface, and opens thereon about 7 mm. from the olfactory suture. This orifice forms a semicircle; the extremities are one above the other, and 4 mm. apart. The margin is distinct and rounded, though thin. The commissure is continuous with the ventral margin, but extends

2.5 mm. in front of it, and about 1 mm. behind it. The dorsal margin is continued backward and downward as a slight ridge upon the mesial surface of the prothalamus near the dorsal border.

There can be no doubt that this aperture corresponds to the foramen of Monro, or passage from the median to a lateral ventricle, but it is not easy to understand how the commissure, a part of the lamina terminalis, can extend so far in front of it.

Into the space which is nearly circumscribed by the margins of the foramen and its posterior continuations there projects a smooth convex surface, which is designated as *x* on figs. 2, 13, and 15. Its posterior border is semicircular, and a deep furrow separates it from the mesial surface of the prothalamus. Anteriorly it is continuous with the outer wall of the lateral ventricle, as shown in fig. 15. As suggested in a previous paper (17, 183, note 31), since this surface indicates a thickening of the outer wall of the ventricle, the thickening itself may be a primordial *corpus striatum*, but I hesitate to employ the term at present and would prefer to designate it as the *corpus innominatum.*

The Thalamencephalon (T).—This is the general name for all the region between the hemispheres in front, and the optic lobes behind. In most brains it is comparatively short, and presents no very characteristic features; but its extreme length forms the most obvious peculiarity of the Chimæra's brain.

With adult mammalia the region includes two irregular masses, the thalami, between which is the third ventricle; the conarium is above and the hypophysis below. With *Chimæra* the thalami themselves form three distinct regions, posterior, middle, and anterior, which I have named *basithalamus*, *mesothalamus*, and *prothalamus.*

The prothalamus. This region has already been described in connection with the hemispheres with which the two prothalami are continuous. There is reason for believing that this region exists in all vertebrate brains, and is very extensive in certain forms. This idea will be again presented at the close of this paper. I pass now to the intermediate region of the thalamencephalon.

The *mesothalamus* (*c t*). In my description of the brain of *Lepidosteus* (17, 179) this region of the brain was called *crura thalami;* the new term is to be preferred.

The mesothalamus consists of two narrow bands about 16 mm.

long, and 2 mm. in vertical diameter; their thickness is about 0.5 mm. Their dorsal and ventral borders are slightly thicker than the intermediate portion, and are inclined slightly toward the middle line so that the inner surfaces are concave, the outer convex.

The two bands may have been united by a thin ependyma, but so far as regards true nervous tissue they are separate in their entire length. Their hinder extremities arise quite abruptly from the basithalamus. Anteriorly, the mesial concavity becomes greater, but at the same time, the dorsal border presents a thinner edge which is turned *outward*. Then each band becomes continuous with the corresponding prothalamus.

The basithalamus (*b t*). This name is given to the depressed and constricted part just in front of the optic lobes, of which it forms a kind of neck. It may be said to be bounded by two imaginary lines, the one passing just in front of the optic lobes and the protuberance upon the underlying crus, the other passing from the most anterior border of the optic lobe in front of the chiasma. The triangular outer surface thus bounded represents the optic tract, the expanded nerve passing upward and backward to the optic lobe of each side. The basithalamus seems to correspond to the hinder part of the thalami with air-breathing vertebrates.

The cavity of the basithalamus is a slender rounded canal, the forward continuation of the optic ventricle. Anteriorly this canal curves upward, and opens through the foramen of the thalamus (fig. 5), just above the chiasma. This foramen is not rounded, but quadrangular, the angles projecting vertically and laterally. From above the orifice is concealed by a pair of thin horizontal plates (figs. 1, 2, 5, *t l*) which are attached to the anterior border of the optic lobes, and united by the posterior fourths of their mesial borders. This double cover is not represented by Valentin, and seems not to have been noticed in the brains of other fishes; but I have found it, under one form or another, in all ganoid, teleost, and plagiostome brains so far examined. It seems to be the reduced representative of the posterior part of the roof of the third ventricle with Amphibia and Myzonts; if so, we should name it *posterior commissure*.

The conarium. With Amphibia this part lies just above the foramen, closing it, in fact; still it not infrequently is removed with the roof of the brain cavity; with most Plagiostomes it is in close contact with the roof, and this was probably the case with *Chimæra*, since the conarium of this example is wanting. A depressed quadrangular space is left upon the median line between the contiguous margins of the optic lobes and the cover above described.

The hypoaria (*h*). As seen in figures 1, 2, and 4, beneath the basithalamus is a rounded mass, consisting of a pair of oval lobes, with a triangular median surface between their hinder portions. These are apparently the parts called by authors *hypoaria*, or *lobi inferiores;* they may correspond to the *tuber cinereum* of anthropotomy, but the homology of the parts of this region of the brain is not yet well determined.

Each lobe is about 6 mm. long, and about 4 mm. wide. They are hollow; their cavities communicate with each other, and, through a vertical passage, with the ventricle of the basithalamus. On the median line the triangular space between the hinder portions of the lobes presents a fissure about 3 mm. long, by which the cavity of the hypoaria opens externally.

Below the corresponding fissure in the brains of *Lepidosteus* and other fishes is a globular mass, apparently vascular, which may represent the hypophysis. No such mass was found in this specimen, but it may have been lost through inadvertence. As above intimated, the homology of these parts is not yet understood.

The optic nerves (*o n*) are about 1 mm. in diameter, excepting just before their union to form the chiasma; here they increase in width, and then become constricted. The dorsal borders of the enlargements are slightly overlapped by the mesothalami.

The *optic chiasma* (*o c*) is very compact; but I have not examined its structure.

Morphological Considerations.—Whatever may be the peculiarities of the hinder regions of the brain of *Chimæra*, there appears to be a close homology between them and the hinder regions of the brains of most sharks and skates; the latter, therefore, as more accessible, should be employed for the determination of the structure, and mode of development of the medulla, cerebellum, and optic lobes.

But the ordinary Plagiostome brain seems to throw no light upon the study of the remaining divisions of the chimæroid brain, and some features of the latter seem to be exaggerations of the characters of certain Ganoids. In the brain of *Scymnus lichia*, however, as figured by Mayer (5, taf. 1, fig. 7), there are indications of a transition between the plagiostome and chimæroid types, and I would urge upon any anatomist who may have the opportunity, the need of a careful examination of its brain. Still more desirable is the discovery of very young examples of *Chimæra*.

I think that I begin to see, though still dimly and imperfectly, the method by which the close homology of the parts in front of the optic lobes can be demonstrated.

The first, and most essential, step in this demonstration seems to me to be the recognition of the distinctions between a *hemisphere* and a *prothalamus*. The former is a *lateral* mass containing a ventricle. The latter is, strictly speaking, a *median* mass inclosing the anterior portion of the third ventricle, which opens laterally into the hemisphere ventricles through the foramina of Monro. Its anterior boundary is the lamina terminalis. In sharks and skates the prothalamus persists as the hinder part of the nearly solid mass in front of the optic lobes. The true hemispheres project forward to a greater or less extent, as shown in a previous paper (27). This median mass also persists in *Ceratodus*, although Prof. Huxley calls it *lobus communis* (16, 30). With *Chimæra* the lamnia terminalis is reduced to a slight commissure, and the outer walls of the prothalamus, almost disconnected, become lateral solid masses, the *hemiprothalami*. The true hemispheres persist, with their lateral ventricles. But with Ganoids and Teleosts the hemispheres seem to be rudimentary, and their name has been usually applied to the hemiprothalami. The mesothalami may be more or less elongated in various genera.

With the air-breathing vertebrates the hemispheres are prominent, and the prothalamus correspondingly reduced. But I think its ventricle can be recognized in all, especially embryos, as the space bounded in front by the lamina terminalis, and opening laterally through the foramen of Monro. A more extended consideration of this matter must be reserved for a separate paper.

Taxonomic Considerations.—The views of Müller, Valentin, and Mayer respecting the affinities of the Holocephala are given in the historical sketch. Gegenbaur (14, 408) makes the group of equal value with Teleosts, Ganoids, and Selachians [Plagiostomes].

Huxley, in speaking (16, 41) of Müller's separation of the Holocephala, expresses himself as follows:—

"It appears to me that he might have been justified in going still further; for, considering, in addition to the cranial characters, the structure of the vertebral column, and of the branchiæ, the presence of an opercular covering to the gills, the peculiar dentition, the almost undeveloped gastric division of the alimentary canal, the opening of the rectum quite separately from and in front of the uro-genital apertures, the relatively small and simple heart, the Chimæroids are far more definitely marked off from the Plagiostomes than the Teleostei are from the Ganoids."

I have only to add, upon the present occasion, that the conclusion which Prof. Huxley bases upon the consideration of other parts of the organization, seems to me fully confirmed by the structure of the brain of *Chimæra*, as described in the foregoing pages; the Holocephala seem to differ from the Plagiostomes more than the Ganoids differ from the Teleosts, and should form a primary subdivision of the fish-like vertebrates, like the Amphibia, Dipnoi, Ganoidei, Teleostei, Plagiostomes, and Myzontes or Marsipobranchs. (See, also, pages 227 and 228.)

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Explanation of Figures.[1]

Figures 1, 2, 4, and 15 are natural size. The remainder are enlarged two diameters.

Fig. 1. Brain of *Chimæra monstrosa*, ♂, from the left side.

Fig. 2. The brain is cut vertically and longitudinally on the median line so as to show the mesial surface of the right half.

Fig. 3. View of the hinder region, from above.

Fig. 4. The same region from below.

Fig. 5. The same region from above and in front, so as to show the optic lobes and the parts in front of them. The cerebellum is foreshortened.

Fig. 6. The optic lobes from above.

Fig. 7. The anterior portion of the medulla, showing parts which are naturally covered by the crebellum.

Fig. 8. Horizontal section of the optic lobes, the peduncles of the cerebellum, and the anterior portion of the medulla.

Fig. 9. Transverse section of the optic lobes in the direction of a line drawn from the anterior extremity of the cerebellum to the posterior margin of the hypoaria.

Fig. 10. Vertical transverse section of the cerebellum between the anterior and posterior laminæ. The corresponding portion of the medulla is not shown.

Fig. 11. Horizontal section of the cerebellum, showing the interior from above.

Fig. 12. Outer surface of the left anterior region, olfactory lobe (separated), hemisphere, prothalamus, and part of the mesothalamus.

Fig. 13. The same (exclusive of the olf. lobe) from above.

Fig. 14. The same from below.

Fig. 15. The same in horizontal section.

Fig. 16. Left olf. lobe, showing the surface by which it was attached to the hemisphere, and the slight depression which constitutes the olf. ventricle.

Fig. 17. The same, showing the anterior surface.

[1] The figures were drawn from nature, and on stone, by Miss G. D. Clements, a student in the Natural History course at Cornell University.

Fig. 18. The anterior surface of the hemisphere corresponding to the surface shown in fig. 16.

Fig. 19. The medulla after removal of the dorsal and lateral lobes so as to show the roots of the vagus.

Fig. 20. Transverse section of the medulla near the hinder end of the lobes.

Fig. 22. The same in front of the nerve roots.

Fig. 23. Transverse section of the spinal cord. (These three figures are mainly diagrammatic, proper microscopic sections not being available.)

Explanation of Signs.

The names of the principal divisions are indicated by capitals, as follows:—

S C, spinal cord.

M, medulla oblongata.

C, cerebellum.

O, optic lobes.

T, thalamencephalon.

H, hemispheres.

O l, olfactory lobes.

The following are designations of the subdivisions arranged under their respective divisions. The numbers indicate the figures in which the parts are shown.

S C, spinal cord.

- *v*, (4, 20, 21, 22) ventral (anterior) median fissure.
- *d*, (3, 22) dorsal (posterior) median fissures.
- *v c*, (4, 22) ventral columns.
- *d c*, (1, 3, 22) dorsal column.
- *v l*, (4, 22) ventral lateral line.
- *d l*, (1, 3, 22) dorsal lateral line indicated by a series of nerve roots.
- *l c*, (1, 22) lateral columns.

M, medulla oblongata.

- IV, (2, 3, 20, 21) fourth ventricle.
- *l*, (2, 3) ligula.
- *n o*, (1) origins of nerves.
- *r*, (1) restiform bodies, continuations of the posterior columns.
- *m t*, (19, 20) median tracts seen in the fourth ventricle.

i t, (19, 20) intermediate tracts.
n t, (19, 20) nodular tracts.
v r, (19, 20) roots of vagus nerve.
d m, (1, 2, 3, 20, 21) dorsal lobes of medulla.
d m', (1, 3, 5, 7) anterior convoluted portion of the same.
l l, (1, 20, 21) lateral lobes of medulla.
l l', (1, 3, 4, 5, 7, 8) anterior convoluted portion of the same.

C, cerebellum.
c, (1) crus or peduncle of the cerebellum.
d f, (3, 5, 10) dorsal furrow.
c a, (2, 8, 11) anterior lamina.
c p, (2, 8, 11) posterior lamina.
i f, (11) furrow on anterior surface of posterior lamina.
c', (2, 8) posterior cerebellum.
c v, (2, 8, 10, 11) ventricle of the cerebellum.
i, (2) communication between the fourth ventricle and the cerebellar ventricle.

O, optic lobes.
c c, (1, 2, 9) crura cerebri supporting optic lobes.
t, (1, 5, 9) protuberance upon the crus cerebri.
o v, (2, 8, 9) optic ventricle, median and larger portion.
o v', (9) median ventral portion.
o v'', (9) lateral dorsal portions.
o v l, (2, 9) lobes of the optic ventricle.
o v p, (2) constricted communication of the optic with the cerebellar ventricle.
o v a, (2) constricted communication with the third ventricle.

T, thalamencephalon.
b t, (1, 2) basithalamus.
h, (1, 2, 4, 5) hypoaria, or lobi inferiores.
h v, (2) ventricle of the hypoaria.
h f, (4) fissure of the hypoaria.
t c, (2) canal continuing forward from the optic ventricle; really part of the third ventricle.
t f, (5) foramen of the thalamus.
t l, (1, 2, 5) double cover over the foramen.
o c, (2, 4) optic chiasma.
o n, (1, 2, 4) optic nerves.

c t, (1, 2, 3, 4, 5, 12, 13, 14) mesothalamus.

p t, (1, 2, 12) prothalamus.

H, hemisphere.

f m, (2, 13, 15) foramen of Monro.

l v, (14, 15, 18) lateral ventricles.

x, (2, 13, 15) rounded thickening of outer wall of ventricles.

l t, commissure of the hemisphere (lamina terminalis).

O l, (1, 2, 12, 16, 17) olfactory lobes.

o l s, (2) suture between hemispheres and olfactory lobes.

o l v, (16) rudimentary olf. ventricle.

o l n, (17) two groups of olf. nerves.

ON THE ROCKS NEAR PHILADELPHIA.

BY THEO. D. RAND.

In pursuit of the study of Mineralogy I have become somewhat acquainted with the rock formations near Philadelphia, and have thought some of the observations of sufficient interest for publication, that others, possessing more knowledge, may apply them towards a solution of the geology of the region. Specimens of many of the rocks to which I refer will be found in the collection recently given to the Academy. I have endeavored to trace the rocks along their outcrop, and will consider them in their order at the Schuylkill, beginning at Gray's Ferry.

From that point to Girard Avenue Bridge, Mica Schists with beds of gneiss occur—the gneiss including granitic veins and the following minerals: Muscovite, Orthoclase, Albite, Tourmaline, Garnet, Beryl, Lime Uranite, Copper Uranite, and Sulphide of Bismuth (Bismuthinite). This is most fully developed at Fairmount. There is a striking resemblance between these rocks and those of the vicinity of Chester, Delaware Co., in which all the above minerals occur, except the Bismuthinite. Carbonate of Bismuth, Bismutite, however, does occur.

On the west bank of the river above Girard Avenue is a mass of coarse granite, in which the characteristic minerals are Muscovite and Biotite intercrystallized. A similar granitic rock appears at several points along the ridge west of the creek known as Mill Creek, in the vicinity of 44th Street, West Philadelphia, and particularly at a point on the Baltimore turnpike in the same vicinity, as observed by Prof. Kœnig and Mr. H. C. Lewis.

Above the Columbia Bridge there is a peculiar gneiss of a reddish color, and near by efflorescences of Halotrichite. More abundant is a hornblendic gneiss at South Laurel Hill.

This belt appears to cross Belmont Avenue above George's Hill, and the Penna. R.R., about half way between 52d Street and Overbrook. A deep cutting exposes the rock, which there abounds in Pyrites, and which in part is very compact. Much of this rock completely decomposes within two or three years after exposure.

At the Falls, a belt of very hard porphyritic gneiss crosses the river, forming the N. W. flank of Laurel Hill, and the S. E. bank of the river, and seems to have caused the abrupt bend at this point. This belt is very narrow at the Schuylkill, only from one hundred to two hundred feet in width, but it widens as it goes southwestward. The lower edge is crossed by the Pennsylvania Railroad less than a quarter of a mile from the rocks last described, the upper at Elm Station, six miles from the city—a distance along the railroad of nearly two miles, but across the strike probably about one and a quarter. This rock is so hard that its outcrop can be almost continuously traced.

At Flat Rock Tunnel, on the Schuylkill, seven miles above Fairmount, a bed of hard mica schists and gneiss crosses the river—this is probably the continuation of the beds so largely wrought for building stone at Frankford, and crossing Wayne Street, Germantown, near the railroad, and the Wissahickon at McKinney's quarry, there causing the abrupt bend in the stream. The minerals of this belt are particularly zeolites, chiefly Stilbite, also Muscovite, Biotite, Orthoclase, Albite, Sphene, Calcite, Apatite, Epidote, Copper Pyrites, Chrysocolla, etc., and Molybdenite. The quarries at Frankford having been most extensive, all these minerals have been found there, nearly all of them at McKinney's, and only the Zeolites, Calcite, Muscovite, Orthoclase, and Albite at the Tunnel. The identity of the rock to McKinney's is, I think, unquestionable, and the continuation at the Tunnel probable.

About two miles above, passing mica schists, sometimes filled with garnets, we reach the well-known Soapstone belt, which extends in a straight line, most clearly marked, from a point on the west flank of Chestnut Hill, about S. 54° W. This belt was supposed to dip under, near Merion Square, at the "Black Rocks," but Prof. Booth called my attention to its appearance at Rosemont Station, Penna. R.R., ten miles from Philadelphia. Its characteristic rock is the so-called bastard soapstone, a paste of Steatite, filled with irregular masses, and occasionally crystals, of Serpentine, probably, as I have heretofore shown, pseudomorphic after Staurolite. This same rock, with the cystals well defined, I have observed on the road from Philadelphia to West Chester, ten and a half miles from Philadelphia, the belt in which Moro Phillips' Chrome mine has been opened.

West of this, at the Schuylkill, and apparently on the S. W. bank only, is a bed of slaty serpentine, very dark olive-green, and sometimes almost black in color, associated with a mineral resembling Schiller Spar, and also an almost unaltered hornblendic mineral, apparently Enstatite. This belt is narrow, but very well defined, with frequent outcrops. It cuts diagonally, but at a very small angle, the rocks next described, and continues in a course W. 5° N., on their north flank, and is almost without doubt continuous with the well-known belt just north of West Chester. Its outcrop is frequently marked by cellular quartz with cavities lined with crystals, and stained by oxide of iron. At one point, one-quarter mile S. W. of Radnor Station, Penna. R.R., twelve miles from Philadelphia, at the side of an old quarry, the mode of formation of this rock from the Serpentine is shown in a remarkable manner. At the bottom, the serpentine is almost unaltered, above, cracks are seen extending through it in various directions, but usually one series nearly parallel and more or less at right angles to another, higher still; these cracks are seen to contain films of quartz, which become thicker and thicker, while the inclosed serpentine is softer and more rusty in color, until, near the top, the cells have thick walls, and contain only a small amount of what appears to be oxide of iron, and in part are empty. Well waters in the vicinity contain magnesia and iron, and sulphuric and silicic acids.

At Spring Mills, a bed of gneiss and granite, or granitoid gneiss crosses the Schuylkill. These are very hard rocks, and form the highest summits of the table-land, of which they form the N.W. boundary. The stratification is nearly vertical, and the characteristic mineral is a bluish quartz, which weathering out of the rock is everywhere visible in the roads. Taking this as a criterion, these rocks extend from above Van Arsdalen's quarry, in Bucks Co., at least to Darby Creek. The gneiss is often hornblendic, sometimes porphyritic, and generally composed of thin layers of alternately light and dark material. It seems entirely destitute of granitic veins or of crystalline minerals, except those composing the mass of the rock quartz feldspar—probably both orthoclase, and a triclinic feldspar, hornblende and mica.

At the Schuylkill, immediately northwest of this, is a small limestone valley, and then the continuation of the Edge Hill rocks. On the northeast side of this valley stretches a narrow dyke of trap almost continuously exposed for many miles, crossing the Schuylkill at Conshohocken, and the Penna. R.R. and the Lancaster turnpike at Wayne, thirteen miles from Philadelphia: there is also an exposure of trap in a cutting of the Pennsylvania R.R. through the granitic belt northeast of Radnor Station. This is not in line with any other trap dyke of which I have knowledge.

The Edge Hill rocks form a ridge at the Schuylkill not over a quarter of a mile in width, but rapidly widening, until between Radnor Station and the King of Prussia they are over a mile and a half wide. They are composed of talc-like schists, but are probably hydro-mica schists, in nearly vertical strata, with beds of quartz with cavities which appear to have contained pyrites, much resembling the auriferous quartz of the Eastern United States. This ridge or table-land, which is quite steep in its slopes, forms the southeast boundary of the Chester Valley.

A remarkable feature of the part of Montgomery Co. and Chester Co. bordering on the Schuylkill is the direction taken by the streams. The general features are high hills extending in a N.E, and S.W. direction with deep limestone valleys between, nearly at right angles to the general course of the Schuylkill. The streams, however, do not follow the valleys. The Wissahickon leaves the Montgomery Co. valley and flows eastwardly through a deep narrow gorge through very hard rocks a distance of over five miles. The Valley Creek flows down the Chester Valley and then turns abruptly westwardly and flows through the N.W. boundary hill. The Gulf Creek flows down the valley two or three miles, then turns westwardly and flows through a deep and narrow gorge into another valley on the west, with banks rising abruptly two or three hundred feet.

NOTES DESCRIPTIVE OF A STONE MOUND AND ITS CONTENTS.

BY JOHN FORD.

A few years ago Mr. E. P. Ford, of Piasa, Ill., a careful student of American archæology, and a valued friend and relative of the writer, became the owner of a tract of timber land bordering on Coup's Creek, a small stream that forms the northern boundary of Brown's Prairie, Macoupin County, Ill.

A group of eight burial mounds lying within the borders of this ground had remained undisturbed prior to its purchase by Mr. Ford.

These were located upon the crest of a ridge which rose some fifty feet or more above the creek level, and about one hundred yards from its northern bank.

They were ranged in a line nearly parallel with the stream, the diameter of each being about thirty feet, and the distance between their respective bases upwards of fifty.

When discovered by Mr. Ford, all but one, the fourth, numbering from east to west, were comparatively hidden by a heavy growth of timber and brushwood.

The absence of vegetation upon the exceptional one suggested the probability of its being what is locally termed a stone mound, and the work of opening it was immediately begun.

About eighteen inches below the surface, and near the centre of the mound, a stone slab was struck, and subsequently two others. These being cleared and lifted, revealed a grave or vault which measured twelve feet in length by four and one-half feet in width, with sufficient depth to permit a man to sit upright. It was constructed of stone plates or slabs throughout, a few of them being quite large, and squared on the edges. The covering was composed of the three largest, while the next in size formed the vertical walls, which were braced upon the outside by others set firmly against them at an angle of forty-five degrees. The floor, which had been sunken somewhat below the original surface, contained a few small slabs, but was more especially composed of a sort of rubble-work. This was only four or five inches in thickness, but very hard and as dry as powder.

From some cause, whether by the action of friends of the dead, by worms, or the percolation of water, it appeared impossible to explain, the entire space between the walls of the grave, not occupied by bones, was packed with a peculiar, granulated, but exceedingly tenacious earth. Owing to the dense character of this earth but little progress was made at the time, beyond ascertaining that a grown person had been placed in a sitting posture in each corner of the grave, all facing eastward; while between them the bones of perhaps twenty others were mingled together indiscriminately. Nearly all of the latter had been broken previous to interment, and it was particularly noticeable that the left sides of the skulls accompanying them had in every instance been crushed by a blow from some blunt weapon, while the remaining portions had been left in perfect condition.

Carefully replacing the covering slabs, and leaving the contents of this grave for future examination, a search was made on the slope of the mound for others. Two smaller ones were soon discovered, each built of the same kind of material and in the same manner as the central one. The smaller of these, measured between the walls, was three feet long by eighteen inches wide, and was, doubtless, the grave of a child, the white lines made by the bones being easily defined in the dark surrounding earth.

A portion of this grave, and nearly the whole of the largest one, was subsequently (in October, 1875) excavated and examined by Mr. Ford and myself, and we had every reason to believe that these, together with the third one in which the skull and shells accompanying this paper were found, had been constructed at the same period of time and by the same people.

The scene presented upon opening the third grave was somewhat novel if not startling in character. Four skeletons sat within it, two and two; their arms crossed, the knees of one pair pressing sharply against the backs of the other, and the faces of all (like those in the central grave) turned directly toward the east. The enveloping earth was not so dense, or the quantity so large in proportion, as in the other graves; so that most of the upper parts of the skeletons were exposed upon lifting the covering slab.

At first it was supposed that the skulls of all could be safely removed; but though the greatest care was taken in the operation, only one specimen, which has been presented to the Academy, was secured in a comparatively perfect condition.

Although this grave measured but six feet in length by three in width, there was little doubt among the party that it contained relics other than those of a human character. A careful search revealed nothing, however, except four large marine shells, the *Busycon perversum*, of Linnæus. The position of each of these in relation to the bodies was the same. The canal or smaller end of one had been placed in the right hand of each individual, while the larger portion rested in the hollow above the left hip. But more remarkable than this was the fact that within each of the shells there had been packed what appeared to be the bones of a child; the skull, which evidently had been crushed before burial, protruding beyond the aperture. Of course, any hypothesis regarding the purpose of this peculiar rite must necessarily be of a conjectural character; nevertheless, it was difficult to resist the conclusion that these infants were sacrificial offerings to the spirits of the dead whom the living desired to honor.

None of the mounds comprising the series under consideration exceeded three feet in height, though several others opened in the vicinity, and in the adjoining county of Jersey, during my visit, rose from five to ten feet above the surrounding level. Nothing was found in them, however, save some broken pottery and a few decaying bones.

After much search, the bluff or quarry from which the slabs had been split was discovered by Mr. Ford, about three-fourths of a mile west of the mounds. The rock is quite hard, somewhat fossiliferous, and probably belongs to the upper carboniferous series.

Whatever may be the facts regarding the origin, degree of civilization, etc., of the mound-building race, it is highly probable that they were a people of fixed habits, possessing decided constructive ability, and subject alike to order and system in their daily avocations.

Evidences of an undoubted character go to show that they were careful cultivators of the soil, and it is no uncommon belief among the thinking men of the Southwestern States that the small prairies so numerous in that section owe their present tillable condition, if not their origin, to the indefatigable labors of this "eminently agricultural people."[1]

These prairies are skirted almost invariably by beds of streams and belts of growing timber, and it was chiefly upon the bottom

[1] Albert Gallatin.

lands adjoining the one and the ridges inclosed by the other that the mounds were constructed. As a rule, those nearest the water level in the region examined by us were mere foundations for dwellings, while those for burial and defensive purposes appear to have been built exclusively upon the ridges. It was also noticed that the burial mounds occupied a position upon the nearest ridge directly northeast of the village proper, while those for defensive purposes were located principally upon the most favorable points northwest of the same.

Mr. Ford informed me that he had observed this peculiar disposition of the mounds at many other points besides those we had visited together, and that, so far as he had been able to ascertain, the same systematic arrangement prevailed along the whole of an irregular line (that may have been an ancient highway), extending from the foot of Lake Michigan to the mouth of the Illinois River, a distance of about two hundred and fifty miles.

The great antiquity of the mounds is indicated by the condition of their contents. Though vast numbers of them have been opened, the relics found therein have been much the same; a handful of bones or a skeleton that crumbled at the touch, with here and there an ornament or weapon, some broken pottery, or a solitary marine shell. Rarely, indeed, has a skeleton been discovered in a condition suitable for intelligent examination, while, until very recently, but one perfect skull belonging incontestably to the mound-building race, has been secured, and that one was taken from a mound in the Scioto Valley, near Chillicothe, Ohio.[1]

[1] Squier and Davis, *vide* Baldwin's A. A., page 48.

June 5.

The President, Dr. Ruschenberger, in the chair.

Thirty-two members present.

A paper entitled "Additional Notes on Bassaricyon Gabbii," by Joel Asaph Allen, was presented for publication.

June 12.

The President, Dr. Ruschenberger, in the chair.

Twenty-four members present.

The deaths of Amable J. Brazier, member, and Philip P. Carpenter, correspondent, were announced.

Remarks on some Parasitic Infusoria.—Prof. Leidy remarked that most of the known parasitic infusoria possessed a mouth, as in those which lived free in the waters. Such is the case with the species of *Balantidium* found in the intestinal canal of man, the hog, and various batrachians; of *Nyctotherus*, found in the intestine of frogs, several insects and myriapods; and the *Conchophthirus anodontæ*, often found abundantly on the branchiæ and palpi of our *Anodon fluviatilis*.

Other parasitic infusoria are not only devoid of an intestinal canal as characteristic of their class, but have no mouth, and, like the tapeworms and Echinorhynchi, absorb nourishment through the exterior surface of the body. Such is the case with the genus *Anoplophrya* of Stein, typified by the *Anoplophrya lumbrici*, found in the intestine of our common earthworms, as well as in those of Europe. Prof. Leidy had also detected the same species in the little wood-worm, *Enchytræus socialis*, and had found two other species, formerly described by him under the names of *Leucophrys clavata* and *Leucophrys cochleariformis*, in the intestine of *Lumbriculus limosus* and *L. tenuis*.

Recently in dissecting the fresh-water snail, *Paludina decisa*, while examining the branchiæ he observed several individuals of an *Anoplophrya* moving actively, as if in antagonism with the ciliary motion of the branchial plates. Seeking the source of the little creatures he found that they came from the rectum of the *Paludina*. In examining other individuals of this snail he observed that some were free, others were infested with few, and some with multitudes of the infusorian. In several instances the *Anoplophryæ* were so abundant as to resemble in their crowded condition a mass of writhing worms, actually distending the portion of the intestine they occupied. The species appears to be an undescribed one, and is interesting from its comparatively large size. It was named and described as follows:—

Anoplophrya vermicularis.—Body cylindrical, slightly tapering posteriorly, rounded at the extremities, or subacute behind; flattened at the anterior extremity; translucent white, finely striated longitudinally, uniformly clothed with short cilia; internally finely granular, with a longitudinal cylindrical nucleus occupying nearly the length of the axis, and with from twenty to thirty contractile vesicles, mostly arranged in one, but often in two longitudinal series. Length from two-fifths to one-half a millimetre; breadth in front .044 to .048 mm., behind .032 to .04 mm.

Besides the movements of progression induced by the cilia, the animal wriggles in a sigmoid manner and even doubles on itself. The contractile vesicles may contract more or less successively to mere points, but apparently at no time entirely disappear, and they may enlarge to double their usual size. The axial nucleus is at first barely perceptible, but becomes very obvious as the animal approaches dissolution

Incidentally Prof. Leidy also stated that *Aspidogaster conchicola*, so common in the pericardium of Anodonta and Unio, he had also found in one instance in the oviduct of *Paludina decisa.*

June 19.

The President, Dr. Ruschenberger, in the chair.

Nineteen members present.

Remarks on the Seventeen-year Locust, the Hessian Fly, and a Chelifer.—Prof. Leidy remarked that he had returned last evening from a short visit to Easton. He stated that the Seventeen-year Locust, *Cicada septendecim*, had made its appearance in the vicinity of that town. He further stated that the wheat in the same locality was seriously affected by the Hessian Fly, *Cecidomyia destructor*, which has now passed into the puparium stage. In one field examined half the crop was destroyed by the insect. He further remarked that his little daughter brought to him an Elater, *Alaus oculatus*, and, on her account professing to attach some interest to a common insect, in examining it with more than usual attention, he was surprised to find concealed beneath the elytra six Chelifers. He was not aware whether the Elater was commonly infested in this manner. In another specimen subsequently found, there were no Chelifers. The Book-scorpion, *C. museorum*, appears not to be common with us, as he rarely met with it. He had occasionally met with another species, perhaps

C. cancroides, attached to the House-fly. The *Chelifer* of the Elater is different from either of those just named, and is perhaps an undescribed species. Its characters are as follows:—

CHELIFER ALIUS.—Body in general chestnut-brown; the pedipalps and the dorsal shield of the cephalothorax being darkest; the abdomen lightest, and in the largest individuals, probably females, whitish with transverse dorsal and ventral bands of brown. Body with the sides nearly parallel, but widening slightly posteriorly; being widest near the termination of the abdomen, except in the largest female, in which it is widest near the middle of the abdomen. Maxillary palps shorter, or not longer than the body; intermediate joints of the same about twice the length of their thickness. Length of body from $1\frac{1}{2}$ to $2\frac{1}{2}$ mm.; length of pedipalps from $1\frac{1}{2}$ to $1\frac{9}{10}$ mm. All parts are hairy, but the abdomen of the largest ones is less so than in the others.

The species bears much resemblance in form and color to the *C. Reussii*, Koch. It also resembles the *C. americanus*, De Geer, but does not possess the knob on the penultimate joint of the pedipalp.

JUNE 26.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

The Birth of a Rhizopod.—Prof. LEIDY remarked that while it was a matter of common observation that the naked Rhizopods, like *Amœba*, and *Actinophrys*, multiply by division, the manner in which the test-bearing forms were produced was not so obvious.

Many instances are recorded in which observers, beginning with Le Clerc, who first described a *Difflugia*, have noticed pairs of individuals attached by the mouths of their tests. In these instances the animals have generally been supposed to be in copulation, or conjugation as it is commonly called, and perhaps such is often the case. It has also been repeatedly noticed in many cases that of the two individuals in conjugation one was somewhat smaller and more delicate, and if it were a colored species, it was paler than the other. Little significance usually has been given to this difference.

Claparede and Lachman (Etudes sur les Infusoires, 1859, 445) have viewed such cases of the supposed conjugation of *Arcella*, as simply the formation of a new test to accommodate the contents of an old one which had become too small.

Bütschli (Archiv f. Mikr. Anat. 1875, 459), after observing the supposed conjugation of *Arcella*, noticed within the test free moving *Amœbæ*. These he supposed were the brood of the former, but after having seen them escape from the test, he failed to trace their further course.

Cienkowski recently (Archiv f. Mikr. Anat. 1876, 41) described the mode of multiplication of *Chlamydophrys stercorea*, in which he observed the animal to protrude from its test a mass of sarcode, which, assuming the size, form, and structure of the parent, became detached from it as an independent individual. He remarks that this procedure for Rhizopods is not new, and has been indicated by Cohn and others, in *Arcellæ*, as copulation.

Prof. Leidy continued: I have repeatedly observed different species of *Difflugia*, *Hyalosphenia*, *Nebela*, *Euglypha*, *Trinema*, *Cyphoderia*, *Arcella*, etc., in what has been supposed to be the condition of conjugation, and have often watched them carefully to learn the results of the process. I have noticed that one individual engaged in the process is often smaller and paler than the other, but frequently also the two were alike in all respects. Between the attached individuals I have observed a fusion of the contents, sometimes a rapid transference of the contents from one to the other test and back again, and at others a sort of circulation or flowing of the contents in a circle from one to the other test. After separation of the tests usually nothing further was observed. In one instance I saw two small Difflugians conjoined with the mouth of a larger, all of the same form; and in another instance I saw three small individuals of *Difflugia spiralis* in the same manner conjoined with one large one of the same species.

I have long sought for the mode of multiplication of the test-covered Rhizopods, but thus far with little success. It appears as if the different forms with which we meet are always mature, and rarely are individuals seen with the ordinary characters which distinguish young from adult animals.

Recently I observed a pair of conjoined individuals of *Euglypha alveolata*, which in their procedure appeared to coincide with the mode of multiplication of *Chlamydophrys stercorea*, as described by Cienkowski. One of the *Euglyphæ* was one-seventh of a millimetre long (0.14 mm. long.; 0.068 mm. in the short diameter), and had four long spines diverging from the fundus of the test. This was replete with the contents, including the usual large nucleus; and it presented no perceptible interval between the mass of sarcode and the interior surface of the test. The sarcode was mingled throughout with particles of food, and also included a large *Navicula*. The food was not collected in balls contained in vacuoles, but was diffused through the sarcode, from the mouth to the fundus of the test, imparting to it a brownish hue. The globular nucleus measured $\frac{1}{25}$th of a millimetre.

Closely adherent to the mouth of the larger or parent *Euglypha* was the smaller or younger one, little more than half the size of the parent (measuring 0.08 mm. long, and 0.06 mm. wide). The young *Euglypha* had the fundus somewhat abruptly narrowed and acute, and had projecting from it the same number of spines as in the parent test. The peculiar structure of the test was apparent, but appeared less extended or unfolded. The contents filled the test, and consisted of clear, colorless, finely granular protoplasm without any mixture of food and without a nucleus.

Such was the appearance of the conjoined *Euglyphæ*, parent and offspring, at the commencement of the observation, at $6\frac{1}{4}$ o'clock in the morning.

Closely watching the pair, the young *Euglypha* was noticed slowly to enlarge, and the brownish matter of the parent sarcode gently flowed into and became gradually diffused with the previously clear, colorless sarcode of the child. The fundus of the latter expanded and became obtusely rounded, like that of the parent. The large nucleus of this disappeared, or became so completely obscured as not to be visible. For some time there was no further very perceptible change within either test.

An hour from the commencement of the observation the young *Euglypha* had nearly acquired the size, shape, and appearance of the parent, and it measured 0.112 mm. long, and 0.064 mm. broad. Now commenced an active circulation, a cyclosis, of the contents of the two tests, resulting in a thorough admixture. The sarcode flowed continuously from the parent on one side through the mouths into the child and back again on the other side. Both tests were replete with one continuous mass of brown, granular sarcode, without nucleus or contractile vesicles, but with the *Navicula*, which remained within the parent. During the circulation of the sarcode, two of the spines, with the circular scale at their base, became detached from the young *Euglypha*. The circulation ceased. At $7\frac{1}{2}$ o'clock I first observed the appearance of a contractile vesicle, 0.016 mm. in diameter, at the fundus of both animals. The vesicle collapsed and reappeared in two, three, or four, each again successively collapsing. With the appearance of the contractile vesicles the contiguous sarcode began to clear up, the brownish matter accumulating in advance of the usual position of the nucleus when present.

At this time the young *Euglypha* measured 0.116 mm. long, and 0.064 mm. broad.

The sarcode of the parent now contracted at the middle, leaving a space between it and the test. The same change occurred in the child. The sarcode of the parent next cleared up in the vicinity of the mouth, then separated from that of the offspring, and retracted a short distance within the mouth.

At 5 minutes to 8 o'clock the two *Euglyphæ* bent slightly from side to side, protruded delicate pseudopods, and in two minutes afterwards were completely separated with their mouths directed downward, and their fundi turned towards my eye.

Half an hour after separation, a pale nucleus had made its appearance in both individuals occupying the usual position, and measuring 0.028 mm. in diameter. Two or more contractile vesicles disappeared and reappeared around the position of the nucleus. While the parent retained the original size, the young *Euglypha* was 0.12 mm. long, by 0.064 mm. broad.

From this observation of the mode of multiplication of *Euglypha*, coupled with that of Cienkowski on the multiplication of *Chlamydophrys*, it may be inferred that all the test-bearing Rhizopods multiply in a similar manner.

The well-fed and replete Rhizopod rapidly protrudes from its test half its sarcode, which assumes the form and constitution of the parent and then separates from it. It is the division of the sarcode mass, as in an *Amœba*, with the development of a new test upon the extruded portion. In forms like *Hyalosphenia*, *Euglypha*, and *Arcella*, the peculiar test is a production from the ectosarc. Without having observed the process, I suspect that the species of *Difflugia* in the act of multiplication protrude their offspring mass of sarcode among particles of sand, which at once adhere and build up the strong wall of their test.

The mode of multiplication of the test-covered Rhizopods reminds one of the mode of production by division of the Desmids, and, in observing the process of production of the *Euglypha*, I was forcibly struck with its resemblance to the mode of production of *Arthrodesmus octocornis*. The production of the young Rhizopod would correspond with the production of a half cell of a Desmid.

The mode of production of Rizopods, as indicated, suggests the probable mode of multiplication of the chambers of the Foraminifera. Masses of sarcode, successively larger and larger, may from time to time be quickly protruded to form the successively larger and larger chambers. The walls of the chambers of the calcareous forms may be developed like the chitinous wall of an *Arcella* upon the protruded mass of sarcode, and the particles of sand of the arenaceous forms may become adherent in the same manner as is suspected to be the case in *Difflugia*.

In this connection it has occurred to me that just as the sarcode mass of a Rhizopod, previous to division, will apparently suddenly grow or expand to nearly double the size, perhaps also in this mode in many tissues of the higher animals we may have a similar procedure in the reproduction of cells. Perhaps in this way the deep cells of the epidermis may give rise to the next series above, or the old ones may be displaced by extension of the protoplasmic mass below.

After observing the birth of a *Euglypha*, I collected material rich in Rhizopods, and spent much time in searching for others in the act of reproduction.

In some water squeezed from sphagnum collected near Swarthmore College, there were abundance of the Difflugian, which I have named *Nebela flabellulum*, with fewer individuals of *Nebela numata*. They were all replete with food, and in most cases the tests so well occupied by the sarcode as to leave no perceptible interval. Incidentally it may be observed that when a Difflugian discharges all its food or the remains of it and is some time deprived of sustenance, the sarcode mass becomes reduced so as to occupy but a small portion of the space within the test to which it is then attached by long threads of the ectosarc. Having observed an individual of *Nebela numata* with a small bulbous mass of sarcode projecting from the mouth, I watched it closely. In the course of one hour and three-quarters the protruded sarcode had gradually enlarged and assumed the form and nearly the size of the test. Half an hour later the sarcodic mass suddenly burst, leaving detached from the *Nebela* test two large and clear globules of protoplasm, and separately the mass of granular matter, remains of the food, that had occupied the entosarc. Later, the two globules of protoplasm appeared shrivelled, and the *Nebela* test contained only some dirt, part of the remains of the food which had occupied the entosarc.

Later, I saw the same process nearly repeated with a *Nebela flabellulum*. This measured a tenth of a millimetre broad, with a fraction less in length, and when first noticed had a mass of protruding protoplasm about one-thirtieth of a millimetre in diameter. Three hours subsequently the latter had separated from the mouth of the test, and had acquired nearly the size and form of the *Nebela*. In this condition it remained another hour, and shortly afterwards appeared shrivelled and dead. The *Nebela* test appeared to be empty of sarcode and contained only dirt, apparently the remains of the food which had occupied the entosarc.

Hertwig and Lesser (Archiv f. Mikr. Anat. 1874, Pl. III., figs. 8 B. C.) represent the same condition in *Lecythium hyalinum* as the result of dissolution.

Bütschli mentions a nearly similar occurrence with an *Arcella*. He says that after the conjugation of a pair, he observed one of the animals with a large portion of the protoplasm protruded. Later, this lay near the *Arcella* as a clear circular plate of the same size, but without mouth or structure. The protoplasm had withdrawn into the test, and, later, both appeared decomposed.

These last cases may have been abortive attempts at reproduction, ending in dissolution.

During the recent observations to detect the mode of multiplication of Rhizopods, I found an *Arcella vulgaris* which contained between the central sarcodic mass and the test four oval bodies. These, at first glance, I thought were young *Arcellæ*, but discovered that they were eggs, and, watching them for several days, they were seen to develop Rotifers. They were prevented from escaping from the test by the sarcode mass of the *Arcella*, and finally all died together.

On the Velocity of Infinite Fall.—Prof. Pliny E. Chase remarked that in his studies of the influence of planetary centres of oscillation, orbital collision, *vis viva*, harmonic nodes, and luminous undulation, his attention had been lately directed to Ennis's views[1] respecting the influence of the velocity of infinite fall. In nebular condensation from r to $\frac{r}{n}$, the increase of radial velocity is $(\sqrt{n}-1)\sqrt{2gr}$; the circular-orbital velocity at $\frac{r}{n}=\sqrt{ngr}$; therefore the increment of radial velocity would be sufficient to produce orbital velocity when $n=\frac{2}{3-\sqrt{8}}=11.656854$.

If M = modulus, or the present light of the sun's homogeneous luminiferous atmosphere, there appears to have been four transformations of uniform into variable velocity, since the nebular rupture of the nearest fixed star, α Centauri. For $\pi^4 M = 214289$, earth's mean distance being taken as the unit. The estimates for the distance of α Centauri, vary between 211400 and 231200. Five rupturing condensations from α Centauri, bring us to earth; and single rupturing falls from Neptune, Uranus, Saturn, and Jupiter, bring us, respectively, to the Asteroids, Mars, Venus, and Mercury. The following table exhibits the accordance between theoretical and observed positions:—

$\pi^4 M \div n^5$	$=.996$	Earth	$=1.000$
Neptune $\div n$	$=2.577$	Astræa	$=2.577$
Uranus s. p.[2] $\div n$	$=1.517$	Mars	$=1.524$
Saturn s. p. $\div n$	$=.749$	Venus a.	$=.749$
Jupiter s. a. $\div n$	$=.473$	Mercury s. a.	$=.477$

Rev. Charles F. Thomas was elected a member.

The following paper was ordered to be published:—

[1] "Origin of the Stars."

[2] s. secular; p. perihelion; a. aphelion.

ADDITIONAL NOTE ON BASSARICYON GABBII.

BY JOEL ASAPH ALLEN.

About a year since, in the Proceedings of the Academy of Natural Sciences of Philadelphia,[1] I described and gave figures of the skull of *Bassaricyon Gabbii*, a new Procyonid, and pointed out its distinctive cranial characteristics. At that time the skin, belonging to the same individual as the skull, had been accidentally mislaid, and could not then be found. Since that time, in re-arranging the collections at the National Museum, it has come to light, and has been kindly forwarded to me for description by Professor Spencer F. Baird. As stated in the original description of the species, the only specimens thus far known to naturalists consists of the skin and skull of a single individual collected in Costa Rica by Mr. William M. Gabb, during his recent survey of that Republic. The skull indicated a form widely distinct, generically, from any other known Procyonid, presenting several features of resemblance to *Bassaris*. In external form, however, it proves to be much like *Nasua*, though very much smaller, and with a quite different pattern of coloration. The skin has been finely mounted by Professor Ward, of Rochester, N.Y., and offers the following characters (Plate 2):—

Nose prodnced, as long or longer than in *Nasua*, and of similar form; ears rather small, rounded, about an inch in length, and about as broad as long; claws large and strong, moderately curved and pointed, gradually tapering to the end, those of the fore-feet nearly an inch in length—much longer and less curved than those of the hind-feet; tail long, the vertebræ alone fully one-half the length of the head and body. General color of the body brownish-black, with the tips of the hairs rusty-yellow, especially over the thoracic portion of the dorsal surface. Nose and chin grayish-white, this color extending back in a narrow streak along each side of the nose to behind the eye, the streaks being separated by a narrow band of black; the gray of the chin also extends posteriorly on either side to beyond the angle of the mouth; a small whitish spot below the eye and another on the

[1] Description of a new generic type (*Bassaricyon*) of *Procyonidæ*, from Costa Rica. Proc. Acad. Nat. Sci. Phila., 1876, pp. 20–23, pl. I.

cheek; also an indistinctly defined area of whitish on the sides of the neck, immediately in front of the shoulder; throat and breast pale yellowish-brown, varying to grayish-brown, much lighter than the general coloration. Ears within and on the edges yellowish-white; externally brownish-black. Tail basally concolor with the back, passing into black at the tip, wholly without lighter rings, or even traces of them; hence the coloration of the tail is entirely different from that met with in *Nasua* and *Procyon*. The pelage is rather full and soft, and brownish beneath the surface. The long hairs are, many of them, faintly tipped with pale rusty; these rusty tips are most numerous over the anterior half of the back, where they are also longer and of a lighter or more golden tint. The ventral surface of the body is scarcely lighter than the back. Size nearly that of *Mustela Pennanti*. Length from the tip of the nose to the eye, 3.07 (inches); to ear, 5.00; to occiput, 5.60; to base of tail, 21.00; tail vertebræ, 11.25; tail to end of hairs, 12.75; fore-foot, 3.00; hind-foot, 3.85.

In general form, especially in the long slender nose, and somewhat in the *pictura* of the face, this species bears considerable resemblance to *Nasua*, much more resembling the species of this genus than those of *Procyon*. The claws, however, are much longer and more attenuated, and the general form of the body is slenderer and the tail longer. In dentition and cranial characters, however, this species differs widely in nearly every detail from any other known form of the family.

The specimen here described and figured is a fully adult (in fact, quite aged, as shown by the skull and dentition) female. Talamanca, Costa Rica (*Gabb*).

JULY 3.

The President, Dr. RUSCHENBERGER, in the chair.

Fifteen members present.

Protovermiculite, a New Mineral Species.—Professor GEO. A. KÖNIG described a micaceous mineral from Magnet Cove, Ark., to which he gave the name Protovermiculite, in preference to that of Hydrophilite, a name already existing in the list of mineralogic synonyms. The mineral occurs in large foliated plates, loose in the soil, and also in smaller prismatic crystals, with Appatite in the black garnet, of the same locality. The structure is strongly micaceous, the habitus hexagonal; but optically biaxial, and hence, as all biaxial micas, probably *monosymetric*. The angle of the optical axis is very small, the hyperbolas touching each other. Thin laminæ are slightly flexible, though without elasticity. Cleavage is less marked than in micas generally. The color is grayish-green in the interior of the plates, yellowish-silvery to bronze color on the outside. Thin laminæ transmit brownish-green light. Hardness a little below 2. Lustre submetallic, and touch somewhat unctuous. Spec. gr. = 2.269. Before the blow-pipe it exfoliates slightly, and fuses at 4 to a black glass. Yields much water in the closed tube. No characteristic reactions with the fluxes. Strong sulphuric acid attacks the powdered mineral vehemently, causing complete decomposition, while flocculent silica separates; hydrochloric acid also effects decomposition. The finely pulverized mineral, placed in an air-tight space over oil of vitriol, loses 20.3 per cent. of water in 24 hours, when the weight remains constant; the water is reabsorbed in less than one hour in contact with the atmosphere. A larger quantity of water is not absorbed, even when placed in a saturated atmosphere. There seems to be a ground for this behavior, although hidden at present. Why are other micaceous minerals, much more cleavable than the vermiculites, and furnished with more capillary spaces, not at all hygroscopic? It may be supposed that a force of attraction other than a mere physical or rather mechanical one must exist in the latter. However, the author is in accord with Prof. J. P. Cooke, Jr.'s, views regarding the cause of exfoliation in vermiculite minerals and crystals of artificial compounds. (*Am. Acad., Boston*, 1874.) Prof. Cooke attributes exfoliation to the escape of the water of crystallization causing the structure of a mineral to break up. Some substances loose their water of crystallization without forcible means, over sulphuric acid, for instance, and their structure is not broken up; yet they do not reabsorb the lost water. Sodium carbonate and the sulphates $RSO_4 + 12$ aq may be cited in this connection. Evidently there is here a broad field for study of the underlying laws. Still Prof. Cooke's hypothesis is accepted for the present, as far as it regards the vermiculites. The present case of Protovermiculite gives it support. Here are two micas, presenting, as will be shown further on, an identical composition, qualitatively and quantitatively, having nearly equal quantities of water. Exposed to strong heat the one increases its volume tenfold by exfoliation, the other hardly doubles it. But when it is found that the former retains over oil of vitriol 11 per cent. of water, whilst the latter only retains 3.36 per cent. under the same conditions, their differing behavior may be accounted for to a certain extent, on the assumption that this water is essential to the structure; the remaining water being accidental moisture.

Composition of the Protovermiculite was found to be in several analyses (the greenish part differs from the silver-white or bronze only by a few tenths of per cent. of ferrous oxide):—

		Oxygen.			Atomic quotients.	
SiO_2	= 33.28	17.738	Si	= 15.55	0.555	
Al_2O_3	= 14 88	6.934	Al	= 7.95	0.145	0.184
Fe_2O_3	= 6.36	1.908	Fe	= 4.45	0.039	
FeO	= 0.57	0.125	Fe	= 0.45		
MgO	= 21.52	8.510	Mg	= 13.01	6.550	
H_2O (of crystall.)	= 3.36				0.181	
H_2O (hygroscop.)	= 20.54					
MnO	= trace.					
TiO_2	= trace.					
	100.51					

Dividing with 0.184 (Al + Fe) into the other atomic quotients, the ratio is obtained:—

$$Si : Al : Mg : O : H_2O = 3.01 : 1.00 : 2.989 : 11.918 : 0.983$$

corresponding absolutely with the symbol—

$$\overset{I}{R}_3 \overset{VI}{R} \overset{IV}{Si}_3 \overset{I}{O}_{12} + H_2O.$$

The mica from Culsagee, North Carolina, described by Prof. Cooke (*loco cit.*), as *Culsageeite*, is composed as follows, according to closely agreeing analyses by himself, Dr. Thos. M. Chatard and the author (F. A. Genth, Corundum, *Proc. Am. Philos. Soc. of Philadelphia*, 1873), and after deducting the water lost over sulphuric acid:—

Culsageeite (Cooke).		Protovermiculite (Köuig) after treatment over SO_4H_2.
SiO_2	= 37.58	41.62
Al_2O_3	= 19.73	18.60
F_2O_3	= 5.95	7.25
FeO	= 0.58	0.71
MgO	= 25.13	26.90
H_2O	= 11.09	4.20

The ratio of Culsageeite corresponds closely to the symbol—

R_3 Ɍ $Si_3\,O_{12} + 3H_2O$.

It might seem that a difference of two molecules of water were not sufficient basis for a separation into two species. Yet when the important rôle which this water plays in the process of exfoliation is considered, and that Culsageeite exfoliates about ten times stronger than Protovermiculite, with an otherwise identical composition, the author is of opinion that strict science requires a separation. The name was chosen to indicate the imperfect vermiculation as compared with the other members of this group.

On the atomic ratio of Jefferisite, this most characteristic vermiculating mineral, there existed some uncertainty in the mind of the author, since the analyses made by Prof. Brush, Dr. Chatard, and himself do not quite agree, and yield atomic quotients quite unsatisfactory. In connection with the above investigation it was thought important to analyze the West Chester mineral once more, with the greatest care possible. 0.5 gr. of the finely pulverized mineral was placed in an air-tight bell-jar over sulphuric acid. In two days it lost 0.054 gr. or 10.8 per cent. It was kept for eight days longer, and weighed every second day, the weight remained absolutely constant. The same substance was then allowed to reabsorb the hygroscopic water by exposure to the air, and afterwards placed in an air-bath at a temperature of 106 C° for 18 hours, when it only lost 8.6 per cent.

The air-dry substance gave—

SiO_2	= 33.03	Si	= 0.555	
Al_2O_3	= 17.38	Ⱥl	= 0.1690	0.2153
Fe_2O_3	= 7.41	Ꞙe	= 0.0463	
FeO	= 1.44	Fe	= 0.0210	0.5252
MgO	= 20.16	Mg	= 0.5042	
H_2O	= 20.90	H_2O	= 0.561 (dried over SO_4H_2)	
		H_2O	= 0.683 (dried at 106 C.°)	
	100.59			

Dividing by 0.2153 (Ⱥl + Ꞙe) we obtain—

Si : Ɍ : R : H_2O = 2.58 : 1.00 : 2.44 : 2.91 : (3.17)
= 5.16 : 2.00 : 4.88 : 5.82 : (6.34).

(1) Brush's analysis (*Am. Journ. Sci.*, 1861); (2) Dr. Thos. M. Chatard's analysis (*Genth on Corundum l. c. supra*); and (3) the author's (*ibidem*) give the following ratios:—

	Si : Ɍ : R
Brush	5.228 : 2 : 4.416
Chatard	5.412 : 2 : 4.928
König, 1st	5.054 : 2 : 4.736
" 2d	5.16 : 2 : 4.88

Prof. J. P. Cooke deduced from the first ratio the formula R_4 $Ɍ_2$ $Si_5\,O_{20}$, omitting the nearly half atom of R in excess of 4. This makes the mineral a true orthosilicate, and is quite satisfactory. But does the analytical result justify such a course? Only on the supposition that the analyzed material was heterogeneous. On the other hand, the two analyses by the author, made five years apart, and on quite different material, agreeing so well among themselves, point very strongly to the fact that instead of omitting the half atom, it has to be increased to a whole atom, and the formula of Jefferisite is therefore to be written—

$$R_5 \, \bar{R}_2 \, Si_5 \, O_{21} + 6H_2O \text{ (König)},$$

instead of—

$$R_4 \, \bar{R}_2 \, Si_5 \, O_{20} + 6H_2O \text{ (Cooke)}.$$

By doubling the molecules of Culsageeite and Protovermiculite their close affinity to Jefferisite is still more perceptible:—

Jefferisite	$R_5 \, \bar{R}_2 \, Si_5 \, O_{21} + 6H_2O$
Culsageeite	$R_6 \, \bar{R}_2 \, Si_6 \, O_{24} + 6H_2O$
Protovermiculite	$R_6 \, \bar{R}_2 \, Si_6 \, O_{24} + 2H_2O$.

Jefferisite and Culsageeite exfoliate with equal energy; the author is inclined to write the formulas of the three species in the above manner as a consequence, on mechanical principles.

July 10.

The President, Dr. Ruschenberger, in the chair.

Twenty-four members present.

The death of David S. Brown was announced.

July 17.

The President, Dr. Ruschenberger, in the chair.

Thirteen members present.

The resignation of Dr. Henry H. Smith, as a member, was read and accepted.

July 24.

The President, Dr. Ruschenberger, in the chair.

Nine members present.

Note on Color Variation in Mammals.—Mr. J. A. Ryder called attention to the fact that many animals, when long domesticated, as the horse, ox, dog, and cat, were frequently asymmetrically colored. Horses were often seen with one white foot, or in extreme cases with three, while the white color sometimes extended further up the limb upon one side than upon the other. He had frequently noticed the same sort of irregularity in the coloration of cattle. It was also noticeable in a very marked degree in rabbits and guinea-pigs, and he had recently seen some goats that were exceedingly asymmetrical in the disposition of color areas.

In studying color variation among feral animals he had noticed that such variations, so far as his observations had extended, were invariably symmetrical. In the case of a raccoon, in the collection of the Zoological Society of Philadelphia, where the variation from the typical coloration of the species was great, the color areas were disposed symmetrically in the same manner as in the ordinary specimens that were its companions in the same cage. The difference was only in the shade, this specimen being a rich brownish-yellow, except the annuli around the tail and the lateral bands on the face, which were of a considerably deeper hue. The nose, feet, and eyes in the ordinary specimens are black; in this specimen all the dermal structures had assumed a much lighter tint, nearly a flesh color. The iris has assumed a remarkably different tint from the jet black of the others, and it is a good illustration of the correlation in coloration of the pelt and eyes, without at the same time having reached total albinism. In a specimen of *Lepus sylvaticus* in the Academy's collection, said to be from New Jersey, the fur is cream colored, and very long and soft, but perfectly symmetrical and uniform in color, and in a specimen marked *L. audubonii*, from California, there is a symmetrically disposed median white band running from the parietal region to the muzzle. In rats, nearly white, the color areas were also found to be very nearly the same on both sides, and in two specimens of *Arvicola*, one with a white head was found to be colored symmetrically, and the other with white head and shoulders and white patches on the flanks and outer sides of thighs was also colored symmetrically. In specimens of Virginia deer in the collection of the Academy, where white and the usual color were separate, the same symmetry was noted as in the other feral specimens mentioned above.

In many domestic animals there is a most decided tendency to preserve, more or less, the symmetry of coloration of the ancestral type, but domestication seems to be at the bottom of the great variability and asymmetry of color of animals brought under its influence. The camel, however, seems to be an exception.

The following summary of the foregoing facts was offered:—

1. That bilateral symmetry of coloration is interfered with in some way by domestication.

2. That where variation in color takes place in feral animals, they are invariably, so far as observed, symmetrically colored.

3. That it is possible that the degree of asymmetry is an indication of the length of time that domestication has been operative.

July 31.

The President, Dr. Ruschenberger, in the chair.

Seventeen members present.

Poisonous Properties of the Leguminosæ.—Dr. Rothrock remarked that hitherto we had by common consent regarded the plants of the order Leguminosæ as, on the whole, rather innocuous. During the past few years a number of its representatives have been attracting attention on account of their supposed agency in poisoning cattle and horses in our southwestern territories. It is true that none of these save the *Sophora*, to be mentioned last, have been subjected to a severe scientific test by physiological experiments; still the main facts alleged are doubtless to be depended upon.

The veteran botanist of the Pacific Coast, Dr. A. Kellogg, has a short article on the subject in the *Proceedings of the California Academy*, vol. vi. p. 3, which goes over most of the ground. It is then only to give an increased circulation to the facts that he alluded to them here.

In southern Colorado, especially about Fort Garland, the offending plant is *Oxytropis Lamberti*, a most variable species. At first, from some of the symptoms, it was supposed that it was due to something like *Aconitum*, but as the region was out of the range of any considerable quantity of *A. nasutum*, the only species likely to be found near, and as we had no definite observations on its action, attention was directed elsewhere, and the *Oxytropis* pretty clearly fixed as the plant. The effect of this appears to be long enduring; the animal becoming demented, and wasting away as his fondness for the poison increases to something like the opium habit in man. Dr. Kellogg contrasts this with the temporary effects (intoxication and stupefaction) of a southern species of *Tephrosia*. During Dr. Rothrock's stay at New Camp Grant, in Arizona, in 1874, it was alleged that *Hosackia Purshiana* was producing like effects on the horses.

In California Dr. Kellogg regards the noxious plant there as *Astragalus Menziesii*, Gray. And it is also asserted that *Astragalus Hornii*, Gray, and *Astragalus lentiginosus*, Dougl., are in the same list in California.

The general name for the disease in the animals is "Loco." Among the inhabitants of the southwest it simply refers to their becoming foolish. As yet we cannot say on what active principle the effects depend; neither do we know whether it is dissipated in drying. It would be well if exact experiments in this direction could be instituted. The boundary lines between a poison and a remedy are rather those of degree than of kind, and it is not improbable that in these very plants our physicians may find a means of "counteracting some tendency to death."

Regarding *Sophora speciosa*, Benth., from Texas, our knowledge is now well grounded, thanks to Prof. H. C. Wood, Jr., M.D. He has succeeded in obtaining an alkaloid, which he names *Sophoria* from the bean. Its effects are not unlike those of Calabar bean. For a full account of this see *Philadelphia Medical Times*, August 4, 1877. The Indians of Texas use the bean to produce an intoxication which lasts from two to three days. Half a bean, it is said, will induce intoxication, and a whole one may lead to dangerous symptoms.

Julia A. H. Walker was elected a member.

AUGUST 7.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

AUGUST 14.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

A paper entitled "On Lagochila, a new genus of Catostomoid Fishes," by David S. Jordan and A. W. Brayton, was presented for publication.

The deaths of Dwight D. Willard and Timothy A. Conrad were announced.

Influence of Magnetism on Living Organisms.—A letter from Dr. JOHN VANSANT, dated New Orleans, December 14, 1876, was read, stating substantially that he had killed a spider by exposing it to the influence of a magnetic current.

The animal had its vitality destroyed by the magnetism emanating from a small steel magnet of the U shape, commonly sold in the shops. The legs of the magnet were about two and a half inches long by a half inch wide, and one-sixth of an inch thick, the distance between the poles being about one quarter of an inch.

He noticed a small spider actively running along the arm of his chair. He brushed it off carefully with his finger and it fell upon the carpet. It began to run but was somewhat impeded by the roughness of the carpet. Having removed the armature he slid the magnet along the carpet following after the spider until it was between the poles. The animal almost instantly stopped and in a few seconds seemed to be motionless; but at the end of two or three minutes it began slowly to move its legs and elevate and depress its head, thus touching and separating itself from one or the other of the poles, but without going from between them. He did not touch it. At the end of five minutes the spider was quite still. After a lapse of ten minutes he covered both spider and magnet with a large tumbler. At the expiration of two hours he removed the glass and observed the spider with a magnifying lens. It was apparently dead. It was not touched during this inspection. It was left in position some twelve hours longer.

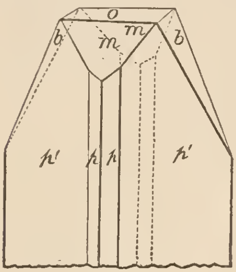
Dr. Vansant states that he has killed spiders and other small animals, as worms and insects, as well as some plants, by magnetism at different times during the past eight years, but never before succeeded in destroying the life of a spider so quickly and without touching it frequently, though lightly, with the magnet he used. In the opinion of Dr. Vansant this experiment demonstrates that *magnetism affects the functions of living beings.*

Mineralogical Notes.—Professor Geo. Aug. König presented the result of an examination of silver ore from "Silver Islet," Lake Superior. In a gangue of Calcite and some quartz one observes Galenite, Sphalerite, native silver, and spots of a pinchbeck colored mineral, possessing metallic lustre were observed. A picking by hand of the latter was not possible, owing to the smallness of the grains. By placing the material in dilute hydrochloric acid, the metallic minerals were left as a spongy mass, including the quartz grains; Sphalerite could be eliminated by sorting. The mixture was then analyzed with the following result:—

Ag	=	32.68
Pb S	=	38.18
(Ni, Co)	=	8.96
Fe	=	0.35
S	=	1.81
As	=	10.56
Sb	=	trace.
Quartz	=	6.00
Calcite	=	1.20
		99.74

The mineral mixture was completely decomposed by nitric acid. Nickel and arsenic are in the ratio = 2.15 : 1 equal to "Niccolite." The latter mineral is strongly cobaltiferous. The sulphur must be considered to be combined with silver as Argentite. When particles of the mixture, showing no Niccolite under the lens, after having been flattened out and rubbed in the mortar, were then dissolved in nitric acid, silver removed by hydrochloric acid, the filtrate gave invariably the arsenic reaction. It is highly probable that a very basic silver arsenid is present in the ore. The speaker, not being aware of any identification of Niccolite from Silver Islet, deemed it expedient to make this communication.

On Strengite from Rockbridge Co., Va.—Prof. Geo. Augustus König described a mineral which he discovered in cavities in Dufrenite. The surface of these cavities is coated with a green spheroidal and radially laminated substance, greenish-yellow, and somewhat silky on the fracture, which the speaker considered to be Cacoxenite. On this latter substance clusters of beautiful, though small, crystals are seen. They present short prismatic forms; their color varies from light pink to deep carmine red, even towards amethystine shades; their lustre is vivid and vitreous, and their hardness slightly below 4. They are transparent. A magnifying power of 2 diameters is required for a proper analysis of the symmetry of the crystals, when they disclose the shape shown in the figure. The prisms are invariably terminated by a rectangular face (often perfectly square) which possesses adamantine lustre (*o*), and by two domes (*b*, *b*) (*m*, *m*). The *m* faces are smooth and brilliant, the *b* faces are striated. There are two prisms, and the prismatic faces (p') appear striated, but not so strongly as the *b* faces. Pyramidal faces appear on some of the crystals, but only on one side, whilst opposite only the domatic face *m* is visible. The face *o* in this case presents a pentagonal shape. None of the crystals possessing this curious hemimorphism was of measurable size. The goniometer used is one with two telescopes, but the light was so feebly reflected from the minute faces that no image could be obtained with the eye-piece, which, therefore, was removed, and the light reflected into the eye directly.



A number of observations were made for every angle and the mean taken, but this method was necessarily uncertain and ineffective.

Angles measured.

$p \wedge p$	=	122° 20′
$p' \wedge p'$	=	117° 25′
$m \wedge p$	=	139° 35′
$o \wedge p'$	=	90° 20′ (first crystal.)
$o \wedge p$	=	90° 5′ (second crystal.)
$b \wedge b$	=	51°
$m \wedge m$	=	64°
$b \wedge o$	=	115° 20′
$m \wedge o$	=	122°

The symmetry of the mineral is plainly orthorhombic, although the angle $o \wedge p$ was not found exactly 90° by direct measurement; because the prismatic face is not even, but striated. The macrodomatic angle $m \wedge m = 64°$ and $o \wedge m = 122°$, we deduce—

$$(180° - 122°) = 58°, \frac{m \wedge m}{2} = 32°$$

$$58° + 32° = 90°.$$

That is, the basal plane *o* is exactly at right angles with the main axis.

A ground form and its parameters could not be established as no pyramidal faces were observed on any of the measurable crystals.

For the projection of the crystal one has—

Macrodome	tg. 58° = 1.603
Brachydome	tg. 64° 40′ = 2.112
Prism p′	tg. 61° 10′ = 1.816
Prism p	tg. 58° 42′ = 1.644

Blowpipe Characters.—In the closed tube the color of the mineral turns to golden yellow, has a tendency to decripitate, and yields water. Treated in the forceps with the oxydizing flame, the mineral is hardly affected, except the change of color, while the flame colors bluish-green (phosphoric acid). In the point of the reducing flame the mineral fuses at 4 to a black non-magnetic glass. With the fluxes it gives only iron reaction.

For analysis only 30.7 mgr. could be collected. After ignition the reddish-brown powder was soluble in strong nitric acid. Phosphoric acid was precipitated by molybdic solution, and in the filtrate the ferric iron by ammonium hydrate. The author obtained water = 6.1 mgr., $Mg_2P_2O_7$ = 19.8 mgr. (P_2O_5 = 12 mgr.), Fe_2O = 13.0 mgr., or in per cent.—

$$H_2O = 19.87 : 18 = 1.104 = 4.16$$
$$P_2O_5 = 39.30 : 142 = 0.277 = 1.045$$
$$Fe_2O_3 = 42.3 : 160 = 0.265 = 1.000$$

101.47

The mineral is, therefore, $Fe_2P_2O_8 + 4H_2O$, and is identical with "Strengite," described by A. Niess (Neues Jahrbüch f. Min. 1877, p. 8). According to Niess, Strengite occurs at the Dunsberg Limonite mine, near Giessen in mamillary, botryoidal aggregations with radially fibrous structure and drusy surfaces, rarely in single crystals, possessing strong vitreous lustre, transparency, and red color in all shades, especially peach blossom and carmine tints, sometimes nearly colorless. The crystals present a tabular form which is produced by the predominance of the macropinakoid. Niess has only observed the prism, the pyramid, and the macropinakoid, with indications of a macrodome. Hence the type of Strengite from the only localities now known—Giessen, Hessen, and Rockbridge Co., Va.—is remarkably differing. The basal plane and the domes, so characteristic at the latter place, are quite wanting at the former. But of the identity of the mineral there is hardly any doubt possible. The Rockbridge variety is only observed in crystals.

Since presenting the first description to the Academy the speaker examined a specimen on which there was one crystal corresponding to the Skorodite type of the Giessen variety.

AUGUST 21.

The President, Dr. RUSCHENBERGER, in the chair.

Eighteen members present.

The Lacquer Tree.—Professor THOMAS MEEHAN remarked that he had had an extract from the *Public Ledger* sent to him, as State Botanist, with the request that he would give any information in his power as to the chances of the tree thriving in this State. He said:—

"The Lacquer plant, *Rhus vernicifera*, is so much like our common poison ash, *R. venenata*, and Japan trees generally do so very well in this latitude, that there is no room to doubt that the tree would thrive. But it is not worth while to introduce the plant, as our own poison ash has the same properties in every respect. The 'Lacquer' is the juice of the tree. It is at first whitish, but becomes black when exposed to the air. It is mixed with a small portion of oil derived from a kind of Trumpet vine, and the exact portion of oil, or the way of mixing it, is supposed to be a secret possessed only by those 'in the trade' in Japan. The 'Lacquer work' itself is made simply by putting very fine powdered charcoal on the wood before applying the prepared resin. Crude gum which I have seen from this Japan poison ash is so exactly like that which I have taken from our own poison ash, that I have little hesitation in saying that any one wishing to try the experiment, would do just as well with the product of our own swamps as with imported trees from Japan.

"It is well, however, to remember that both of these—our own and the Japan trees—are excessively poisonous, much more so than our common poison vine. It is very friendly with me, as almost all these noxious plants are; but I have known many persons very badly served even by passing where the trees were."

AUGUST 28.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

B. F. Lautenbach, M.D., and Frank Woodbury, M.D., were elected members.

Prof. Wm. A. Buckhout, of Centre Co., Pa., was elected a correspondent.

The following paper was ordered to be printed:—

ON LAGOCHILA, A NEW GENUS OF CATOSTOMOID FISHES.

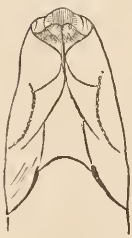
BY DAVID S. JORDAN AND A. W. BRAYTON.

During a recent collecting tour in the Southern States the writers secured in the Chickamauga River, near Ringgold, Catoosa County, Georgia, a species of Sucker, new to science, which is believed to represent a new generic type. This genus, for which we suggest the name *Lagochila* (*lagocheilos*, having a hare-lip, in allusion to the peculiar mouth, and to the vernacular name of Hare-lip Sucker), bears somewhat the same relation to *Myxostoma*, and the other typical *Catostominæ*, that the genus *Exoglossum* bears to the typical *Leuciscinæ*.

Lagochila lacera, Jordan and Brayton, gen. and sp. nov.

Generic Characters.—Similar to *Myxostoma* (*Ptychostomus*, Agassiz) except in the structure of the mouth parts. Dorsal fin short; lateral line well developed; scales large, subequal; air-bladder in three parts; fontanelle between parietal bones well developed, pharyngeal bones weak, with numerous small teeth; upper lip not all protractile, greatly enlarged, finely plicate; lower lip longitudinally enlarged, but attenuated, and singular in form. It consists of two elongated and narrow lobes, separated by a narrow deep fissure, which extends inward to the edge of the mandible proper, which seems to be armed with a rather hard or almost horny plate, about as in the genus *Pantosteus*. The two lobes of the lip are weakly papillose. The lower lip is entirely separated from the upper at the angles by a deep fissure. Over this fissure the skin of the cheeks lies as a sort of cloak; the crease separating this skin from the mouth, extending up on the sides of the muzzle. The fissure between the lips extends down on the skin of the under side of the head. The opercle is extremely short, and the eye is entirely in the posterior part of the head.

Fig. 1.



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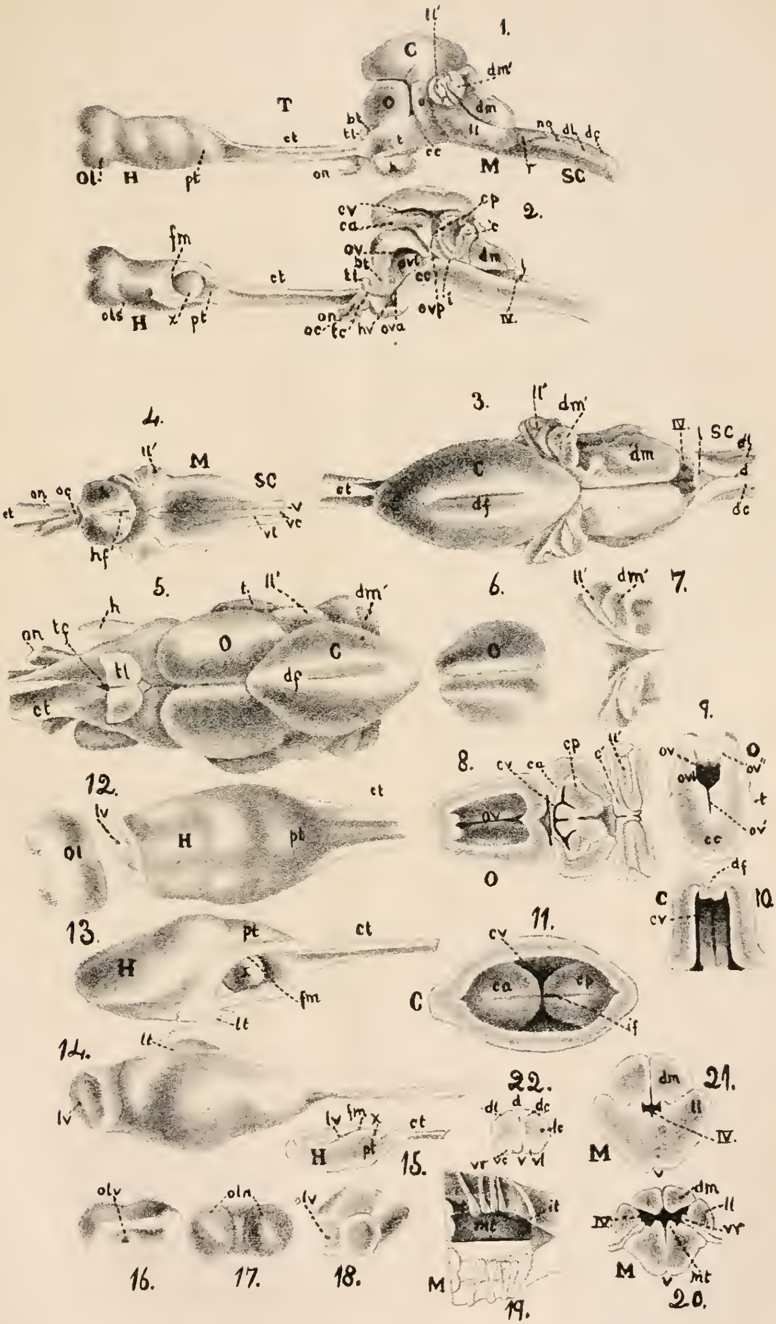
1. View from below. 2. Front view of mouth (natural size).

Specific Characters.—Head rather short—$4\frac{2}{3}$ in length, conical, with lengthened snout, the region between the eyes flattened and



Wilder on Brain of Chimæra.

Robt. Ridgway, del.

Bassaricyon Gabbii, Allen.

provided with prominent mucous ridges; cheeks and lower part of the head rather swollen; greatest length of opercle not more than that of eye. Eye medium, contained twice in snout, $4\frac{1}{3}$ in length of side of head.

Body rather elongate, not much elevated or compressed, the form being intermediate between that of *Myxostoma cervina* and that of *M. duquesnii*. Position and form of fins as usual in the genus *Myxostoma*, the dorsal rather short and not especially elevated, its free border rather more concave than usual.

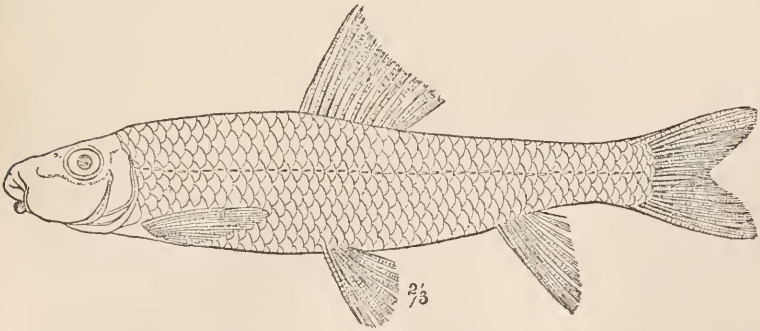
Fin rays: D. I. 12, A. I. 7, V. 9. Scales rather large, but little crowded forwards, 5–45–5. Lateral line very distinct, nearly straight.

Color somewhat olivaceous above, sides and belly more silvery; lower fins faintly orange.

Length of types respectively 10 and 4 and 3 inches.

Hab. Streams tributary to the southern bend of Tennessee River, in the States of Georgia, Tennessee, and Alabama. Fishermen tell us that this is the commonest and most valued species of sucker found in that region, and that it is everywhere known by the name of "Hare-lip Sucker," and sometimes of "Split-

Fig. 2.



mouth" or "Split-lip Sucker." It frequents rather deep waters, and is often taken with the hook. We obtained but two specimens in the Chickamauga, and one in Elk River at Estill Springs, in Tennessee. A minute examination of the bones of the head and jaws is desirable, but we have thought it best to defer it until more specimens are obtained, not wishing to mutilate the original types.

The drawings accompanying this paper were made from the larger of the type specimens.

The genera of *Catostomidæ* may be thus compared :—

* Body oblong or elongate, with a short, subquadrate dorsal fin of 10 to 17 developed rays.

† Mouth singular; the upper lip not protractile, greatly enlarged; the lower lip developed as two separate lobes; the lower jaw provided with a sheath (*Lagochilinæ*).

a. Air bladder in three parts; scales large. subequal; pharyngeal bones and teeth ordinary; fontanelle well-developed; lateral line present. LAGOCHILA, 1.

†† Mouth normal, the lower lip undivided, either tuberculate or plicate (*Catostominæ*).

b. Air bladder in three parts; lateral line present; fontanelle present; scales large, subequal.

c. Pharyngeal bones very broad and strong; the lower 7 to 10 teeth on each side, greatly enlarged and truncate; the teeth on the upper part of the bone small, as usual in the family. PLACOPHARYNX, 2.

cc. Pharyngeal bones not especially enlarged; the teeth of the usual type. MYXOSTOMA, 3.

bb. Air bladder in two parts.

d. No lateral line; fontanelle present; lips plicate; no mandibulary sheath; scales large. ERIMYZON, 4.

dd. Lateral line well developed; lips tuberculate.

e. Fontanelle distinct; no mandibulary sheath.

f. Scales moderate, not crowded forwards, about equal over the body; body long and little compressed; head long and flattened, transversely concave between orbits; the physiognomy being therefore peculiar. HYPENTELIUM, 5.

ff. Scales small; smaller anteriorly and much crowded; head transversely convex between orbits. CATOSTOMUS, 6.

ee. Fontanelle obliterated by the union of the parietal bones; mandible with a cartilaginous sheath; scales small. PANTOSTEUS, 7.

* Body much elongated, subcylindrical forwards; dorsal elongate, falciform, of 30 or more rays; fontanelle obliterated by the union of the parietal bones (*Cycleptinæ*).

g. Mouth small, subinferior, with papillose lips; scales rather small. CYCLEPTUS, 8.

*** Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present (*Bubalichthyinæ*).

h. Dorsal rays about 30 in number (24 to 33); anal rays about ten (9 to 12); scales large.

i. Pharyngeal bones narrow, with the teeth relatively thin and weak.

j. Mouth small, inferior, protractile downwards; dorsal fin often greatly elevated.

CARPIODES, 9.

jj. Mouth larger, subterminal, protractile forwards (species of larger size, dusky colors, with lower dorsal). ICHTHYOBUS, 10.

ii. Pharyngeal bones strong; the teeth comparatively coarse and large, increasing in size downwards; dorsal fin moderately elevated; mouth inferior.

BUBALICHTHYS, 11.

hh. Dorsal fin with about 50 rays; anal 13; scales moderate; teeth as in *Bubalichthys* (?) (Asiatic species). MYXOCYPRINUS, 12.

September 4.

The President, Dr. Ruschenberger, in the chair.

Fifteen members present.

On the Bed-bug and its Allies.—Prof. Leidy remarked that it was commonly supposed that the swallow, pigeon, and bat were infested with the bed-bug, and that those animals introduced the insect into houses. Packard (Guide to Study of Insects, 551) observes that the bed-bug "lives as a parasite on the domestic birds;" and adds that a gentleman informed him "that he has found a nest of swallows on a court-house in Iowa swarming with bed-bugs." Westwood (Introd. ii. 475, note,) says it is certain that bed-bugs "swarm in the American timber employed in the construction of new houses." "In the western part of our country," continued Prof. L., "I frequently heard that bed-bugs were to be found at any time beneath the bark of the cottonwood and the pine. In these positions I never found one, nor have I ever found the insect except in the too familiar proximity of man. Recently, when in the West, while watching some cliff swallows passing in and out of their retort-shaped mud nests, built under the eaves of a house, I was told that these nests swarmed with bed-bugs, and that usually people would not allow the birds to build in such places, because they introduced bed-bugs into the houses. Having collected a number of the bugs, as well as others from the interior of the house, specimens of both of which are submitted to the examination of the members, I found that while the latter are true bed-bugs, *Cimex lectularius*, the former are of a different species, the *C. hirundinis*. The bugs infesting the bat and pigeon have likewise been recognized as a peculiar species, with the name of *C. pipistrelli*, and *C. columbarius*." Prof. L. further noticed that the habit of the *C. hirundinis* was similar to that of *C. lectularius* in the circumstance that the bugs during the daytime would secrete themselves in crevices of the boards away from the nests. After sunset he had observed the bugs leave their hiding-places and make their way to the nests. From these observations it would appear as if the peculiar bugs of the animals mentioned did not reciprocally infest their hosts.

On the Growth of Cocculus Indicus.—Mr. Ryder remarked that the termini of the branches of *Cocculus indicus*, as observed in the Horticultural Hall in Fairmount Park, were coiled to the left about objects that came within reach. These terminal coils, which simulated tendrils in form, would, if straightened out, measure 6 to 8 inches in length. The buds upon them appeared to be aborted or rudimentary, and as soon as the coil was securely wound round its object of support, growth in a longitudinal direction in the branch in question seemed to cease; but below the proximal part of the coil, or that nearest the root, one of the fully developed buds would break and continue the ascending axis, which, when it had attained a length of 1 or 2 feet, would coil its terminus, and stop growing lengthwise as the branch had done from which it grew. This process seemed to be repeated indefinitely. The plant might be called a terminal twiner. Other menispermaceous plants seemed to have a similar tendency, though not so marked, and some were not very different in habit from ordinary twiners, as, for example, *Menispermum canadensis.*

SEPTEMBER 11.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

A paper entitled "On a New Species of Helix from Texas," by Wm. G. Mazyck, was presented for publication.

SEPTEMBER 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

The death of H. E. Van Rijgersma, a Correspondent of the Academy, was announced.

On the Distribution of Plants.—ISAAC C. MARTINDALE exhibited specimens of *Phallus*, and stated that he had noticed its reappearance in the yard attached to his dwelling for four years. Its development was very rapid; at the time it was first noticed this year it presented the appearance of a hen's egg with about one-third of the surface protruding from the ground; within twenty-four hours it had more than doubled in size, and showed some signs of an opening at the upper end; about six hours later the stipe had forced its way out to the extent of nearly six inches. Although so offensive in odor, it attracted large numbers of flies, from twenty to thirty being on it at one time. He stated, as a singular fact, that this species reappeared year after year in a space not more than three feet in diameter; and although plants of this class produce an immense amount of spores, not more than four specimens of this species had been noticed near the locality on any occasion.

In connection with the subject, Mr. Martindale further stated that probably no class of plants have a greater amount of pollen in proportion to the number of seeds produced than the Pines. He had recently detected one tree of *Pinus mitis*, near Camden, which species he believed was gradually disappearing from this section of the country; there were but three cones on the tree, which was a large one, and evidently on the decline.

AUBREY H. SMITH spoke of the disappearance of the Red Oak, *Quercus rubra*, from a locality in western Pennsylvania, about one hundred miles from Lake Erie, that had been visited by him during the past summer. He was informed that it had been quite abundant there thirty or forty years ago; indeed large numbers of fallen and partly decayed trees were still to be seen through the woods.

Mr. MARTINDALE also stated that while a number of plants that were now common in the Southern States bordering on the Atlantic coast, and of frequent occurrence in this latitude and further north a few years ago, were gradually disappearing from their northern localities, other species, heretofore regarded exclusively as southern, were extending their range to the northward. He had recently collected *Pluchea bifrons* near Cape May, New Jersey, a species which had not heretofore been detected in that State.

SEPTEMBER 25.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The death of John Milton Earle, a Correspondent of the Academy, was announced.

A. J. Drexel, Alexis T. Cope, Miss Clementine Cope, and Miss C. E. Cope were elected members.

The following were elected Correspondents:—

Clarence King, of Washington, Daniel C. Eaton, of New Haven, Count A. G. Marschall, of Vienna, Edward Von Mojsisovics, of Vienna, Dionys Stur, of Vienna, Franz Toula, of Vienna, A. Bastian, of Vienna, J. G. Rein, of Frankfurt on the Main, C. Arendts, of Munich, Spiridione Brusina, of Agram, Jos. Szabo, of Buda Pest, C. Stahl, of Stockholm, Philippe de la Harpe, of Lausanne, Elisée F. Reclus, of Paris, Émile Cartailhac, of Toulouse, Ernest Chantre, of Lyon, J. J. Collenot, of Sémur, Henri Coquand, of Marseilles, Jules Gosselet, of Lille, Edmund Hébert, of Paris, Wm. Boyd Dawkins, of Manchester, Peter Martin Duncan, of London, A. H. Green, of Leeds, J. W. Judd, of London, John Morris, of London, Andrew Murray, of London, Wm. Whitaker, of London, and H. B. Medlicott, of Calcutta.

October 2.

The President, Dr. Ruschenberger, in the chair.

Thirty-two members present.

The death of Dr. Edw. Roemer, correspondent, was announced.

Sensitive Stamens in Purslane.—Mr. Thomas Meehan said the stamens of *Portulaca oleracea* were sensitive. They expanded when the flower opened, and, on being touched, rose slowly, though with some force, and embraced the pistil. On being again touched, they fell back to their former position. After having once gone through this upward and backward movement, they would not repeat it, so far as his observation went. It was better to use the lens to observe the motion on the growing plant in the ground than on a gathered specimen. He remarked on how much there was to observe in the common things around us, and yet the long time it seemed to take us to discover them. About thirty-five years ago, he said, he made the discovery of sensitive stamens in the common garden Portulacas the subject of his first contribution to scientific literature; and one would suppose that he himself at least, with this hint, would have examined the Purslane before now. He spoke of the relationship of *Portulacaceæ* with *Cactaceæ*. *Opuntia* had sensitive stamens, and with the same behavior in the same organs in *Portulaca*, essentially the same viscid juice, and tendency to succulence, there was little beyond an increased number and consolidation of parts in *Cactaceæ* to distinguish them from *Portulaceæ*.

Emigration of Solanum rostratum.—Mr. Thomas Meehan exhibited a specimen of *Solanum rostratum*, collected by Dr. A. Gattinger, of Nashville, Tennessee, from waste ground about that city, where it had evidently established itself. It is a native of Colorado and contiguous territory, and is believed to be the plant which originally sustained the beetle *Doryphora decemlineata*, until it found a choicer article in the common potato. Mr. M. thought this the first case of its being found east of the Mississippi River. The potato beetle had in a measure forsaken it, and it was now following the beetle.

Dimorphism in Ailantus glandulosa.—Mr. Thomas Meehan exhibited specimens of *Ailantus glandulosa*, gathered on the grounds of Mrs. Aaron V. Brown, of Nashville, Tenn. There were but six to seven pairs of leaflets forming the entire leaf, terminating in a pair, and not with an odd one, as in the normal form. The leaflets were roundish-oval, very oblique at the base, having large coriaceous auricles, smooth and shining on the upper surface, and canescent beneath. The normal form has double the number of leaflets, which are narrowly lanceolate, and drawn out into a long narrow point. Nothing could be more unlike than the two forms. There were three trees near each other, among many hundreds of the normal form, all of which appeared to have come up in a measure naturally along fence rows in an old field. The broad shining leaflets gave the trees so marked an appearance as to attract attention from a long distance. They were seed-bearing (female) trees, as were many others of the normal form near them. It was, therefore, a great point gained to be able to show that the case was not one of sexual variation, to which many cases of dimorphism were properly referred. Another very interesting fact was that a branch of the normal form came out of one of the trees, and it was from this branch that the normal leaf now exhibited was taken. The laws regulating these variations seemed still obscure.

On the Feeding of Dinamœba.—Prof. LEIDY remarked that bias frequently proved to be an obstacle in the way of research. In his study of the rhizopods, he had repeatedly watched different kinds of *Amœba* for long periods with the view of ascertaining their usual mode of feeding. Ordinary experience had prepossessed him to direct his attention to the forepart of the body, that is to say, the part in advance in the movements of the animal, as the point at which food would be taken. He had been surprised at the rarity of the occurrence in which he had seen *Amœbæ* swallow food when the apparent greediness of the animal was taken into consideration. In the last number of the Popular Science Review, there is an interesting article, by Mr. P. Martin Duncan, entitled "Studies amongst *Amœbæ*." From this he learned, from the observations of Mr. Duncan, that the *Amœbæ* habitually take their food at what may be considered the posterior part of the body. With this hint, he examined specimens of the curious amœboid animal, described under the name of *Dinamœba*, of which he had recently obtained a good supply from the ditches of a cranberry field at Ateo, New Jersey. He had since on several occasions had the opportunity of seeing the *Dinamœba* take its food, which was done, as indicated by Mr. Duncan, at the posterior part of the body. One instance appeared to him to be particularly interesting, and was related as follows:—

Seeing a specimen of *Dinamœba* with its left side in contact with a filament of the alga *Bambusina Brebissonii*, he was led to watch it. On closer examination it proved that the alga entered to the left of the tail and extended through the body, causing a slight bulge of the ectosarc by its other end to the left of the head. The *Dinamœba* became slightly elongated, and the alga sunk more inwardly from behind. The former moved with an inclination to the right, causing the alga to assume an oblique position from left to right. The anterior end of the alga suddenly protruded from the body of the animal, so that this appeared to be pierced by it. In this condition the alga entered the *Dinamœba* to the left of the tail, and protruded at the right of the head. Gradually the alga was made to assume a transverse position. The right extremity of the alga now became depressed and the left elevated, so that the alga assumed nearly its original position, in which it appeared to perforate the left border of the animal obliquely from the tail end. It gradually acquired a central position, penetrating the animal from tail to head. The *Dinamœba* now elongated at both ends, a third greater than its former length, extending in a fusiform manner upon the alga. The animal next doubled upon itself, so that both ends of the alga approached in front and protruded side by side from the head. One extremity of the alga then sunk within the *Dinamœba*, and subsequently the other extremity, so that the filament, about three times the length of the animal, became coiled up within it.

The observation of swallowing the *Bambusina* was made in the afternoon of September 15. In the evening, several hours after the first observation, on looking at the *Dinamœba*, which had been preserved in an animalcula cage, it was observed sitting, as it were, on a large filament of the alga *Didymoprium Grevilii*. The posterior end of the animal extended as a cylindrical expansion along the alga to a greater length than the breadth of the body of the *Dinamœba*, and so closely clasped it as to contract the gelatinous envelop of the alga to little more than the thickness of the green cells. After some time the alga suddenly broke, and the two portions were gradually bent backward and made slowly to approach, so as to become parallel with each other. One of the pieces was then drawn within the animal a convenient length, broken off, and completely swallowed, and this was followed by a similar movement of the other piece. Shortly after the first rupture of the alga, when the two portions projected at an obtuse angle from the back portion of the *Dinamœba*, the animal contracted in length, and discharged from the right side a mass of bodies, which consisted of the separated cells of *Bambusina*, probably from the filament it had swallowed in the afternoon.

Prof. Leidy continued that the two successive observations in the feeding of *Dinamœba* appeared to be particularly fortunate, as they apparently explained certain facts in the habits of the animal. *Dinamœba* had been noticed to be especially fond of the alga *Didymoprium*, for it was found to be present as the principal element of the food in numerous specimens. *Bambusina* was less frequently found among the food contents of the animal. The algæ were equally abundant in the localities of the *Dinamœba;* and, from the observations detailed, it would appear that the *Didymoprium* is preferred as food from the comparative ease with which its filaments are broken into pieces of convenient size for swallowing.

The observations are, moreover, interesting from their indicating discrimination and purpose in the movements of one of the simplest forms of animal life. The movements are to be viewed as reflex in character, though resembling the voluntary movements by which the most intelligent animal would prepare morsels of food of convenient form to take into the mouth. In striking contrast were the movements, noticed on several occasions, by which an *Oscillatoria* obtained entrance into the empty shell of an *Arcella*, and there, coiled up, crept round and round incessantly.

Concretions resembling Bones.—Prof. LEIDY directed attention to some large specimens on the table which had been sent to the Academy for his inspection. They had been recently mentioned in the daily papers as bones of a large reptile found in the coal-measures of Hazleton, Pa. Though presenting a remote resemblance to bones, one of which especially looked like the coracoid of a reptile, they proved to be nothing but irregular nodules or concretions of iron ore, or limonite.

Mineralogical Notes.—Professor GEO. AUG. KŒNIG placed on record a determination of Ankerite from the Phœnixville tunnel. Professor Genth mentions the occurrence of this mineral at the Phœnixville mines in curved rhombohedral crystals, but usually in yellowish-white, crystalline, granular masses. An analysis by Dr. W. P. Headden is given (see below) (Prel. Report on the Mineralogy of Penna., 1875). The specimens from the tunnel present crusts, one-quarter of an inch thick, covered with brown, well-defined rhombohedrons, whose faces do not show any curvature. Underneath this brown crystalline surface the mineral is colorless, and possesses very brilliant vitreous lustre. Small cleavage pieces are perfectly transparent.

The angle of the rhombohedral pole edge was found by the speaker = 105° 59′, differing slightly from measurements of other localities, as 106° 12′ (Molls), and 106° 6′ (Ettling). The components of Ankerite are the carbonates of calcium, magnesium, and iron, whose rhombohedral angles are respectively 105° 5′, 107° 29′, and 107°. It is clear that the angle of a mixture of the three must lie between the extremes, and must occupy a distinct relation to their respective quantities. As those are known to vary between magnesium and iron, the angles must necessarily vary accordingly.

Specific gravity = 2.953, at 22° C.

The mineral was analyzed at the speaker's request by his assistant, Mr. R. B. Chipman, with the following result:—

CO_2	=	44.56	:	44	=	1.013 molecules
CaO	=	28.60	:	56	=	0.510
FeO	=	14.41	:	72	=	0.200
MgO	=	13.03	:	40	=	0.325
		100.60				

yielding the empiric formula—

$$Mg_3Fe_2Ca_5C_{10}O_{30}$$

also—

$$(\tfrac{3}{5}Mg,\ \tfrac{2}{3}Fe)CaC_2O_6$$

Dr. Headden's analysis (loc. cit.) gives—

$CaCO_2$	=	50.72	:	100	=	0.5072 molecules
$MgCO_2$	=	21.98	:	88	=	0.2497
$FeCO_2$	=	27.29	:	116	=	0.2352
Insoluble	=	0.22				
		100.21				

yielding the empiric formula—

$$Mg_5Fe_5Ca_{10}C_{20}O_{60}$$

also—

$$(\tfrac{1}{2}Mg,\ \tfrac{2}{5}Fe)CaC_2O_6$$

Hence, Ankerite occurs at Phœnixville in two varieties:—

At the mine with the ratio Fe : Mg = 1 : 1
In the tunnel " " Fe : Mg = 2 : 3

OCTOBER 9.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty members present.

Apparent Discriminative Power in the Selection of Food by a Heliozoon.—Prof. LEIDY remarked that he had on several occasions observed actions in the rhizopods apparently indicating a discriminative power in the selection of food. It was certain that they generally swallowed living algæ and animalculæ, and avoided dead ones. He recently had observed a heliozoon eject an article, which appeared to indicate discriminative power. The heliozoon was *Acanthocystis spinifera*. The genus differs from *Actinophrys* in being provided with siliceous rays in addition to the ordinary soft rays. The former emanate from minute disks, forming, as it were, a sort of flexible armor to the body of the *Acanthocystis*. While examining an individual, a rapidly moving, oval, flagellate infusorium, as it was supposed to be, came into contact with several of the soft rays. The infusorium was paralyzed; it assumed a globular shape and became quiescent. It was gradually drawn towards the body of the heliozoon, which projected its armor to meet it, but quickly withdrew it again, and the heliozoon was pushed off beyond the siliceous rays. The same movements were repeated, and then the infusorian remained outside the siliceous rays. The objects were examined from time to time for several hours. The infusorium was no more drawn towards the body of the heliozoon. After a time it projected a minute bud, which gradually extended into a tortuous tube, proving the supposed infusorium to be a zoospore. It was finally abandoned by the heliozoon, apparently as if it had been determined not to be its proper food.

On Helminthophaga leucobronchialis (Brewster). — SPENCER TROTTER communicated the fact that last winter, while arranging the collection of warblers (*Sylvicolidæ*) in the museum of the Academy, he had discovered among them a specimen of *Helminthophaga leucobronchialis.* This rare species was described by Mr. Wm. Brewster, of Cambridge, Mass., who procured the first specimen at Newtonville, Mass., in the spring of 1870, a description and plate of which he published in the Bulletin of the Nuttall Ornithological Club for April, 1876. A second specimen was taken near Clifton, Delaware Co., Pa., in May, 1877, by Mr. C. D. Wood, an account of which Mr. Trotter sent to the Bulletin for July, 1877. The one now under consideration is, therefore, the third specimen of this rare species which has been discovered.

When he found it, there was no label attached designating its species, sex, or the locality where it was procured; but on the bottom of the stand was written "J. C., 20 Oct. 1862," and three other words that were much blurred, and which he believed to be "not from Bell." Bell is an Ornithologist of New York. The above indicates that John Cassin (for all the birds he examined have the same J. C. written on the stands or labels) had studied the specimen. The date he supposed to be that of its capture; and it is a curious fact that this specimen should have been procured at least eight years before the one from which the first description was taken. He had compared the specimen carefully with Mr. Brewster's description, also with Mr. Wood's specimen, and with these it agrees almost precisely. As the two former were males, from its similarity to them, he believed this one to be a male also. He took pleasure in adding another rare bird to the many which the Academy already possesses.

OCTOBER 16.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

Mineralogical Notes.—Professor GEO. AUG. KŒNIG placed on record the results of an investigation of a peculiar form of Magnetite from Magnet Cove, Ark. The material was obtained from

Dr. Lawrence through Dr. Leidy. It occurs in nodular masses, sometimes nearly spherical, with a very smooth surface, which not unfrequently is iridescent. There is no evidence whatever of crystalline form. The fracture is very even and straight, like a cleavage face. Color, black; lustre, vivid, metallic. It is thoroughly compact, and surpasses the crystallized Magnetite in hardness. It is strongly magnetic, attracting small fragments of itself. At Magnet Cove, collectors designate it as "rolled Titanium."

Specific gravity = 4.951 at 20° C.

B. B. Gives reaction of Titanium with salt of phosphorus, and fuses with difficulty.

Composition—

Fe_2O_3	=	64.47
Al_2O_3	=	3.06
TiO_2	=	3.25
V_2O_3	=	0.17
FeO	=	26.23
MgO	=	3.45
		100.63

This agrees perfectly with the general formula, $\overset{II}{R}\overset{VI}{R}O_4$, as follows:—

$\overset{II}{Fe}\overset{VI}{Fe}O_4$	=	84.52
$MgFeO_4$	=	7.72
$MgAlO_4$	=	4.16
$MgTiO_4$	=	3.90
$MgVO_4$	=	0.22
		100.52

OCTOBER 23.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-seven members present.

Remarks on Rhizopods, and Notice of a New Form.—Professor LEIDY remarked that, while in the Rocky Mountains last summer, he had continued his researches among the rhizopods. He had detected many forms, but they were nearly all of the same kind he had found in the vicinity of Philadelphia. His investigations led him to suspect that the species of fresh-water rhizopods were cosmopolite. He had found the greatest number of species and the greatest profusion near the sea level, though they were abundant even at an altitude of 10,000 feet in the Rocky Mountains. The most prolific localities of the fresh-water rhizopods are sphagnous swamps. Moist sphagnum often teems with multitudes of beautiful forms. A single drop of water squeezed from sphagnum has at times been found to contain hundreds of individuals of *Hyalosphenia*, *Nebela*, *Euglypha*, etc., of different species. Ponds and ditches in sphagnous swamps are also rich localities for other forms. Ponds and ditches prolific in aquatic plants, in sandstone, quartzite, argillaceous, and granitic districts, have also been rich in rhizopod life. Ponds and springs in limestone districts are exceedingly poor, which is the more remarkable when we take into consideration the exceeding abundance of rhizopods in the ocean, and the vast contribution the ocean forms have made to the limestone rocks. Over and over again he had been disappointed in his expectation of finding rhizopods among the profusion of vegetation of some large springs in the limestone districts of our neighboring counties.

Among the peculiar forms of rhizopods found in the West is an interesting one obtained from a pond, at an elevation of 10,000 feet, in the Uinta Mountains, Wyoming. It was found in association with *Cyphoderia margaritacea*, which was first discovered in the Alps. It is also related with *Cyphoderia* in a manner parallel with *Centropyxis* as related with *Arcella*. In the side view it has the same shape as *Cyphoderia ;* but, viewed in front or behind, it presents a conical process diverging on each side of the posterior third. The shell is yellow, chitinous, and incorporated with scattered particles of quartz sand. The mouth is circular, and surrounded by a delicate, colorless zone. The sarcode and pseudopods are the same as in *Cyphoderia*.

Length, 0.112 to 0.14 mm.; breadth between points, 0.08 to 0.124 mm.; breadth in opposite direction, 0.072 mm.; width of mouth, 0.028 mm.

CAMPASCUS CORNUTUS would be an appropriate name for the animal.

On Fossil Fishes.—Prof. LEIDY stated that the beautiful specimens of fossil fishes, presented this evening by Mr. Jeanes, were obtained from Bear River, Wyoming, and had been purchased by him in his recent trip west. They are some of the species named in Prof. Cope's communication to the American Philosophical Society last July.

OCTOBER 30.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-three members present.

Mineralogical Notes.—Prof. KŒNIG described a mineral from Bear Creek, Colorado. Dr. Joseph Leidy mentions Bergen's Ranch, 25 miles from Denver, as the more precise locality. The mineral occurs as a crust, one centimetre thick, on earthy Limonite. The surface of the crust is mammillary in structure, and a cross fracture exhibits banded texture. No crystalline form is observable even when considerably magnified, but small fragments appear hyaline and transparent under the microscope. The color is light greenish-blue, and snow-white in spots. The mineral is friable between the fingers, and adheres slightly to the tongue.

Before the blowpipe the mineral is infusible, and imparts a strong green color to the flame. With salt of phosphorus and tin or charcoal, copper reaction. Decomposed by cold, concentrated hydrochloric acid, with separation of flocculent silica. Yields much water in the closed tube.

Composition—

SiO_2	=	24.96
Al_2O_3	=	33.85
Fe_2O_3	=	0.31
CuO	=	5.40
P_2O_5	=	0.69
Comb. H_2O	=	22.60
Hygrosc. H_2O	=	12.30
		100.11

Supposing the copper to be present as $CuSiO_3$, one obtains the following very satisfactory ratio:—

SiO_2	=	21.06	0.700	:	1
Al_2O_3	=	34.16	0 666	:	1
SiO_2	=	3.90	0.130	:	1
CuO	=	5.40	0.131	:	1

The combined water gives 3 molecules respectively for the aluminum and copper silicate. Hitherto no notice had been taken of the large percentage of hygroscopic water, whence the 4 and 6 molecules have been deduced.

The mineral is, therefore,

$$\underset{\text{Allophane.}}{(Al_2SiO_5 + 3H_2O)_5} + \underset{\text{Chrysocolla.}}{(CuSiO_3 + 3H_2O)}$$

Two analyses from different parts of the crust gave the same result, and a rational relation between the two molecules (5 : 1) seems to exist.

C. Few Seiss, Miss E. B. Rice, Miss Mary B. Rice, Andrew J. Parker, M.D., J. D. Thomas, M.D., and S. H. Guilford, M.D., were elected members.

The following were elected correspondents: Sereno E. Watson, of Cambridge; Wm. G. Farlow, of Cambridge; Geo. L. Goodale, of Cambridge; John Duns, of Edinburgh; Dr. Ernst Candeze, of Liege; Dr. C. A. Dohrn, of Stettin; Baron E. Von Harold, of Berlin; Vicomte Henri de Bonvouloir, of Paris; Baron Maximilien de Chaudoir, of St. Petersburg; Henry W. Bates, of London; Etienne Mulsant, of Lyons; M. A. Chevrolat, of Paris; S. Solsky, of St. Petersburg; Alfred Preudhomme de Borre, of Bruxelles; Jules Putzeys, of Bruxelles; Chas. C. Parry, of Davenport, Iowa; A. Ernst, of Venezuela; G. V. Black, of Jacksonville, Ind.; R. J. Lechmere Guppy, of Port of Spain, Trinidad; and Edw. Hull, of Dublin.

The following was ordered to be published:—

ON A NEW SPECIES OF HELIX FROM TEXAS.

BY WILLIAM G. MAZYCK.

Helix (Triodopsis) Henriettæ, Mazyck.

Shell rimately umbilicated, depressed, globose, rather solid, with numerous regular delicate striæ, dark brownish horn color; spire obtuse; whorls about five and a half, slightly convex; suture deeply impressed; beneath convex, smoother than above; umbilicus very deep, reaching the apex, but only exhibiting the last three whorls, grooved within; body-whorl gently ascending just behind the aperture, and then suddenly and shortly deflected, very much constricted behind the peristome, with two deep exterior pits, having the space between them elevated into a prominent ridge; aperture subtriangular, peristome much thickened within and very slightly reflexed, very tortuous, yellowish-white, furnished with a small denticle near its upper termination and an erect lamelliform tooth, which is equal in length to about one-fifth the diameter of the base of the shell, extending from the lower end of the uppermost pit almost to the inner edge of the body-whorl; low down in the mouth of the shell there is, between this tooth and the denticle, a large, white, tongue-shaped, concave tooth; and very near this, but rather lower down in the mouth of the shell, and on the base of the body-whorl, there is an oblique, stout, white tooth, which is sometimes slightly cleft on the edge. The parietal wall, which is covered with a semitransparent callus, bears a very strong, arcuated, entering, white tooth, whose outer margins form almost a right angle.

Diam. maj. $\frac{1}{2}$; min. $\frac{7}{16}$; alt. $\frac{1}{4}$ inch.

Habitat.—Eastern Texas. Mr. Jacob Boll.

This species more nearly resembles *Helix vultuosa*, Gld., than any other North American species, but differs from that shell in the shape and size of the umbilicus and in the form and armature of the aperture, which in *vultuosa* is lunate, almost circular, and in this species is rather V-shaped; in *vultuosa* the peristome, though moderately so, is decidedly reflexed, and its plane is almost entirely unbroken; in *Henriettæ* it is very much thickened, but scarcely at all reflexed, is very tortuous, and bears on its inner margin an obtuse denticle and a long lamelliform erect tooth, which are wanting in *vultuosa;* in *Henriettæ* the two internal teeth are so far within the aperture as to be seen only on looking into it, while in *vultuosa* they are plainly visible from the base of the side; in the latter the parietal tooth is arched *upwards*, and its outer margin is rounded—in *Henriettæ* it takes the opposite direction, and its margins form almost a right angle; the deep pits behind the peristome are wanting or obsolete in *vultuosa.*

The species is referred to by Mr. Bland in "Remarks," p. 116–117.

NOVEMBER 6.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-one members present.

The deaths of John Gould Anthony and of Prof. James Orton, correspondents, were announced.

NOVEMBER 13.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

A paper entitled "On the Diameters of the Incisors of Rodents," by John A Ryder, was presented for publication.

The Agricultural Ants of Texas.—Rev. H. C. MCCOOK gave an abstract of a paper, in course of preparation, upon the Agricultural Ants of Texas, *Myrmica molefaciens*, Buckley (*M. barbata*, Smith). He had visited Texas during the summer, and, encamping in the midst of a large number of formicaries, had given several weeks to the study of these and the cutting ants. Mr. McCook referred to the first notice of the agricultural ants by Prof. Buckley, in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, and to the subsequent, much more detailed, observations of Dr. Gideon Lincecum. Notwithstanding the doubt with which Dr. L.'s statements had been received, Mr. McCook was able to verify many of his recorded facts, to complete many, to correct some, and to add new facts to the known history of these most interesting insects. The point chosen for study is in the neighborhood of Austin, Texas, upon the tableland to the southwest of the Colorado River and its affluent, Barton Creek. The soil is black and sticky, varying in depth from three feet to a few inches. The bed rock is limestone, which crops up in striated and punctured masses. The formicaries of the ants are very numerous, and are found along roads, in open prairies, in the very streets, sidewalks, gardens, and yards of Austin; one was even perceived in the stone-paved court of a hotel. They are, as found upon the hills, commonly flat, circular clearings, hard and measurably smooth, well enough described by Lincecum as "pavements." A few were found with low mounds in the centre, a few inches in height and two or three in diameter. These mounds were frequently composed of bits of gravel of one to two grains weight. The width of the formicaries varies from twelve feet to two or three feet. They are invariably located in open sunlight. Yet the meridian heat of the sun is avoided, the ants ceasing work entirely at 12 M. and remaining housed until between 2 and 3 P. M. Very little work was done at night, except in cases where the nest had been disturbed. The process of making a clearing was observed, and suggested strongly the modes of pioneers in an American forest. "Stumps" of grass remained at the inner edge of the clearing; beyond these, ants were engaged cutting off the spires of grass. Generally the head was downward, mandibles applied quite close to the roots, and the stalk yielded under a combined process of cutting, pinching, tearing, and twisting. In one case a worker climbed to the top of the grass and gained the advantage of leverage by bearing down. The rank vegetation of the semi-tropical climate is kept in complete control; clearings were found among the tall thickets of wild sage and daisy which could not intrude upon the emmet preserves. From each formicary diverge roads in number from three to seven, widest at the home terminus, and extending for many feet—sixty feet, more or less—into the surrounding herbage. These roads are level and smooth, and in busy hours of the day are thronged by worker ants going and coming. The mode of gathering grain was completely observed, single insects having been followed from the nest to the harvesting grounds and back. Seeds were gathered from the ground, never from the plant. The seeds, which were collected in large quantities, were exhibited, and the report of the Botanical Section of the Academy upon the same, which had been made after careful examination by Messrs. Meehan, Burk, and Redfield, was read. The seeds were of small Euphorbiaceous and Rubiaceous plants, *Croton*, *Paspalum*, *Aristida stricta*, and *Buchloe dactyloides*, the common western buffalo grass. The last two named were the most numerous.

The chain of evidence that determines these ants to be true harvesters is as follows: 1st. Workers were seen gathering seeds and carrying them into the formicaries through the central gates. 2d. The same seeds were found in granaries within the opened formicaries. 3d. The same seeds with the outer shell removed were found in other granaries. 4th. The ants were found carrying out shells to the refuse heaps, which heaps, as reported by expert botanists from collections, contain no perfect seeds among them. Several observers, under Mr. McCook's direction, are noting the winter habits and the condition of the winter formicaries of these agriculturals, and, when these notes are complete, the entire paper will be given to the public. The reported sowing of a crop from year to year was considered, and so far confirmed that in many cases the clearings were found to be covered by crops of *Aristida*, which crops were as distinctly marked upon the clearings as a farmer's wheat or grass crop upon any particular field. The formicaries could be recognized at a distance by the circular mass of tall yellow needle grass (*Aristida*). On the prairies and low land a sharp conical mound rises in the midst of a clearing more or less extensive. Specimens brought to Mr. McCook by Dr. Leidy, from Wyoming Territory, were identified as of the same genus, *M. occidentalis*, Cresson. Mr. Cresson had described the male as a separate species, *Myrmica seminigra*.

Several questions which arose were answered as follows: Why should the needle-grass (*Aristida stricta*) be planted upon the formicary clearings when seeds could be had all around the nest without that trouble? Evidently (if we are to suppose a planting) the saving of time and labor in harvesting thus accomplished might be a sufficient reason. Mr. McCook was unwilling as yet to commit himself to the theory of an intelligent planting of seeds by the ants. His opinion at present was that the ants simply preserve growths which accidentally arise from seeds carried out of the granaries for various reasons. It should be remembered that *only a portion* of the formicaries are thus covered, not one-half, perhaps one-third. Of twenty-two registered nests (in one list) in which the details are given in his field notes, ten are reported with needle-grass crops. This crop is usually on the margin of the clearing. Thus (extract from Notes), "No. 15. Space clear about one and a half feet diameter, needle-grass for two feet beyond on all sides. . . . . 18. Small space at the gate open. A circular belt of six feet, total diameter, covered with needle-grass. 20. Small hill; about twelve inches clear space, eight inches (each side) of needle-grass. . . . . 22. Four feet of clear space, gravel covering the space immediately surrounding the gate; tufts of needle-grass on outer edge. . . . . 2. Two feet diameter bare; about one foot each side covered with needle-grass. . . . . 4. Formicary four feet in diameter, with tufts of needle-grass." This will give a fair idea of the way in which the pavements run.

How did the naturalists of the last century account for the ancient sacred, classical, and popular opinion of the harvesting powers of ants, and how did they fall into the mistake of rejecting the ancient tradition? The mistake was doubtless due to the fact that no harvesting ants have yet been observed in northern Europe, whose naturalists gave tone to the natural history of the last century. The more widely extended research of very recent times has brought opinion back to the old channel. The origin of the opinion was accounted for by those who rejected it by supposing that the yellowish grain-like cocoons (the "eggs" of common speech) which ants are frequently seen carrying when nests are disturbed, were popularly mistaken for grains of wheat.

Is there anything like a systematic direction of these harvesting labors? Do the queen or major-workers, for example oversee the work of the formicary? The queen has nothing to do (apparently) but replenish the population of the community. Her life is spent, for the most part, under ground. There are no "officers" that could be distinguished. Each ant acts with an individuality and independence of behavior that quite accurately answers to that oldest description of her habits—(Prov. vi. 7) "Having no guide, overseer, or ruler." Each worker is a law unto herself, and yet the work moves on with perfect harmony, and as if with the utmost unity and system in management. The worker-majors act constantly as sentinels, and once or twice was observed what appeared to be an effort to extend aid to harvesters in gathering seeds; but nothing like leadership.

Mr. McCook then proceeded to describe the interior of a formicary, illustrating his remarks by various specimens preserved in plaster, plaster-casts, models, and drawings. Each formicary has one or more gates, rarely more than two, sometimes three. Sometimes two gates are found connected by a smooth, sunken track. The gates are circular openings at the surface. Within is a vestibule, shelving downwards less than or about 45°; it is about one to two inches wide, smooth, low, one-half to one-quarter inches in height, shortly diverging in tubular galleries connecting with granaries.

Accumulations of seeds were found within half an inch of the gate, more frequently lower down. Those described in detail were found one and a half inch from the surface. Stripping off the soil in horizontal layers, and working carefully with a trowel, Mr. McCook uncovered a series of oval, circular, and crescent or horse-shoe-shaped rooms, quite uniformly $\frac{1}{4}$ inch in height, but ranging to $\frac{3}{8}$ and $\frac{1}{2}$ inch. Of these, as examples, say, No. 1 was in diameters $3\frac{1}{2}$ by 4 inches; No. 2, $3\frac{3}{4}$ by $3\frac{3}{4}$ inches; No. 3, 6 by 3 inches. The roofs and floors were hard and smooth. In one nest opened in a light yellowish soil, and white "adobe," the black, unctuous "soil" had been brought down ten inches, and the floor, side walls, and roof plastered therewith. The upper granaries were covered with heaps of seeds, which must have nearly touched the roof. Narrow gangways were left at the outer margin between grain heaps and wall. The granaries were connected with each other by tubular galleries. The nurseries or rooms in which the larvæ and pupæ were stored, were of the same character as the granaries. One large nursery, ten inches below the surface, was illustrated by a model and plaster cast. It was exposed entire by careful and extremely tedious manipulation with knife and trowel. The difficulty of this and similar operations was greatly increased by the attacks of the ants, whose sting is quite as severe as the wasp's. Mr. McCook prosecuted these labors with one man and sometimes two constantly engaged in brushing off the enraged insects. The nursery was horse-shoe-shaped, the opening toward the centre of the nest, and one of the prongs directed in the line of the gates, with which it was apparently connected. The floor was hard, smooth, and plastered with the black top soil. The nursery was nine inches across the mouth, the length of the arms five inches, being also about three inches wide at the mouth, and much narrower, three-quarters of an inch at the junction. Nothing but larvæ, pupæ, and a few callow ants was found in this nursery.

Section cuttings were made, and drawing and casts obtained. It was found that the granaries were arranged one above another from a quarter of an inch to three inches distant. There was a general tendency of the rooms to what may be called floors or stories, which was stronger or more regular in some formicaries than others. A cast and drawing showed how the rooms of each story are connected together, and the stories united with each other and the gates, by galleries. There was a massing of the granaries toward the centre, and an apparent preference for one half of the formicary space to the neglect of the other. Excavations were made several feet in depth, the queens, virgins, and males always eluding search, although the latter were in great number somewhere within the nest. One of the men assisting at the digging, said that in sinking a well he had found these ants coming out of their "holes" fifteen feet below the surface.

Some of the general habits of the ants were described, and their means of attack and defence were referred to, their stinging organs being explained, and the mode of inflicting the wounds, as well as effects, which are very severe, and continue for a day. In the case of children the sting is sometimes quite serious. The universal popular name of these ants in Texas is the "Stinging Ant." The mode of preserving the formicary from inundation by the massing of the workers in the vestibule and around the gates, was observed and described. He was not satisfied that this was the work of design, but it evidently served the purpose of partly stopping the influx of the water, not wholly. Examples were given showing strong intelligence in separating white meal from arsenic, with which it had been mixed, and of the refusal of poisoned molasses. A remarkable garnering by the agriculturals of a swarm of white ants, *Termes flavipes*, beaten down by a shower was described. These insects, males and females, were seized and carried in great numbers within the formicary. Reference was also made to the synonyma of these insects. Two years before Prof. Buckley's description as *Myrmica molefaciens*, Mr. Frederick Smith had described a female from Mexico as *Myrmica barbata*. It is probable that Mr. Smith's name will prove good, but the description, as compared with the insects, was not satisfactory. Moreover, the description of the supposed male in a private letter from Mr. Smith to Mr. Cresson does not at all answer to the Texas species. Not having seen Smith's types, Mr. McCook was still in doubt, and for the present retained the name given by Buckley. It is probable, however, that both the generic and specific names by which the ant has so long been known, must yield, and the name stand (as recently suggested in a private letter by Dr. Forel, the distinguished author of "The Swiss Ants") *Pogono-*

myrmex barbatus, Smith. However, the popular name given by Lineecum, "Agricultural Ants," will be permanent, exeept perhaps in Texas, where the people will doubtless continue to call the insects the "Stinging Ants."

Remarks on Ants —Prof. LEIDY remarked that he had read Mr. Lineeeum's eommunications on the habits of the agrieultural ant of Texas with much interest, and that he was disposed to take a different view of some of his observations from the author. He considered the elearing of a spaee around the nest, with the exeeption of a grass that grew thereon, and the eolleetion of the seeds of the grass when ripe, all very probable, but he suspected that the sowing of the seed was aeeidental rather than intentional. If the grass seeds are favorite food, many may be aecidentally dropped and left on the clear spaee in carrying them from the surrounding region to the nest, and the lost seeds germinating may supply the future harvest field.

He further stated that, during his trips in the summer to the Rocky Mountains, he had observed, through the plains of western Kansas, Colorado, Wyoming, and Utah, formiearies of an ant, whieh he had suspeeted to be the same as the agricultural ant. Having submitted specimens of the ant to the Rev. Dr. McCook, he was informed they pertained to a different species, the *Myrmica occidentalis* of Cresson.

The formicaries of this ant inelude a eireular space from three to eighteen feet in diameter with a central eone of less than one-third the diameter at base, and from ten to eighteen inehes high.

The circular space is usually devoid of every vestige of vegetation, rarely presenting even the stump of a plant. Oecasionally, however, it retains near its boundary some grasses, usually bunehes of *Eriocoma* or *Triticum*. The space is mostly level and elear of loose soil, and if stony the pebbles are firmly impacted. The central cone is composed externally of small loose gravel stones, carried by the ants from the interior of the nest. The interior of the cone is eomposed of finer material, and is excavated into galleries. The finer soil forming the walls of these galleries is mingled with root fibres. These suggest the probability of being retained to give greater coherenee to the friable soil. The larger stones on the exterior of the cone were found by weighing to be six times heavier than the workers who earried them to their plaee. The entrance to the interior of the formicaries consisted usually of one or two openings near the base of the eone.

The outside of the eireular formicaries are closely and often densely skirted with vegetation, espeeially by sage bushes, *Artemesia tridentata*, grease wood, *Sarcobatus vermiculatus*, etc.

Aecidentally, Prof. L. eontinued, he made an observation that rendered it probable the *A. occidentalis*, like many other ants, fostered insects for their saccharine productions. Noticing several ants carrying what he supposed to be large stones into their nests, on closer examination these proved to be a large species of *Coccus*. A specimen of this insect was about the one-fourth of an inch long and the one-fifth of an inch broad, of a pale pinkish hue. The body, independent of the head, exhibited ten segments, of which the thoracic ones possessed short limbs ending in a single, black, curved unguis. The anterior pair of limbs were twice the size of the others. The antennæ were fuscous and eight-jointed. The source of the coccus was sought in the vicinity of the formicary, but not found. *Opuntia* grew abundantly in the neighborhood, but no cocci were upon it.

On a Stone Axe.—Mr. JOHN FORD presented fifteen species of fossil land and fresh-water shells, all of the quaternary period, a stone axe or celt, a sample of Lignite, and a bone, belonging to the genus *Canis*.

These were collected by himself and a friend in a cutting for a roadway made through the outer bluff on the margin of the Mississippi River, a short distance northwest of Alton, Ill. The axe, which is somewhat unique in form, has an especial interest, owing to the peculiar conditions attending its discovery. The roadway referred to is about twenty-five feet in width, forming a sort of terrace running parallel with the river, but some fifty feet above it. From the outer edge of this the bluff slopes to the water, while the inner edge is flanked by an escarpment composed entirely of natural deposits left *in situ* by the workmen. In height the latter is about equal to the width of the cutting, thus making the whole vertical measurement from the present surface of the river to the top of the bluff some seventy-five feet. It was in the face of this perpendicular wall, from three to five feet above the roadway, and twenty feet below the summit, that all the specimens under consideration were found.

The presence of land and fresh-water shells may be accounted for on the theory of deposition at a time when the Mississippi, or what is more probable, a great fresh-water lake covered that portion of the country, at an elevation much higher than the present river surface. The waves of this lake, dashing against the loftier limestone bluffs that still remain unaltered a few rods further inland, doubtless threw down myriads of land shells. This same force brought in large quantities of fresh-water shells, and these, mingling with the others, aided in forming the vast pile of debris of which the outer bluff is principally composed. The same theory may explain the presence of the wolf bone and Lignite, but it can reveal little or nothing in regard to the axe. The wall referred to presented in every part a solid front, without fissure or crevice, everywhere hard and impenetrable, except by pick or crowbar, and yet, twenty feet under the surface, within this stony matrix deposited by water thousands of years ago, laid the evidence of the presence of the man of the period, a stone axe artistically made and doubtless used for purposes of battle. When or how it was buried is as much a mystery as is the history of its maker. Whether it was dropped from a canoe into the accumulating debris, or hurled from the land at a passing enemy, is a problem which cannot be solved; but that it had lain for unnumbered centuries in the sepulchre from which it was exhumed, there are abundant reasons to believe.

NOVEMBER 20.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-six members present.

Correction of "Notes on American Cretaceous Fossils."—The following note, dated Porto Plata, San Domingo, Oct. 15, 1877, was received from Mr. WM. M. GABB:—

"In my paper on cretaceous fossils in the Proceedings for 1876, of which I have just received a copy, I find that, by some unaccountable mistake the genus *Volutifusus*, Conrad, is placed in the sub-family *Voluntinæ*, after *Rostellites* (p. 290), where it does not belong, as well as in the *Scaphellinæ*, where it should be (p. 291), and where I intended it should go, as is amply proven by the first paragraph on the following page, where I say 'I am by no means convinced that *Volutifusus* should be separated from *Scaphella*,' which it follows on p. 291. I do not pretend to explain or excuse this inadvertence, but desire to put the correction on record. I also note the following errata: In last line of page 289 for 'bi cit.' read 'loc. cit.;' page 279, line 14 from top, for 'larger' read 'longer;' page 305 under *P. elliptica* for 'seven' read 'my;' page 309, line 22 from bottom, for '*Pseudocardia*' read '*Protocardia*.'"

NOVEMBER 27.

The President, Dr. RUSCHENBERGER, in the chair

Thirty-eight members present.

A paper entitled "On the Alkali from the vicinity of Fort Bridger, Wyoming Territory," by Edw. Goldsmith, was presented for publication.

Remarks on the American Species of Difflugia.—Prof LEIDY remarked that the genus *Difflugia* was first described by Leclerc, in 1815, and was founded on three forms, of which one is referred by Ehrenberg to his *D. proteiformis*, and the others to *D. acumi-*

nata and *D. spiralis*. Lamarck, without distinction, applied the former name to the whole of them.

In his study of the fresh-water rhizopods of this country, Prof. Leidy had recognized about fourteen kinds of *Difflugia*, which are sufficiently common and characteristic to be worthy of distinctive names. Nevertheless his investigations had led him to believe, with Wallich, that through transitional forms they all merge into one species.

The well-marked varieties observed are as follows:—

1. Difflugia proteiformis. Ehrenberg.

This name, the oldest and first applied by Lamarck, is used with rather uncertain signification. It was suggested that it should be restricted to the variety having its shell spheroidal, ovoidal, or subpyriform, with circular transverse section and with the mouth circular and not crenulated.

2. D. pyriformis. Perty, Carter, Wallich, Ehrenberg.

3. D. acuminata. Ehrenberg.

4. D. compressa. Carter.

5. D. entochloris.

Like the latter, but with the fundus of the shell surmounted by from one to three obtuse processes. Sarcode green. Is it *D. mitrata*, Wallich; or *D. triangulata*, Lang.?

6. D. urceolata. Carter.

D. lageniformis, Wallich; *D. amphora*, Leidy.

7. D. olla.

Like the latter, but provided with several nipple-like processes to the fundus.

8. D. corona. Wallich.

9. D. lobostoma.

Mouth 3 to 12 lobed, spineless. *D. tricuspis*, Carter; *D. oblonga*, Fresenius; *D. crenulata*, Leidy.

10. D. globularis. Wallich.

Exclusive of the varieties.

11. D. cratera.

Minute, goblet shaped, with ovoid body, and wide cylindrical throat.

12. D. vas.

Resembling *D. pyriformis*, but with the neck narrowly constricted from the body.

13. D. spiralis. Ehrenberg, Bailey, Fresenius, etc.

14. D. marsupiformis. Wallich.

Including the variety *D. cassis*, Wallich.

In the Trans. Acad. Sciences, Berlin, 1871, Ehrenberg gives a list of upwards of one hundred named species of *Difflugia*, and later he described eight others. The list, however, includes most other related genera, except *Arcella*, so that if all were excluded except those pertaining to *Difflugia* in its restricted sense, the number of species would be considerably reduced. It is remarkable that the long list includes less than half the species above named, nearly all of which appear to be very common. Further, most of those of our list mentioned in Ehrenberg's list are the least characteristic of the series. None of those named by Ehrenberg are suggestive of the forms called *D. urceolata*, *D. olla*, and *D. corona*. Many of Ehrenberg's forms are badly figured and imperfectly characterized, and his lists appear greatly extended by the same things having been described over and over again under different names.

In Wallich's able papers on fresh-water rhizopods, referring to forms from Bengal, the Himalayas, Greenland, Labrador, Nova Scotia, and England, there are indicated about a dozen species of *Difflugia*, in the restricted sense in which the genus is now viewed, and the present list includes all of these except, at most, two.

The Aeronautic Flight of Spiders.—Rev. H. C. McCook remarked that October 25, 1877, was a warm day, with a soft wind from the west; just such an autumn day as would tempt young spiderlings to essay their aerial trips. The point of the following observations was the fields back of the "Presbyterian Home for Widows," in the suburbs of Philadelphia. Stooping low, and glancing along the meadow, the eye caught the sheen of myriads of fine silken filaments glistening in the sunlight. The tops of the grass spires, and the bushy heads of tall weeds were netted together by innumerable threads, and from many points of the same, like filaments were streaming out at various lengths into the air. Numerous small spiders, chiefly orbweavers, the young of *Tetragnatha extensa*, were rising from these plants, and sailing off over the field. But the finest exhibition of the aeronautic flight was seen along the post and rail fence which divides the meadow. The tops of the posts were the favorite spots, and upon all of these clusters of young wolf spiders (*Lycosidæ*) were gathered, sometimes eight or ten in a group. The purpose in choosing these elevated spots is quite apparent, the breeze being much stronger there than close to the surface of the earth, and consequently affording much better facility for flight. The presence of a deliberate and wise volition is all the more evident from the fact that the *Lycosidæ* are ground spiders, and are rarely found in such positions as the above. They had certainly mounted to the top of the fence with the settled purpose of taking advantage of the stronger breeze, and the better "send off" which the superior height afforded. He found that the threads, spread out by spiderlings on the grass stalks, which floated quite lazily, when the stalks were broken off and lifted higher, immediately fluttered off briskly, and soon carried the little arachnid away with them. Fortunately, the posts suited the observer's convenience quite as much as the spiders', and he could easily notice the methods of the miniature balloonists.

The very top of the post was generally chosen as the point of ascent. The first position was to turn the face in the direction from which the wind was blowing. Then the abdomen was elevated to an angle of about 45°, and, at the same time, the eight legs were stiffened, thus pushing the body upward. In order to permit this movement, the claws were brought in somewhat, but not beneath the body, so that when the legs were stiffened the body stood high above the surface. From the spinnarets at the apex of the abdomen a single thread was exuded, and rapidly drawn out by the breeze, until, by reason of its delicacy, it was lost to eyesight. Four, five, even six feet of the line would at times be in view. Gradually the legs were inclined in the direction of the breeze, and the joints straightened out. The foremost pair of legs sank almost to the level of the post; and these especially, but indeed all the legs, and the entire attitude of the creature, presented the appearance of an animal resisting with utmost force and tension of muscles the effort of some superior power to snatch it away. Suddenly and simultaneously the eight claws were unloosed, and the spider mounted with a sharp bound into the air, and went careering away across the meadow, at a rate more or less rapid according to the velocity of the wind.

The utmost care was used to determine whether in this upward bound the volition of the spider had any further agency than the simple unclasping of the feet from the post. Owing to the extreme difficulty of such an observation, he could not speak with absolute confidence, but was able to satisfy his own mind that the aeronauts always vaulted upward and clear of the post at the moment of releasing their hold. That this was so in many cases, at least, he could hardly be mistaken. A similar action was frequently observed among the spiders before the final flight. Something was noticed a little like the frolicsome pranks of kittens or lambs. One would rush up to another, who thereupon would immediately change position, either by running or quickly vaulting to another part of the post. At times the leap would be made away from the post, but the buoyancy of the thread which had been exuded being insufficient to overcome the weight of the spider, instead of rising into the air, the creature returned to the post, or struck upon the adjoining rail. In these and similar movements, Mr. McCook was able to detect distinctly the vaulting action of the spider, and the eye, being thus familiarized with the movement, was less liable to be deceived in the more difficult observation of the quick spring at the time of the aerial flight. The posts and part of the rails adjoining were covered with threads adhering to the wood, and streaming out into the air. These were the result, in part, of the feints at flight just referred to; but were partly owing to another cause. The spiders, previous to flight or vaulting, attached themselves to the post in the manner common to most of their order. The apex of the abdomen was thrust down upon the surface, and the liquid silk at the same time exuded from the spinnarets was thus caused to adhere thereto. As the creature moved away, the thread was run out into line and gave the spider a firm attachment. It was a question whether this anchorage is always made previous to flight, and whether the thread is cut immediately before the ascent? The observations made all pointed to an affirmative answer; but the matter was not positively settled.

The attempt was made to follow some of the aeronauts beyond the point of ascent. The difficulty of getting the object in position relative to the sun favorable for such observation, the motion of the air which carried most of the spiders upward, as well as the rapidity of the flight, frustrated many attempts. A position was finally taken beside one of the posts of the bars, which, being opened, gave a point of observation with the back to the sun, the eye upon the object, and a fair opportunity to follow it without the delay of leaping over a high fence, which before had been between the observer and the course of the spider before the wind. Fortune favored patience, and at last a spider took flight in a line which was little higher than the face. Following the arachnid at a moderate run, with the eye held closely upon it, it was observed that the position of the body was soon reversed, that is, the head was turned in the direction toward which the wind was blowing, instead of toward the point from which it blew, as before the ascent. Thus the long thread which streamed out above the aeronaut inclined forward, and at the top was in advance of its head. It was also observed that the legs were spread out, and that they had been united at the feet by delicate filaments of silk. The action by which this spinning work was accomplished was not noticed, owing to the smallness of the creature, the rapidity of its movements, and the difficulty of such an exceptional mode of observation. But the fact was noted. The reason naturally suggested for it is the increased buoyancy resulting from the increased surface thus offered to the resistance of the air.

The spider was followed for a distance of eighty feet, when it gradually settled downward upon the meadow. Before, or rather during this descent, a small, white, flossy ball of silk was seen accumulating at the mouth of the spider, which, with the peculiar motion of the forefeet, palps, and mandibles, at once suggested the drawing in of a thread. This behavior is not infrequent with spiders under other circumstances; but it became especially interesting at that moment, for at once it suggested an act of volition on the part of the lycosid, by which it, in a measure at least, might control its descent. Evidently the shortening of the overhanging thread operated like the furling of sails upon a vessel, and decreasing the motion of the spider, increased the influence of gravity upon the body, which thus sank toward the ground. At the same time, the diminution of surface of the thread above, and the increase of bulk at the mouth, decreased the buoyancy of the whole, and allowed the creature to fall. Exactly the same effect was thus produced by the spider-aeronaut, and by a strikingly analogous mode, as the human aeronaut accomplishes when he contracts the surface of his balloon by causing the inflating gas to escape.

Some observations were made at the same time upon the aerial flights of several species of small orbweavers. These were stationed upon the tall grasses and weeds, from which innumerable cords of spider-silk were streaming, and upon which similar threads were twisted and meshed by the eddies of the wind, and the passing of the spiderlings from point to point. The attitude of most of these was one of expectation. Only two were observed in actual flight, and one of these was assisted. The nearness to the ground and the shelter of the surrounding herbage, may have retarded the process. However, this greater deliberateness is quite in harmony with the phlegmatic orbweavers, just as the energy of the *Lycosidæ* in mounting the fence, and their haste to be off, is characteristic of that group, who are, indeed, in their vigorous, stirring activities, quite typical Americans. The little orbweavers were hanging upon the lower part of the floating strings near the point of attachment to the grass. Their backs were downward and their heads outward or toward the free end of the thread. The first, second, and fourth pairs of legs were stretched along the thread, and the third and shortest pair were held off, curved, the feet apparently united to the main thread by taut filaments. This position, so far as could be determined, was maintained after flight. In some cases a series of two or three puffs or pellets of floss were gathered around the thread between its free end and the spiderling. They were generally cone-shaped, the apex toward the spider. In form they were not unlike the pellets which one used to see gathering upon the roll of wool as it passed from the fingers of our maternal ancestors into the whirling "flyers" of an old-fashioned spinning wheel. Perhaps they may have been wrought by a similar process, the twisting of the loose thread through the action of the wind, and the counteraction of the spider.

The above observations were the most complete and satisfactory which Mr. McCook had been able to make, but he referred, in further illustration and confirmation of these, to the results of observations and experiments of several previous years. In the closing days of October, if the weather have the usual mildness of that period, these aerial flights may be seen from almost any open spot of country-side. The 29th of October, 1875, was especially remarkable for the exhibition of this habit. All the young of the spider-fauna seemed to be afloat. It was like the simultaneous outbreaking among our children of the annual fury for special games, marbles, tops, jumping rope or hoop. The air was filled with floating filaments of spinning-work. Passing along the public squares of Philadelphia, Mr. McCook arrested and examined some of these ; the prevalent, indeed it might be said, the unvarying type, was the single thread, long, with a flossy tuft of irregular form, but commonly hammock-shaped, at or near the middle of the line. A small dipterous insect was found entangled upon one of these threads. Fairmount Park was filled with these excursionists. All day long the filaments were floating across the Schuylkill River, entangling with the decks and smoke-stacks of passing steamboats, and with the persons of passengers and crews. One of the latter caught a number of the threads, on which he found small spiders, and on three threads little flies. The next day Mr. McCook saw some of these attenuated balloons float across the river at a height of from 60 to 70 feet, and entangle with trees upon the high bluff. The temperature, however, had fallen several degrees, and comparatively few of the aeronauts were afloat. The floating filaments while in motion preserved generally a crescent or horse-shoe shape, the "horns" or forks nearly equal in length or not greatly unequal, and pointed toward the direction of the wind. At or near the point of curvature or divergence was the puff of floss or "basket" as it might, perhaps, be called.

Mr. McCook, in conclusion, referred to experiments which he had made afield and from his study-window with young spiders, particularly the young of *Agalena nævia*, the speckled tubeweaver. When let loose into the air from the finger-tip, the spiderlings floated out by a single thread which was always and instantly first attached to the finger. At first, the head was outward, the abdomen being toward the hand, from the apex of which the long superior spinnerets diverged. Presently the little creature turned and cast out a thread behind, when, if permitted, it would usually clamber up the original thread to the finger. When this was broken off, the spider, seated midway of the two filaments, floated off and outward, and was lost to sight. Again, by an eddy of the air, the thread would be thrown backward and upward and catch against the wall upon which the little voyager would anchor. At other times, much to his surprise, after the thread had been quite lost to view, and the spider was supposed to be far away upon its flight, it would descend, as from the clouds, and send out its silken grapnels against the observer's cheek or nose. The will of the little spider seemed to have no control over these movements, which apparently were always wholly at the mercy of the wind. However, the manner of accomplishing the aerial flight by means of the buoyancy of a single thread, or rather of two threads united at or near the middle, was quite in accord with the methods above described. Reference was also made to the remarks of other observers which were compared with those here given.

A. H. Franciscus, Henry Pemberton, Jr., Henry Cope Haines, Oswald J. Heinrich, and Wm. R. Wharton were elected members.

Dr. H. Halloway, of Laporte, Ind.; Dr. Robt. Wiedersheim, of Freiburg i. B.; Carl Semper, of Würzburg; Chas. Brongniart, of Paris; and George Bowdler Buckton, of Weycombe, Haslemere, England, were elected correspondents.

The following was ordered to be printed:—

THE SIGNIFICANCE OF THE DIAMETERS OF THE INCISORS IN RODENTS.

BY JNO. A. RYDER.

Upon making sections of the cutting or incisor teeth of various species of rodents and rodent-like animals, it is observed that a great disparity exists amongst the various forms in respect to the ratio of the antero-posterior to their transverse diameters. This character is sufficiently marked to divide the order into two sharply-defined groups as follows:—

a Incisors wider than thick;[1]
b " thicker than wide.

A number of species falling under the definition of group *a* may be arranged in a series in which the final terms approach group *b*, thus, *Mesotherium*, *Lepus*, *Lagomys*, and *Phascolomys*, the marsupial. In the same way, a series may be arranged which shall represent a gradual intensification of the character as indicated in the definition of group *b*, thus, *Castor*, *Lagostomus*, *Cavia*, *Mus*, *Calamodon*, and *Anchippodus*, amongst Tæniodonts; *Sciurus* and *Cheiromys*, amongst primates. The curvature of the upper incisors in group *a* is greater than in *b*, that is, an arc which will coincide with their curvature is the segment of a smaller circle; in both groups the curvature of the lower incisors is less than that of the upper ones. In the last and extreme type of group *a*, the antero-posterior diameter of the lower inner incisor is to its transverse as 1 is to 3; conversely, in the extreme forms of group *b*, the antero-posterior diameter very greatly exceeds the transverse, the ratios being as 3, or even more, is to 1. These contrasts become visually apparent in the cut, where the diagrams of cross-sections of incisors of rodents and rodent-like animals all stand in the same position with reference to fore and aft and lateral directions.

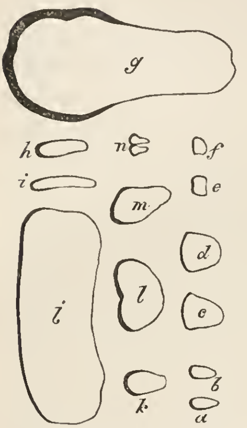
The two groups may be further distinguished as follows:—

a Gnawing apparatus not so powerfully developed or specialized;
Temporal muscles feeble, or inserted very close to condyles;
Crowns of incisors widely separated from pterygoid processes;
Incisive alveoli extending as far as, or a little further back than, the symphysis mandibuli.

[1] This grouping, it should be remembered, is entirely morphological.

b Gnawers of hard substances; incisors greatly developed;
Temporal muscles and pterygoid processes strongly developed;
Crowns of incisors relatively near pterygoid processes;
(Masseters greatly developed, *Castor*);
Incisive alveoli extending beyond symphysis mandibuli, and often reaching to the base of the pterygoid processes.

The diametrically opposite structural characters pointed out signify more or less diametrically opposite habits. The genera of group *a* have relatively weak incisors as compared with those of *b*, which is in obvious correlation with the feebleness with which they manifest the gnawing habit. Whatever may have been the ways in which the incisors of *Mesotherium* were used, it is very evident that they could never have been used in the same way as those of the squirrel and beaver. They appear to have been wholly adapted for cropping herbage, and not in the slightest degree for gnawing. The *Leporidæ* and *Lagomyidæ* with their feeble incisors have also a very moderately developed gnawing habit, which is in accordance with the weakness of their incisive mechanism. The presence of an accessory pair of incisors of weaker development in the lower jaw of *Mesotherium* and in the upper jaw of the *Leporidæ* and *Lagomyidæ*, the deciduous outer, upper, and lower pairs in *Cheiromys*, the apparent continuity of the incisive with the molar series in the *Tæniodonta*, give us a hint as to the probable manner in which the evolution and functionalization of the median anterior pair of teeth (incisors) came about in the gnawers and aberrant gnawing forms of other orders.



a, cross-section of a lower, *b*, of an upper, incisor of the squirrel; *c*, do. of a lower, and *d*, of an upper, incisor of the beaver; *e*, do. of an upper, and *f*, of a lower, incisor of the hare; *g*, cross-section of a lower incisor of *Calamodon simplex* (after Cope); *h*, do. of an upper, and *i*, of a lower, incisor of *Cheiromys*; *j*, do. of an upper incisor of *Mesotherium cristatum*; *k*, do. of an upper incisor of *Cœlogenys*; *l*, do. of an upper incisor of *Hydrochœrus*; *m*, the form of the obliquely worn face of an upper incisor of *Phascolomys*; *n*, cross-section of both upper incisors of *Cavia aperea*. The anterior portions of the sections look towards the left hand.

It may be said, in a general way, that the excess of the antero-posterior diameter of the chisel-like incisors of group *b* over their transverse one is in obvious correlation with the hardness of the substances which they are designed to cut. The illustrations which verify this assumption are sufficiently striking to make the principle clear. I will cite but four. The beaver is notorious for the magnitude of the work he will accomplish with his busy jaws and incisor teeth, which are in the form of curved, subtriangular prisms: a form well adapted to secure strength, and frequently met with amongst the cavies, porcupines, and chinchillas, though, in the latter, a cross-section often approaches more the form of an isosceles triangle with its most acute angle pointing in a backward direction. This form of tooth, of course, has the same mechanical advantages to resist breaking strains as that with the sides nearly parallel, as in the squirrel. Incisor teeth, pyriform in section, are found in the guinea-pig and the fossil Tæniodont *Calamodon;* this, like the last, has similar mechanical advantages. The squirrel,[1] with its power of gnawing the exceedingly hard covering of nuts to obtain their nutritious contents, is a second familiar example. The destructive abilities of mice and rats are due to the form of their incisors and powerful masseter muscles. Lastly, *Cheiromys*, the insectivorous lemurine primate, beaver-like, gnaws open the burrow of its prey, the larvæ of wood-boring insects. The incisors of this group, constructed, as they are, with reference to the use of the least amount of material, are still further strengthened by their form; that is, they are curved in such a way as to cause the lines of greatest strain to pass longitudinally through a great part of the mass of the tooth. This end is attained in the beaver and squirrel by an admirable arrangement of the masseter muscles, the fibres of which are disposed in lines parallel to that of the greatest strain exerted upon the lower incisors. This arrangement of muscular fibres also admits of the application of the

[1] One African species is reported as gnawing ivory, by M. Du Chaillu, but only on the authority of the natives. He has named it on this account *Sciurus eborivorus* (see Proc. Boston Soc. Nat. Hist. vol. vii. p. 363). Prof. Cope informs me that, on the plains, the fallen antlers of deer are gnawed by rodents; and some assert that they are entirely eaten up in this way, which is held to account for the infrequency with which they are ound where many thousands are annually shed.

whole of their power without mechanical loss, which would not be the case did not such parallelism exist. Whatever strain passes transversely through the teeth, and which may more properly be regarded as breaking strain, must pass through their long diameter; in this way the same mechanical advantage is secured as where a builder places a horizontal beam in such a position that the greatest strain shall fall through its greatest diameter.

The foregoing facts may then be interpreted thus :—

1. Where the incisors are wider than thick, the gnawing habit is feebly developed.

2. Where the incisors are thicker than wide, the gnawing habit is greatly developed.

That is to say, a certain manner of using the incisor teeth (to gnaw) has been a continuous stimulus to which growth force has been as continuously responsive. The opposite forms of development have thus been the result of stimuli differing in kind and degree. According to this view, plastids are brought in increased numbers wherever an increased amount of work is to be done, while at the same time an increased waste of structure is going on, solely by the operation of the above causes, while those causes are in and of themselves wholly passive. Illustrations immediately occur to us where we have the working of such principles displayed: in muscular work, *massage* and alterations in the form of parts due to the establishment of new and approximately normal relations with the environment, as happens in unreduced dislocations and fractures; the thickening of the epidermis of the knee, as on the sole of the foot, and due, like the last, to frequent and similar contact with the earth as a passive stimulus.

The significance of accessory rudimentary incisors present in some forms of true rodents, as pointing to the manner in which the evolution of the rodent type of dentition took place, may be overrated, yet, when it is borne in mind that in other groups the appearance of diastemata between the different kinds of teeth took place gradually, and in a way which unmistakably shows the gradual steps of the process, we may be excused for thinking the same to have been the case here, although without positive, tangible evidence in the shape of intermediate fossil forms that exhibit such a passage from the ordinary type. We have four instances pointing towards a progressive functionalization of the median pair of incisors as gnawing teeth, and this, taken together with the evidence yielded by their forms in section, induces us to venture the reflection that the more severe strains to which they were subjected by enforced or intelligently assumed changes of habit were the initiatory agents in causing them to assume their present forms—such forms as were best adapted to resist great strain without breaking. I am aware that this relation between function and structure, in the case of the incisors of rodents, has been pointed out long since, but it seems to have been coldly received by most anatomists, perhaps because not in accordance with the theory of special creations. Not wishing to discuss the merits of such an objection, it seems to us far more reasonable to believe that organisms are gradually shaped (modified, transmuted) by forces under the surveillance of an orderly reign of law, *i.e.*, to a series of mechanical causes producing morphological effects, than to resort to an endless chain of special expedients to account for the facts.

In respect to the changes in the mandibular articulation and muscular motor apparatus of the jaws of *Rodentia*, I venture to suggest that these have had an origin similarly due to enforced or intelligently assumed changes in the mode in which their functions were exercised. The molar teeth have also been modified by the same agency, as will be shown elsewhere.

DECEMBER 4.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

On the Introduction and Disappearance of Plants.—Mr. ISAAC C. MARTINDALE spoke of the appearance of plants in certain localities, where, heretofore, they had not been detected, and of their disappearance from sections where formerly they were quite plentiful. He stated that *Pinus mitis* was at one time abundant in this region, and extended northward into New England; but that it was believed now to have entirely disappeared from its northern localities, and it was thought by some persons to have disappeared from New Jersey also; he had, however, detected one tree near Gloucester City the past summer, and had recently found on a high edge of ground near Moorestown a strip of woodland, which contained a large number of trees, nearly all of which were from eighty to one hundred feet in height, and eighteen inches or more in diameter at the base; a few trees of the same species were growing in an adjoining field, where, the owner of the land informed him, grain had been harvested in the early part of the present century, showing the growth of wood to have been very rapid. On examining these trees he found evidence of a periodicity in their fruiting; it being well known that the species of pines in this section require two years to perfect their fruit. This year a considerable number of cones had set on the branches, but those which formed last year, and were now full grown, were very few indeed, and the mass of cones which were first noticed were chiefly those which matured last year or before, and had long since opened and discharged all of their seed. As is well understood among farmers and nurserymen, apple-trees do not produce abundantly every year, but seem to have periods of great fruitfulness. He thought a similar condition existed in *Pinus mitis*, which might be offered as one reason for its gradual disappearance, it being evident in view of the doctrine of "the survival of the fittest" that a tree which formed fruit once in two years, which fruit required two years to come to maturity, could not maintain a position as if the conditions were otherwise. Should any of the occurrences of early or late frosts, severe drought, an extreme degree of rain-fall, prevail on the fruit-bearing years, which would not be an unusual thing, it is apparent that the chances of perpetuating its kind would be lessened in a corresponding degree. As evidence of these conditions having to some extent existed in the past he found that but very few of the seeds which have been perfected had germinated so as to produce young trees; the greater part of the trees now standing appeared to be on the decline, and when they are gone there is but little to build a hope on for a succession of the same species.

Circumspection of Ants.—Professor LEIDY remarked that, a number of years ago, he had been led to an observation on the little red ant, sometimes a great pest to our dwellings, which would indicate a ready disposition to become circumspect. When he purchased his present residence, while it was undergoing some repairs, he noticed a fragment of bread, left by a workman in one of the second-story rooms, swarming with ants. Apprehending that the house was seriously infested, to ascertain whether it was so he placed a piece of sweet cake in every room from the cellar to the attic. At noon every piece was found covered with ants. Having provided a cup of turpentine oil, each piece was picked up with forceps and the ants tapped into the oil. The cake was replaced, and in the evening was again found covered with ants. The same process was gone through the following two days, morning, noon, and night. The third day the number of ants had greatly diminished, and on the fourth there were none. He at first supposed the ants had all been destroyed, but in the attic he observed a few feasting on some dead house flies, which led him to suspect that the remaining ants had become suspicious of the sweet cake. He accordingly distributed through the house pieces of bacon, which were afterwards found swarming with ants. This was repeated with the same result for several days, when, in like manner with the cake, the ants finally ceased to visit the bacon. Pieces of cheese were next tried, with the same results; but with an undoubted thinning in the multitude of ants. When the cheese proved no longer attractive, recollecting the feast on dead flies in the attic, dead grasshoppers were supplied from the garden. These, again, proved too much for the ants; and, after a few days' trial, neither grasshoppers nor anything else attracted them; they appear to have been thoroughly exterminated, nor has the house since been infested with them.

DECEMBER 11

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-six members present.

DECEMBER 18.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The death of John McAllister, Jr., was announced.

A Dog with Supernumerary Toes.—Mr. RYDER remarked that he had recently seen a dog with five toes on both hind feet, but upon a careful examination it was found that the metatarsals of the extra inner toes were entirely absent, there being no apparent vestige of a metapodial ossification in the pouch of skin that supported the distal ungual bone with its nail and that connected these with the tarsus. They seemed to hang rather loosely, and to be rather in the way than of any use. In the absence of metatarsals, and indeed of all appearance of ossifications, except the ungual ones, they differed from somewhat similar abnormal conformations of feet in dogs, figured in DeBlainville's *Osteographie*, where one is represented with six toes, there being two extra inner ones.

Rhizopods in an Apple-tree.—Professor LEIDY remarked that, a couple of weeks ago, at Swarthmore, while waiting for the railway train to return home, his attention was attracted to a large apple-tree which, shortly before, had been prostrated by a storm. In the fork of the trunk there was a bunch of moss which he collected and took home. On washing the moss and examining the water, he was not a little surprised to find in it many rhizopods. Of these, one was *Difflugia cassis*, and was abundant. Another was *Difflugia globularis*, few in number. The others were *Trinema acinus*, *Euglypha alveolata*, and *Euglypha brunnea*. The position of these animals, in the moss on the tree, was about eight feet from the ground.

DECEMBER 25.

The President, Dr. RUSCHENBERGER, in the chair.

Fifty-five members present.

The following reports were read and referred to the Publication Committee:—

REPORT OF THE PRESIDENT FOR THE YEAR ENDING NOVEMBER 30, 1877.

It is well known that the Academy of Natural Sciences of Philadelphia had its origin in an opinion of its founders that the association of those disposed to devote their spare hours to a study of natural objects and the laws under which they exist, would be advantageous to all who might engage in it. Their purpose was to form a society composed of persons who desired to acquire knowledge, and impart it to each other and the public. The founders believed that a union of those whose tastes were alike in this sense would be a source from which each member might derive something which, separately, they might not be able to gain. Any one desirous to learn, or willing to assist others to learn, was, and is still, considered eligible to membership; no degree of proficiency in natural science was or is an essential qualification.

The Society assumed the name of Academy because it signifies a place to learn, a school, a resort of learners.

From its foundation the Academy began to form a library and collections of natural objects for the common use of its members, as well as of others interested in the acquisition and diffusion of knowledge of the works of the creation. To acquire and increase the means of facilitating the labors of students has always been a primary object. Its members are all volunteers, willing to give money, or time, or labor for the advancement of the common cause. The work they have done has always been spontaneous, self-imposed, and, in its ultimate object, benevolent and charitable, if it be charitable to add to the stock of knowledge for the free and common use of mankind.

Very many are indebted to this Academy for initiation into paths which have conducted them to distinguished positions in scientific explorations and surveys, in colleges and universities, positions which they might not have been able to qualify themselves to fill without those facilities of study which this institution affords freely to young aspirants. A list of names of those who have become distinguished naturalists through the agency of this Society, would indicate the extent of benefit it has conferred in this sense.

That the course heretofore pursued by the Academy has been generally satisfactory is proved by the liberal contributions of materials and money which it has received from time to time from very many of our public-spirited fellow citizens. It seems reasonable to suppose that observance of the general policy which has been successful in the past is calculated to secure the confidence and encouragement of the public in the future, upon which the continued prosperity of the society mainly depends.

I have the pleasure to state that during the past year the general progress of the Academy has been steady, tranquil, and satisfactory. The attendance at the stated meetings indicates that interest in scientific investigations has not abated. The average number of members present at each meeting through the year is thirty-two. The extent and value of work done by the members may be fairly estimated by reference to the published record of Proceedings.

Through exchanges with kindred societies, the liberality of authors and editors, and the beneficence of the I. V. Williamson Library Fund, and the Thomas B. Wilson Library Fund, numerous and valuable additions to the library have been made. The number of members and others who consult the library, it is believed, has increased.

More than five thousand persons, besides those introduced by members or otherwise, have visited the museum, to which many valuable gifts have been made.

The steady growth of the museum clearly indicates that the building should be completed as soon as practicable. In this connection a committee was appointed in February to apply to the State of Pennsylvania for assistance. The application made was not successful, but it is hoped that at the approaching session of the Legislature the claims of the Academy to the fostering care of the State will be favorably considered.

I respectfully suggest that the invitation given last December to the executive officers of the State and members of the Legislature individually to visit the museum and library as frequently during the year as might be agreeable to them, should be renewed, that they may have opportunity to become acquainted with the character of the institution by personal observation.

The officers and members of the Zoological Society of Philadelphia have been invited to participate in the proceedings at the stated meetings of the Academy whenever they might desire to submit for consideration any subject of zoological interest.

At the stated meeting of the Council in April, Dr. J. Gibbons Hunt, on the unanimous nomination of the Biological and Microscopic Section of the Academy, was duly elected Professor of Histology and Microscopic Technology.

Early in May, Professor Hunt formed a small class, and delivered a course of lectures which were well received; the fees paid on account of them were not equal to the necessary expenditure.

This experiment has demonstrated, in my opinion, that the scheme of establishing professorships and systematic teaching in connection with them, cannot be realized until endowments sufficient to defray incidental expenses and compensate the professors have been provided. The purpose of the proposed professorships is to enable the incumbents of them to devote their whole time to advance the interests of science by taking entire charge of the collections pertinent to their respective departments, by engaging in original research, and by giving systematic courses of instruction. To enable them to do this, they should receive compensation sufficient to render them independent of any other employment for a livelihood. Persons properly qualified to fill these proposed positions are not likely to be engaged at an annual salary of less than from two to three thousand dollars. It is vain to expect the plan to be realized, desirable as it is, until ample means are provided.

The Sections of the Academy are now performing some of the duties assigned by the By-laws to the professors. They relieve the Curators of the details of arrangement and classification of those departments of the museum which are appropriate to their respective pursuits.

In January the Mineralogical Section, and in February the Physics and Chemistry Section were formed and accepted by the Academy.

At present there are six Sections of the Academy, namely—

The Biological and Microscopic Section.

The Conchological Section.

The Entomological Section.

The Botanical Section.

The Mineralogical Section.

The Physics and Chemistry Section.

A list of the members and correspondents of the Academy, made up to June 30, 1877, has been printed and distributed. Although unusual care was taken in the preparation of this list, it is not presumed to be free from errors. Probably there are names misspelled, some omitted, and some retained which should not be.

On the 30th of June, 1877, it is believed the number of living members was 835, and, as far as ascertained, the number of living correspondents 507. Of these, 297 are foreign, and 210 are residents of the United States.

During the year 43 members have been elected, 18 have resigned, and 12 have died, indicating an increase of 13 members.

The number of correspondents elected during the same period is 71. The death of 7 has been reported. It is conjectured, however, that some have died whose demise has not been communicated to the Society.

The attention of members and correspondents is respectfully invited to this list, and they are requested to report to the Recording or to the Corresponding Secretary such errors as they may discover in it. If they will report also changes of residence or post-office address they will contribute largely towards rendering future editions of the list accurate.

The Biological and Microscopic Section of the Academy held an annual exhibition on Monday evening, November 19th. About 300 objects were shown under 120 microscopes, many of which are remarkable for perfection of construction. The museum was open on the occasion. It is estimated that not less than 3000 visitors were present during the evening.

The financial condition of the Society is always interesting. I have the pleasure to state that at present the Academy is free of debt. But its resources do not insure its freedom from pecuniary inconvenience, nor authorize indifference to the ways and means of providing sufficiently for future wants.

It is well known that the origin, progress, and present condition of the society are due to the benevolence and charity of many intelligent and liberal individuals exerted in its favor in the course of the past sixty-five years. All the possessions of the institution are from charity, and they are all used for the charitable purpose of increasing and diffusing knowledge of the natural sciences.

The library and museum have acquired such sturdy proportions that their preservation and maintenance require now a very considerable annual expenditure, which must increase with their growth. Properly cataloguing the continuous additions to the library, and promptly mounting, labelling, and displaying specimens in the museum as fast as presented, can no longer be safely confided to volunteer and gratuitous labor alone. There is constant occupation for two or more experts, for whom a reasonable compensation is essential.

Janitors must be paid. Fuel, light, water-rent, freight, stationery, repairs, etc. etc., amount to a considerable sum in the aggregate.

Exclusive of trust and special funds, the semi-annual dues of members and the small fee demanded from the general public for admission to the museum are the chief resources of the Academy. They have not been equal to the current expenses of the year.

The Council has not been inattentive to the Academy's pecuniary condition. As precautionary measures the current expenses were carefully examined and reduced as much as was deemed fairly practicable; and a circular was addressed to the members individually, asking contributions towards raising means to meet an estimated deficiency. This appeal has been liberally answered by the generous, and it is confidently believed that all demands against the Society will be promptly satisfied.

Measures should be devised to avoid the necessity of resorting to such expedients in the next and subsequent years. It is possible that annual appeals for help may weary the community. The ordinary income should at least equal, if not exceed, the necessary expenditure.

Exclusive of the expenditures on account of increase of the library, and the publication of the Journal and Proceedings of the Academy, the annual expenses necessarily exceed $5000.

The estimated annual income is—

From members' dues	$2890
" initiation fees	300
" admission to the museum	500
" Thos. B. Wilson fund, towards librarian's salary	300
	$3990

The annual income is not uniformly equal. Some members have failed to pay their dues for this year, and some for several years past, a failure which may be possibly ascribed in part to the general stagnation of business that has so long prevailed in the community.

It is presumed that the dues required from members, if punctually paid, will defray the current expenses, and enable the Academy to secure to them the privileges of membership without additional liability. Life-members, that is, those who commute the semi-annual dues by a single payment, are entitled to the same privileges.

If all members were to avail themselves of the right to become life-members, an important source of income would become extinguished, and, for a time, the Academy might find it difficult, if not impossible, to provide the ways and means to meet its necessary expenses. But it would not be released from its implied obligation to members to secure to them their stipulated privileges (By-laws, Chapter IX.).

The economical or personal advantages of life-membership become apparent from an examination of the list of members. The cost of a life-membership is equivalent to the payment of ten years' dues.

The printed list shows that—

5	have been	members	between 60 and 65 years.
10	"	"	50 " 60 "
15	"	"	40 " 50 "
29	"	"	30 " 40 "
124	"	"	20 " 30 "
285	"	"	10 " 20 "
367	"	"	10 and less.

Four hundred and sixty-eight members, or more than one-half of the whole number, have survived their election considerably beyond ten years.

The advantage of life-membership is so evident, that it may be expected that all who are able will avail themselves of it. As long as the moneys received for life-memberships are securely funded they are no less advantageous to the Academy than to the member. If spent as fast as paid they serve to diminish an important source of revenue without lessening the expenditure, or obligations of the Academy to its members.

Prior to May, 1876, moneys received for life-memberships were expended. At that time a by-law was enacted which directs that they shall be funded. It is evident that a perennial income of five or six per cent. from a fee of life-membership securely invested is fully equivalent to the semi-annual dues, the payment of which necessarily ceases on the resignation or death of the member. Had the Academy been able to invest all fees for life-membership paid since its origin, a fund would have been accumulated by this time, the income from which would be sufficient to render appeals to members for aid to meet current expenses unnecessary.

There is a hope of pecuniary comfort in the future. It is estimated that at least eight life-memberships will be paid every year, and that the fund arising therefrom will ultimately yield sufficient to relieve the Society from the difficulty of paying its current expenses.

It may be considered expedient at a future time to invest the initiation fees with the life-memberships, and, in this manner, create a curator's fund.

In conclusion, I recommend members not to rely exclusively on the State to supply means to complete the building. The building-fund at this time amounts to $2083. It is believed that, notwithstanding the unpropitious condition of the times, continuous efforts by the members and friends of the Academy to procure individual contributions to the fund will secure its growth until it is sufficient to warrant resumption of the work of construction. Perseverance generally leads to success in every laudable enterprise: let us hope that it may not be wanting or fail in this one.

Respectfully submitted,

W. S. W. Ruschenberger,
President.

REPORT OF RECORDING SECRETARY.

The Recording Secretary respectfully reports that during the year ending Nov. 30, 1877, forty-three members and seventy-one correspondents were elected.

Eighteen members resigned, as follows: C. H. Howell, F. W. J. Wylie, De Forrest Willard, E. K. Tryon, Jr., J. J. Sinnickson, C. P. Sinnickson, T. Sinnickson, Jr., John Thompson, Christian Febiger, G. A. Nicholls, B. A. Lewis, H. H. Smith, James Tyson, B. B. Comegys, J. E. Mears, J. W. Leeds, and W. H. Castle.

The deaths of twelve members and seven correspondents were announced. They have been duly recorded in the published proceedings.

Twenty-nine papers have been presented for publication, as follows: E. Goldsmith 3, Rev. H. C. McCook 2, John A. Ryder 2, D. S. Jordan 2, D. S. Jordan and C. H. Gilbert 1, D. S. Jordan and A. W. Brayton 1, Jacob Ennis 1, Jas. Lewis 1, E. D. Cope 1, T. A. Conrad 1, H. W. Henshaw 1, M. C. Cooke 1, Isaac Burk 1, A. W. Vodges 1, Geo. Hay 1, Wm. F. Bundy 1, Theo. Gill and J. F. Bransford 1, W. H. Dall 1, H. C. Yarrow 1, Burt G. Wilder 1, J. A. Allen 1, Theo. D. Rand 1, John Ford 1, and Wm. G. Mazyck 1. Twenty-eight of these have been printed in the Proceedings, and one remains to be reported on.

One hundred and seventy-six pages of the Proceedings for 1876, and two hundred and eighty pages for 1877 have been issued, the former being illustrated by eleven plain, and the latter by one plain and one colored lithograph.

There were but two meetings during the year at which verbal communications were not made. The speakers were Messrs. Leidy, McCook, Meehan, Koenig, Cope, Blake, Goldsmith, Willcox, Vaux, Frazer, Young, Coates, Martindale, Foote, Hawkins, Chapman, Leconte, Cross, Morris, Redfield, Haldeman, Chatard, Ashburner, Rothrock, Brown, Lawrence Smith, Dougherty, Hunt, Rand, Ford, Chase, Peale, Ennis, McQuillen, Ryder, Thomas, A. H. Smith, Trotter, Reed, Jeanes, Lewis, and others. The more important of these communications have been reported for the Proceedings and published.

Art. VIII., Chapter I., of the By-laws was amended by the addition of the words, "Provided that no Professor or Assistant Professor in the Academy shall occupy the position of Councillor —those who are ex-officio members of Council excepted."

Twenty-nine complete sets of Mr. Isaac Lea's valuable publications on Conchology and Geology, and about 332 surplus volumes of his "Observations on the Genus Unio," have been presented to the Society by the author. Mr. Charles F. Parker has carefully arranged the loose sheets and plates of which this valuable gift was composed into volumes, and they have been added to the list of publications offered for sale by the Academy.

Dr. J. G. Hunt having resigned from the Council in consequence of his election to the position of Professor of Histology and Microscopic Technology, Mr. S. Fisher Corlies was elected to fill the vacancy on May 29.

All of which is respectfully submitted.

EDWARD J. NOLAN.

REPORT OF CORRESPONDING SECRETARY.

The Corresponding Secretary makes the following report of the business of his office during the past year, ending Nov. 30, 1877.

Letters of transmission from other societies or bodies	56
Letters of acknowledgment	61
Miscellaneous correspondence	21
Acknowledgments from correspondents	20
Letters written by order of the Academy	4
Correspondents notified of their election	77
Acknowledgments for donations to Museum	218

In addition to the above mentioned, numerous letters of a trivial nature have been received and answered, containing inquiries concerning admission to the museum, others offering valueless curiosities for sale at immense prices, and so on. These have not been brought before the Academy for obvious reasons. There have also been received a number of pamphlets and volumes from correspondents, all of which have been placed in the library.

The following letters have been received acknowledging the receipt of Journal and Proceedings.

Jan. 2. Cincinnati Society of Nat. Hist.
Museum of Comp. Zoology, Cambridge, Mass.
American Antiquarian Society, New York.

Jan. 9. Cincinnati Society of Nat. Hist.
Yale College Library.
Jan. 23. Royal University Library, Strasburg.
Poughkeepsie Society of Nat. Hist.
Royal Bavarian Academy, Munich.
Literary and Philosophical Society of Liverpool.
Royal University of Würzburg.
Royal Society of Sciences of Upsal.
Jan. 30. Imperial Botanical Garden, St. Petersburg, Russia.
Heidelburg University.
Feb. 13. California Academy of Sciences.
Feb. 20. Franklin Institute acknowledging loan for Centennial Exhibition.
Mar. 20. Chicago Acad. Sciences.
Mar. 27. American Geographical Society, New York.
University of the State of New York.
Society of Natural History and Medicine, Giessen.
April 3. Natural History Society of Basel.
California Academy of Sciences.
Royal Society of Sciences, Göttingen.
Royal Danish Academy of Sciences, Copenhagen.
April 10. Royal Botanic Garden, Edinburgh.
April 24. Brazilian Legation, New York.
Boston Society of Nat. Hist.
May 22. Smithsonian Institution.
May 29. Royal Grand Ducal Institute of Luxembourg.
Royal Society of London; asking for supply of deficiencies.
May 1. Yale College Library.
June 19. Edinburgh Geological Society.
Royal Society of Edinburgh.
Statistical Society, London.
June 26. Belfast Natural History and Philos. Soc.
July 3. Buffalo Society of Natural Sciences.
Royal Superior Technical Institute of Milan.
July 17. Mus. Comp. Zoology, Cambridge.
July 3. Royal Bohemian Society of Sciences of Prague; asks deficiencies.
July 10. Academy of Natural Sciences, Catania.
July 17. Linnæan Society of Bordeaux; asks deficiencies.
Quarterly Journal of Conchology.
July 24. Royal Norwegian Society of Sciences of Throndhjem.
July 31. Chicago Academy of Sciences.
Aug. 7. Royal Society of New South Wales.
Royal Geological Society of Ireland.
Aug. 14. Museum of Natural History of Carinthia.
Smithsonian Institution, Washington.
Aug. 28. British Museum, London.
South African Museum, Cape Town.

Aug. 28 Yale College Library.
California Academy of Sciences.
Sept. 11. Royal Society of New South Wales; asks exchange.
Oct. 2. Royal Academy, Palermo.
Society for Promotion of Scientific Research, Hamburg.
Oct. 16. Academy of Science and Literature of Montpellier; asks deficiencies.
Natural History Society, Dantzig.
Natural History Society, Frankfurt a. M.
Natural History Society, Augsburg.
Society for Native Natural History, Württemburg.
Oct. 30. New Zealand Institute.
Nov. 13. Royal Society of Edinburgh.
Nov. 27. Worcester Lyceum of Nat. Hist.
Natural History Society of Freiburg.
Academia Regia Lynceorum, Rome.
Royal Society of New South Wales.
Yale College Library.
Museum Teyler, Harlem.

The following letters announce the sending of publications to the Academy.

Jan. 23. Ksl. Leop. Carol. Acad., Dresden; asks for deficiencies.
Board of Direction of the Ferdinandeum at Inspruck.
Royal Bavarian Acad., Munich.
Acad. of Science and Letters of Montpellier, France; asks deficiencies.
Royal Society of Sciences, Upsal.
Manchester Literary and Philos. Society; asks deficiencies.
Jan. 30. Imperial Botanical Garden, St. Petersburg, Russia.
Royal Society of New South Wales, Sydney.
Portuguese Centennial Commission; asks exchange.
Feb. 6. West Riding Geological and Polytechnic Soc., England.
British Museum, London, Eng.
Mar. 6. Department of State, Washington, sending "the Draining of Lake Fucino," accomplished by H. E. Prince Alex. Torlonio, Rome, 1876.
April 3. Linnæan Society of Bordeaux.
Natural History Society of Toulouse, France.
National Society of Agriculture, Nat. Hist., and Useful Arts, Lyons, France; asks deficiencies.
Society of Natural History and Medicine, Gęissen.
Royal Academy of Sciences of Vienna.
Natural History Society of Halle.
Natural History Society of Hamburg.
Physico-Medical Society of Erlangen.

April 24. Royal Academy of Sciences, Vienna.
May 1. Academy of Natural Sciences, Catania, sending a memorial diploma, and medal.
British Museum, London, Eng.
May 8. Society for the Encouragement of Horticulture, Berlin.
May 22. Medical Society of Frankfurt a. M.
Belgian Microscopical Society; desires exchanges.
Natural History Society of Leipzig.
Royal Academy of Sciences of Amsterdam.
Catholic University of Louvain; returns a duplicate.
Ksl. Leop. Carol. Acad.; desires deficiencies.
July 3. K. K. Geological Botanical Society of Vienna.
July 10. Ksl. Leop. Carol. Academy of Dresden.
Geological Society of India.
July 17. Society for the Diffusion of a Knowledge of Natural History, Vienna.
July 3. Royal Bohemian Society of Sciences of Prague.
July 24. Royal Norwegian University of Christiania.
Natural History Society of Bamberg.
July 31. Netherland Zoological Society.
British Museum, London.
Aug. 14. Museum of Natural History of Carinthia.
Sept. 11. Royal Society of New South Wales.
Secretary of State of New Hampshire.
Oct. 16. Academy of Science and Literature, Montpellier.
National Museum, Mexico.
California Geological Society sends specimens.
Natural History Society, Dantzig.
Bavarian Academy of Sciences, announcing also the discontinuance of a publication.
Royal Academy, Stockholm.
Royal Hungarian Society, Budapest.
Norwegian Museum.
Natural History Society, Frankfurt a. M.
Royal Zoological Society, Amsterdam.
Society for Native Natural History, Württemburg.
Oct. 23. Dorpat Natural History Society.
K. K. Zoological Botanical Society, Vienna.
Physical Central Observatory, St. Petersburg.
Nov. 27. Batavian Society of Experimental Philosophy, Rotterdam.
Zoological Mineralogical Society, Regensburg.
Medical Society of Frankfurt a. M.
Natural History Society of Toulouse.
Academia Regia Lynceorum, Rome.
Natural History Society, Freiburg.

Miscellaneous Correspondence received:—

Feb. 6. National Institute of France, desiring deficiencies.
Feb. 16. Marshal J. Burdge, Allamuchy, N. J., making general inquiries.
Feb. 27. Emmet Crawford, Lieut. U. S. A., desiring advantages of Museum.
Natural History Club, Vienna, notice of formation.
Zoological Society of Philadelphia, thanks for invitation.
Mar. 6. Dr. Emil Bessels, Washington, concerning Eskimo skulls.
Chas. A. Kesselmyer, concerning Calendarium Perpetuum Mobile.
Mar. 20. J. G. Cooper, M.D., Cal., offering sale of specimens.
Royal Academy of Sciences, Berlin, desiring missing volumes.
May 1. Wisconsin Academy of Sciences, desiring to receive exchanges.
May 15. Royal Botanic Garden of Edinburgh, desiring exchange.
Thos. M. Brewer, of Boston, desires publications for the Museo Civico di Storia Naturali di Genoa.
June 5. Chas. A. B. Hall, Ann Arbor, Mich., regarding Woodruff Expedition.
June 12. Harvey Fisher, Philadelphia, concerning certificate.
Royal University of Strasburg, desiring deficiencies.
July 17. John W. Taylor, Leeds, Eng., desiring certain publications.
July 24. Zoological and Botanical Society of Helsingfors, desiring exchange.
Sept. 13. S. Brusina, Agram, Austria, desiring certain papers.
Prof. Percival de Loriol, Geneva, concerning diploma.
Royal Zool. Soc. Amsterdam, desiring deficiencies.
Nov. 13. Dr. H. Scheffler, Braunschweig, sending publications.
Nov. 27. Publishers of Obst- und Garten-Zeiting, asking exchange in 1878.
Central Meteorological Observatory, Mexico, asking exchange.
Geological Reichsanstalt, Vienna, asking deficiencies.
Prof. Thos. R. Fraser, correcting an error in list of Correspondents.

Letters, acknowledging election as Correspondents, have been received from:—

Prof. Dr. P. Groth, Strasburg, Dec. 17, 1876.
N. S. Maskelyne, London, Dec. 20, 1876.
George Rolleston, Oxford, Eng., Dec. 29, 1876.
Juan J. Marin, Philadelphia, Feb. 7, 1877.
Dom Pedro D'Alcantara, New York, March 20, 1877, by A. P. de Carvalho Borges.
Lieut. A. W. Vodges, Charleston, April 8, 1877.
L. G. de Koninck, Liege, April 23, 1877.
Prof. Alphonse Favre, Geneva, April 23, 1877.
Percival de Loriol, Geneva, April 22, 1877.
Lieut.-General A. Gadolin, St. Petersburg.
H. Trautschold, Moscow.
A. S. Packard, Jr., M.D., Salem, Mass., May 10, 1877.

Valerian von Möller, May 3, 1877.
L. Rütimeyer, Basel, May 12, 1877.
N. de Kokscharow, St. Petersburg, May 19, 1877.
E. Desor, Neuchatel, June 1, 1877.
Baron Ferdinand von Richthofen, Berlin, June 10, 1877.
Dr. F. von Hochstetter, Vienna, June 25, 1877.
Daniel C. Eaton, New Haven, Oct. 26, 1877.
A. M. Owen, M.D., U. S. N., Aug. 22, 1877.
Andrew Murray, London, Oct. 30, 1877.
Dr. Philip de la Harpe, Lausanne, Oct. 31, 1877.
P. Martin Duncan, London, Nov 1, 1877.
Edw. von Mojcisovics, Vienna, Nov. 4, 1877.
John W. Judd, London, Oct. 31, 1877.
J. Gosselet, Lille, Nov. 13, 1877.
J. J. Collenot, Semur, Nov. 3, 1877.
W. Boyd Dawkins, Manchester, Nov. 7, 1877.
Franz Toula, Vienna, Nov. 1, 1877.
William Whitaker, London, Nov. 7, 1877.
Prof. J. G. Rein, Marburg, Oct. 31, 1877.
Dionys Stur, Vienna, Nov. 1, 1877.
J. Bastian, Berlin, Nov. 3, 1877.
Dr. Carl Arendts, Munich, Nov. 12, 1877.
Count August Frederic Marschall, Vienna, Nov. 3, 1877.
Henri Coquand, Marseilles, Nov. 13, 1877.

Respectfully submitted,

GEORGE H. HORN, M.D.,

Corresponding Secretary.

REPORT OF THE LIBRARIAN.

I had the pleasure of announcing in my last annual report that the number of additions to the library for the year ending Nov. 30, 1876, was greater than that of any other year with one exception. The record for the twelve months ending Nov. 30, 1877, shows a still greater increase, the additions during that period numbering 2698, or 207 more than were received in 1876.

Of these accessions 849 were volumes, 1839 pamphlets and parts of periodicals, and 10 maps, charts, photographs, etc.; 2049 were octavos, 540 quartos, 51 duodecimos, and 48 folios.

They were derived from the following sources:—

I. V. Williamson Fund	787	Heirs of the late Dr. Jos. Carson	195
Societies	712	Wilson Fund	79
Editors	439	Rathmell Wilson	67
Authors	216	Connarroe Fund	33

H. C. Coates	23	U. S. Commission of Fish and Fisheries	2
Department of the Interior	22	Messrs. Walch & Son	2
Publishers	9	Dr. Geo. Bennett	1
Portuguese Centennial Commission.	9	Jas. L. Claghorn	1
Minister of Public Instruction, Spain	8	The late T. A. Conrad	1
Laurenço Malheiro	7	Corporation of the City of Launcestown	1
Treasury Department	7	Department of Agriculture	1
War Department	7	T. F. Dibbs	1
Minister of Public Works, in France	6	S. A. Forbes	1
Same, through W. S. Vaux	9	Dr. Alfred Fricke	1
Isaac Burk	5	Geological Survey of N. Hampshire	1
F. V. Hayden	5	Geological Survey of Spain	1
Smithsonian Institution	5	Government of Victoria	1
F. B. Hough	4	H. M. Hull	1
Geological Survey of Penna.	4	Chas. S. Keyser	1
Mexican Government	4	Geo. W. Lawrence	1
New South Wales Centennial Commission	4	W. Moore	1
Bureau of Education	3	E. C. Nowell	1
British Museum	2	Messrs. Pawson & Nicholson	1
G. H. Cook	2	The late J. S. Phillips	1
Dr. G. M. Levette	2	A. Randall	1
J. H. Redfield	2	W. C. Stevenson	1
Tasmanian House of Assembly	2	The late Robert Swift	1

They were divided as follows:—

Journals	1575	Mineralogy	19
Geology	207	Physical Science	15
Botany	182	Medicine	13
General Natural History	168	Anthropology	11
Conchology	107	Helminthology	11
Entomology	96	Ichthyology	11
Voyages and Travels	71	Agriculture	10
Bibliography	58	Mammalogy	8
Ornithology	46	Herpetology	6
Chemistry	44	Encyclopædias	3
Anatomy and Physiology	37		

In addition to the prompt arrangement and cataloguing of the accessions, the card catalogue of the works on Voyages and Travels, with copious cross references, has been completed, and more than three-fourths of the books included in the department of General Natural History have been catalogued in the same way. It was hoped that the work in the latter department would be finished, but the entire lack of clerical assistance during the greater part of the year, together with the comparatively short time at my disposal after the performance of the routine duties of the library, has made this impossible. Mr. Thos. P. Parker has affixed numbers to all the books catalogued, with neatness and accuracy.

It will be observed that the I. V. Williamson Fund has furnished the largest number of additions received during the year from any one source. Many of the works so obtained are indispensable to the working naturalist, and but few of them can be referred to in any other library in the city.

A few popular books of travel and general natural history have been obtained by means of the Conarroe Fund arising from the sale of publications given to the Academy by Geo. M. Conarroe, and the income of the Wilson Fund has been devoted as heretofore to the purchase of the continuations of the valuable works subscribed for on behalf of the Academy by the late Dr. Thomas B. Wilson.

Among the special donations during the year, the most important have been the valuable selection from the library of the late Dr. Jos. Carson, presented by his children Hampton L., Ann C., and Susan Carson, and a portion of the library of the late Dr. Thomas B. Wilson, presented by his brother, Mr. Rathmell Wilson. The former included a copy of the Cavendish Society's edition of Gmelin's Handbook of Chemistry, and several other valuable chemical works, together with a large number of volumes on Materia Medica and general botany not before in the possession of the Society. Mr. Wilson's donation was especially important, from the fact that it contained several parts required to complete volumes which had been formerly presented by Dr. Wilson and which remained incomplete at the time of his death.

Sixty-eight letters have been written applying for deficiencies in periodicals, and in addition, propositions to exchange have been sent to the editor of every new scientific journal noted during the year. The answers have been numerous, and for the most part satisfactory; and it is hoped in time to obtain, either by exchange or purchase, complete sets of all journals not at present in the library.

In consequence of the necessity for the strictest economy in the management of the library, as well as all other departments of the Academy, only those books which would be damaged if left unbound have been sent to the binders. These have included the journals most constantly referred to, and a few other volumes received from the publishers in numbers.

A fine portrait in oil of the President of the Academy, Dr. W. S. W. Ruschenberger, was presented by Mr. Wm. P. Jenks, for which very acceptable gift the thanks of the Society were voted to the donor.

All of which is respectfully submitted.

EDW. J. NOLAN,
Librarian.

REPORT OF THE CURATORS.

The museum of the Academy is in an excellent state of preservation, and in an advanced condition of systematic arrangement. I present a report from Mr. C. F. Parker, the Curator in charge of the museum, of the work done during the year.

PHILADELPHIA, Dec. 8, 1877.

DR. JOS. LEIDY,
Chairman of Board of Curators A. N. S.

DEAR SIR: I herewith inclose the following report of work done in the museum:—

Mr. John A. Ryder has made a catalogue of the mammalia in the museum of the Academy, founded on Dr. Slack's catalogue (Gill's classification being adopted). He has also labelled the crania and osteological collections of bats, rodents, edentates, marsupials, and monotremes, besides the series of crania and horns that are placed around the galleries of the museum.

With the assistance of Mr. Ryder the collection of Ophidia has been undergoing a thorough overhauling, the alcohol has been renewed when necessary, the bottles washed, and new labels written, all old labels being preserved, especially those in the handwriting of distinguished herpetologists who formerly devoted attention to this department of our collection. Seventeen families have been worked over, or about three-fourths of the entire collection. The donations which have been accumulating for some years, have also been distributed in the collection in proper systematic order. Many of these prove to be desiderata to the already large collection.

The collection of Chelonia has also been labelled and arranged during the year; it is found to embrace seven families of sixty-five species, represented by about four hundred and fifty specimens.

The collections illustrating the osteology of the Chelonia, Ophidia, and Sauria have also been labelled.

A considerable number of large labels for the more striking objects in the vertebrate palæontological collections have been prepared and put in place.

The collection of mammal skins has been examined.

The whole collection of birds has been thoroughly examined and dusted, and is generally in good condition.

Mr. W. G. Freedly has finished the arrangement and labelling of the collection of birds' eggs.

The collection of sponges sent to Prof. Hyatt for study has been returned, and has since been labelled and arranged.

The cases in the Museum have all been secured, as far as possible, against dust, by the addition to the doors of strips of list. The greater part of this very necessary work was performed by Mr. Thos. P. Parker.

Most of the specimens given, deposited, and purchased during the year have been labelled, and put in their proper places.

The collection of minerals is being rearranged, and labelled according to the classification of Dana. C. F. PARKER.

Special reports on the additions and improvements to the conchological, botanical, and mineralogical cabinets, will be presented by the sections who have them in their special care.

Additions to the remaining departments of the Academy during the year are as follow:—

Mammals.—Mounted specimens of Phalangista vulpina, and Ornithorhynchus anatus, and skin of Belideus, from Tasmania, presented by W. H. Archer.

Sixteen skins, from Brazil, presented by Dr. José de Saldanha. Reindeer antlers, Cumberland Inlet, from Lieut. W. A. Mintzer. Leather of Kangaroo, Tasmania, from S. Arnett.

Mounted specimen of the Spitz dog. Mrs. John B. Nimex.

Scotophilus cinereus, from J. O. Schimmel; Hesperomys leucopus and Condylura cristata, from Geo. Raphael. Tooth of Sperm whale, from Mrs. Paul Shirley; skull of new-born Donkey, by J. A. Ryder; and a fœtal Calf, by John Winter. Numerous samples of wools, produced in Tasmania, presented by the exhibitors of the International Exhibition of 1876.

Birds—Platycercus cyanopygus, Australia, from the Zoological Society of Philadelphia; Conurus solstitialis, Demerara, from S. S. Haldeman; three mounted Cupidonia cupido and Buteo virginianus, from T. R. Peale; mounted Meleagris gallopavo, crested variety, from J. O. Schimmel; and Speotyto cunicularia, from E. H. Peabody.

Twenty-three species of birds' eggs, from Beesley's Point, N. J., from Caleb Wood; eleven species from another donor; eggs of Crax alector and Callipsittacus novæ-hollandiæ, from G. Pavonarius; Ostrich egg, from Michael C. Carey; specimens from Mrs.

Paul Shirley; and the malformed genitals of a fowl, from P. B. Mingle.

Reptiles, Amphibians, and Fishes.—Four skins of reptiles, Brazil, from Dr. José de Saldanha; a small collection of reptiles, Florida, from Lieut. A. W. Vogdes; Iguana, St. Andrews, from Albert S. Duer; and turtle eggs, Delaware, from G. Freyer. Spelerpes ruber, from W. F. Marshall. Small collection of fishes and reptiles, San Domingo, from W. M. Gabb.

Seventy-seven species of fishes, chiefly from east coast of United States, from the National Museum, through the Smithsonian Institution.

Specimens of the viviparous fish, Zygonectes Notii, Mobile, from Dr. G. H. Masten. An Eel-pout, Zoarces anguillaris, east coast, from G. W. Bugbee & Co.; and a second from Wm. Liming. Two fishes, Bermuda, from P. J. Lauber; Lepidosteus, Delaware Bay, from Mr. Holbrook; Tetrodon laevigatus, N. J., from Dr. Kingston Goddard; and a skeleton of a fish, Chimbote Bay, S. A., from Dr. J. T. Coates.

Articulates.—Seventy-one species of spiders, mostly of Pennsylvania, and a collection illustrating the habits of the American Tarantula, and the architecture, etc., of other spiders, presented, under certain conditions, by Rev. H. C. McCook. Scorpions, Florida, from Lieut. A. W. Vogdes. Cenobita Diogenes, Turk's Island, from Wm. M. Gabb; Limulus polyphemus, Key West, from Dr. G. R. B. Horner; and Menippe mercenaria, east coast, from Wm. Liming. Fulgora lanternera, Brazil, from T. C. Bond; and Gryllotalpa longipennis, from R. W. Merrill. Hornet's nest, from A. T. Goodman; and bark of Hickory mined by Scolytus quadrispinosis, from Dr. E. C. Evans. Cocoons and raw silk, and wax, Peru, from José Carlos Tracy; and Cochineal, reared at Cape Town, from J. McGibbon.

Radiates and Protozoans.—Fourteen sponges, from Florida, in exchange from the Boston Society of Natural History. Corals and hydroids, dredged off Florida, from Lieut. A. W. Vogdes. Coral, Bermuda, from H. A. Slocum.

Fossils.—A human skeleton, together with other bones, teeth, and shells, from a shell-mound at Tampa, Florida, presented by Lieut. A. W. Vogdes.

Eozoon Canadense, from the Laurentian limestone of Canada, from the Geological Survey of Canada through W. C. Stevenson.

Four fossil fishes from the tertiary of Wyoming, presented by Joseph Jeanes.

Fragment of jaw, tooth, and two vertebræ of Mosasaurus; eighteen vertebræ of crocodile; marginal bone of a turtle, and fragments of a fish jaw; and a fossil sponge from the marl and cretaceous limestone of New Jersey, presented by Col. T. M. Bryan.

Ten fossils, mostly Ammonites, from Chili, in exchange from Prof. Domeyko.

Incisor of Kangaroos and Canine of Diprotodon, Queensland, from Dr. Geo. Bennett.

Several molars of Rhinoceros, Colorado, from Dr. Jos. Leidy.

Twenty-eight Upper Silurian fossils, Dudley, England, from T. A. Conrad.

Six Devonian fossils, Richmond, Ind.; a fossil plant, foot track, and rain drop markings, from the triassic shales, Bucks County, Pa., presented by Dr. G. T. Heston.

Shark tooth and a bone, marl of Fostertown, N. J., from H. M. Potts; three reptile bones, N. J., from R. H. Nash; two teeth of Mosasaurus, Lumberton, N. J., from Elwood K. Phillips; and Idonearca, Barnesboro, N. J., from Charles Berry.

Carboniferous fossils, Arkansas, from W. E. Rowell; large coral fossil, Pa., from W. S. Vaux; and Polypodium Hochsteteri and fossil shells, from H. W. Mitchell.

Three samples of Diatomaceous earth, California, from the California State Geological Society.

Two cetacean vertebræ, Ashley R., S. C., from Philip Wineman; and fragment of antler, same locality, from C. S. Bement.

Thirteen species fresh water shells, lignite, and calcaneum of Canis, from bluff on Mississippi, near Alton, Ill.; several fossils from Cuba, and others from East Park, Philadelphia, presented by John Ford.

Two Streptelasma corniculum, near Clifton, England, from Fanning C. Tucker; petrified wood, Launcestown, Tasmania, from A. Harrap; cast of spine of Edestus, Collinsville, Ill., from Dr. G. Hambach; and photograph of skull of Bison latifrons, from Cincinnati Society of Natural History.

Ethnological and Miscellaneous.—The interesting and valuable collection, illustrating the stone age, made by the late Franklin Peale, and bequeathed by him to the American Philosophical

Society, has been deposited in the Academy, on condition of being returned on demand.

A colleetion of wearing apparel, colleeted during the years 1838–42 in the Hawaiian, Society, Samoan, and other Pacific Islands, mostly made from bark of the paper mulberry, Broussonetia papyrifera, consisting of the following: 27 tapa dresses, mostly Hawaiian, 4 bed curtains, 3 marros or waist-cloths, 7 mats, Hawaiian and Samoan, 2 pieces of imprinted tapa, 1 oiled bark cloth and a table cover, a number of waist ribbons and imitation shawls, 2 Samoan fishing dresses, made of the leaves of the Dracæna or dragon tree, 2 work-bags, 4 sehool satchels, 2 poi bowls, an ava bowl used in making the intoxicating drink of the Pacific Islands; a fine specimen of the native New Zealand dress, made of Phormium tenax and dog's hair, Fiji nose flute, pandean pipes from Samoa, a kris from the Sooloo Islands, aneient fly-brush, royal Hawaiian necklace, an apparatus used by the natives to catch fish, stamp used in printing tapa, Hawaiian and Samoan fishing lines, sennit of three kinds, tortoise shell bracelet from Hawii, Tahitian drinking cup made of a cocoanut, Hawaiian quoit and an ancient mirror, gourd containing the perfumed oil with which the Tahitians anoint themselves, dagger from King's Mill Islands, go-go or soap bark from the Phillipines, specimens of the ava root (Piper methistieum), Hawaiian and Samoan necklace, money bag from New Granada, doll dressed in the costume worn by the ladies of Lima about 1840, and various other artieles, presented by Titian R. Peale.

Eight specimens of stone implements, from Chester County, Pa., from E. A. Barber.

Native Indian bows and arrows, Central America, from S. S. Haldeman.

A large terra-cotta water filter, presented by Dr. J. M. de Silva Coutinho.

Spurs worn by the "Guasos," of Chili, in 1826, rowel 4 inches in diameter, from Dr. Rusehenberger.

Indian relics, stone muller for grinding pigments, from Joseph Willcox.

Esquimo fishhook from Ivigtut, Greenland, from Lieut. W. A. Mintzer.

Model of Parthenon, Athens; model of pyramid of Cheops, made from the original stone; Japanese pillow and slippers; native bows and arrows, Sandwich Islands; Malay dirk; clay lamp from Egyptian tomb; brick from the great wall of China, presented by Mrs. Paul Shirley.

Stone implements, consisting of chisels, arrowheads, ornaments, fragments of pottery, etc., from the banks of the Susquehanna near Lewisburg, Union County, Pa., from C. T. Grier.

Pottery, arrowheads from a shell mound at Tampa, Florida, from Lieut. A. W. Vogdes.

One skeleton (adult) one ditto (child), and nine skulls from Peru, presented by Dr. C. A. Siegfried, U. S. N.

Specimen of carved stone pipe from North Western America, from C. S. Bement.

Indian pestle, found on a farm in Bushkill Township, Pike County, Pa., from Maxwell Somerville.

A skull and human bones taken from an Indian mound five miles northwest of Shipman, Ill., Oct. 1875, also shells, pottery, etc. Stone axe from the face of a cutting for a roadway in the outer margin of the Mississippi River, one mile above Alton, Ill. Stone axe from Macoupin County, Ill. Stone axe from near Norristown, Montgomery County, Pa.; six arrowheads from Ohio, three ditto from Illinois, and two from Indiana, presented by John Ford.

Respectfully submitted by

JOSEPH LEIDY,
Chairman of Curators.

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION.

The year just closed has witnessed a marked improvement in the interest manifested in this Section, evinced both in the more liberal display of microscopical objects and the increased number of communications upon allied subjects, which have had the gratifying effect of largely augmenting the attendance upon the meetings. This latter condition has also been contributed to by a modification of the By-laws providing that the meetings of the Section shall be held semi-monthly instead of monthly; while the labors of a business committee, appointed to provide and arrange material for the meetings, have been so efficiently performed that the Section takes pleasure in also recognizing that influence.

Early in the year the Section was called upon to fill vacancies occurring in two of its most important offices, Dr. Ruschenberger having resigned from the directorship, and Dr. Richardson from that of Recorder; the regrets of the Section at this unexpected change was expressed in resolutions of thanks (ordered to be placed on the minutes) to these gentlemen, for the faithful and long-continued discharge of their duties.

Dr. R. S. Kenderdine for Director, and Dr. Carl Seiler for Recorder were elected to fill the vacancies for the unexpired term. Subsequently the Vice-Director and three other members tendered their resignations, all of which were accepted upon the usual conditions. A member was lost in consequence of being dropped from the Academy's list.

This withdrawal of original members has been in numbers more than compensated for by the election of eight active members and the addition of four assoeiates.

A book has been provided by the Curator for the purpose of keeping therein a record of the successful methods of preparing microscopic objects, that the members may have the opportunity of aiding each other in their work.

Six papers have been read before the Section, five of which have been published in periodicals.

Their titles were as follows:—

"Post Centennial Microscopic Notes," by Dr. J. G. Hunt; "Staining and Mounting Animal Tissues," by Dr. Carl Seiler; "Late Improvements in Microscopes," by Mr. Jos. Zentmayer; "Observations upon the Life and Habitat of the Melicerta and Limnias," by Dr. C. N. Peirce; "Eucalyptus Oils," by Thomas Taylor; "Origin and Development of Deciduous and Permanent Teeth," illustrated by sections, and drawings, by Dr. J. H. McQuillen; one lecture on "Some Analogies between Animal and Vegetable Tissues," by Dr. J. G. Hunt; "An Exhibition with the Gas Microscope," by Dr. Reed.

Five verbal communications on "The Reproduetion of Plants and especially of the Spyrogara Dubia" were given by Dr. J. G. Hunt; one on a "New Self-Centering Turntable," by Mr. Jos. Zentmayer; one on "Physalia and its Lasso Cells," by Capt. Mortimer; one on a "New Histological Stand," of his invention, by Mr. Jos. Zentmayer; and remarks upon Baush & Lomb's New Microscope, by Dr. J. G. Hunt. These essays and communications presented as they were with microscopic illustrations, wherever practicable, elicited much interesting and instructive discussion, participated in by many of the members.

On November 19th the annual microscopical exhibition was held, the museum and adjoining rooms being opened and lighted for the reception and better accommodation of our invited guests. At an early hour the members of the Academy never before witnessed so large and interested an audience (numbering near three thousand) as was assembled within its building. Nor did our friends and visitors ever have the pleasure of viewing a more liberal and beautiful display of microscopes and microscopical objects than was on that occasion presented.

Our Director, Dr. Kenderdine, welcomed the audience with some appropriate remarks, in which pertinent allusion was made to the advanced step in education, which had been so largely contributed to by microscopists in urging the importance of educating the eye to observe.

In this necessarily abridged and imperfect sketch of the work and progress of the Section during the past year we see that much yet remains to be done to increase its efficiency and interest; but with what has been accomplished in this department of science, we are warranted in believing that with our present knowledge and growing opportunities we shall recognize the interest awakened as permanent, and that the future will be not less fruitful in results than the past has been.

The officers elected to serve for the ensuing year are as follows:—

Director	Dr. R. S. Kenderdine.
Vice-Director . . .	Dr. J. H. McQuillen.
Recorder	Dr. Carl Seiler.
Corresponding Secretary .	Dr. C. N. Peirce.
Treasurer	Dr. Isaac Norris.
Conservator . . .	Dr. J. G. Hunt.
Curators	Dr. Charles Schaffer,
	Charles Zentmayer.

C. Seiler,
Recorder.

REPORT OF THE CONCHOLOGICAL SECTION.

The Recorder of the Conchological Section respectfully reports that during 1877 papers have been accepted and published in the Proceedings of the Academy of Natural Sciences, aggregating 106 pages, by authors as follows:—

William H. Dall,	40 pages.	William M. Gabb,	51 pages.
Jas. Lewis, M.D.	11 "	T. A. Conrad,	4 "

During the year the Section has lost by death several of its most useful collaborators. Principal among these was our fellow-member Timothy A. Conrad, who, although not a regular attendant at our meetings, was actively engaged in furnishing papers and illustrations for the American Journal of Conchology from its commencement to its discontinuance. He also contributed to the Academy's Proceedings almost up to the time of his death, and always took great interest in our welfare.

We have also lost two valued correspondents, John G. Anthony, of Cambridge, Mass., and Dr. P. P. Carpenter, of Montreal, Canada.

Mr. Anthony was for many years interested in our fluviatile mollusca. He was a man of liberal ideas, and was ever ready to lend a helping hand to all seeking information, whether the beginner or the more advanced student.

Dr. Carpenter's specialty was the study of the marine mollusks of the West Coast of North America. Both were zealous contributors to our museum, our library, and our publications.

From the report of our Conservator we find that during the year ending Dec. 1st, 1877, 831 species, numbering 2923 specimens have been added to our collection. He says "among the most important of these accessions are:—

"1392 specimens of 355 species of California shells collected by Henry Hemphill, including many rare and minute forms mostly new to our collection, and all from authentic localities.

"243 specimens of 83 species of Polynesian mollusks and shells collected by the Godeffroy expeditions. Most of these are alcoholic specimens, and all are new to the collection. Both the above were purchased from moneys obtained by the sale of duplicates from the collection of the late John S. Phillips, and his name has accordingly been placed on the labels as donor.

"Dr. Isaac Lea has generously given us his entire collection of Unionidæ in alcohol, comprising, in forty large jars, 972 specimens of 234 species. This collection is very valuable from the fact that it includes the types of nearly all the descriptions of the soft parts of Unionidæ described by Dr. Lea.

"The Liverpool Free Public Museum and Library has sent us 50 species, principally of *Oliva* and *Nassa*, including authentic specimens of a considerable number of the species described by Mr. F. P. Marrat, who has made the study of these genera a specialty."

The museum work for the year aggregates as follows:—

New additions	831	trays and labels,	2,923	specimens.
Completion of the arrangement of selections from the Phillips collection	449	" "	1,531	"
The Robert Swift collection has been arranged as far as the end of the marine and fluviatile univalves	2831	" "	10,883	"
Total	4111	" "	15,337	"

The Section is again under great obligations to Mr. Charles F. Parker, who has carefully cleansed and mounted for us the whole of the above, principally during hours for which he is not compensated by the Academy as one of its curators. It is the donation to us of the labor of many days. Our collection now contains about 30,000 trays and 100,000 specimens. Your Conservator availed himself, during a visit to Europe the past summer, of an opportunity to institute a comparison between our Conchological cabinet and that of the British Museum in London, and gives the following figures as approximately correct.

The Academy's collection occupies about 2600 square feet in glass cases, and 2000 square feet arranged under glass in drawers, accessible to the public. Total, say 4600 square feet.

The British Museum collection is contained in 48 cases, about 4 x 7 feet each, say 1350 square feet in all. A conchologist familiar with this collection stated that it is principally contained in the glass cases, the exceptions being mostly among the land shells, of which many are in drawers. It would appear from these figures that our collection is at least double in size that of the British Museum, which has usually been regarded as the largest conchological cabinet in the world.

The officers of the Section for 1878 are—

Director	W. S. W. Ruschenberger.
Vice-Director . . .	William M. Gabb.
Recorder	S. Raymond Roberts.
Secretary	Rev. E. R. Beadle.
Treasurer . . .	William L. Mactier.
Librarian	Edward J. Nolan.
Conservator . . .	George W. Tryon, Jr.

Respectfully submitted,

S. Raymond Roberts,

Recorder.

The following are the additions to the Conchological Museum received during the year:—

Rev. E. R. Beadle. *Helix intorta*, Sowb., var. *Liguus flammea*, *L. picta*, var. *Tapes æquilatera*.

A fine *Panopæa glycimeris* (dredged alive).

R. I. Betz. *Teredo navalis*, from Atlantic City, N. J.

Thomas Bland. A number of land and marine shells from the Bahamas, including *Helix Milleri*, *H. provisoria*, *Pupa Martensi*, *Cerithium septemstriatum*, *Egeta Floridana*, *Cryptogramma flexuosa*, etc.

Twelve species of *Bulimus*, etc., collected by A. Agassiz in Peru. Thirteen species of *Pupa*, *Realia*, etc., from Mauritius. Nine species fresh-water shells from Mexico.

T. M. Bryan. *Leucocheila marginata*, from Vincenttown, N. J.

W. W. Calkins. Thirteen species of marine shells from Florida and Bahamas.

H. C. Coates. A small collection of shells from the Cape of Good Hope.

W. Doherty. *Pupa Cincinnatiensis*, Judge, from Cincinnati, O. *Somatogyrus aureus*, Tryon, from Kentucky.

John Ford. *Triton Tranquebaricum.* Land and fresh water shells from the Bluff at Alton, Ills.

Wm. M. Gabb. Fifteen species of land and marine shells from St. Domingo. A large number of specimens of eleven species of land and marine shells from Turk's Island.

Mr. Holbrook. Number of specimens of *Mytilus edulis*.

Ernest Ingersoll. *Planorbis plexatus*, Ingersoll, from St. Mary's Lake, Colorado.

Isaac Lea. Forty jars of Unionidæ in alcohol, 257 species.

Joseph Leidy. Remarkable specimen of *Strombus gigas*.

Liverpool Free Public Museum and Library. Fifty species of marine shells. (In exchange.)

E. R. Mayo. Thirteen marine species from the Coast of Massachusetts.

H. W. Mitchell. *Mytilus latus*, Lam., from New Zealand.

Chas. C. Phillips. Eighty-three specimens of twenty-one species of marine and land shells from the Gaboon Coast, Western Africa.

John S. Phillips' Fund. Eleven species from various localities.

A California collection of 355 species, numerous specimens.

Eighty-three species, principally in alcohol, collected by the Godeffroy expeditions in Central Polynesia.

Rutgers College. Four species of marine shells from Japan. (Exchange.)

Mrs. Paul Shirley. Two fine specimens of *Oliva porphyria*.

D. B. Smith. *Cassis tuberosa*, Lam. Young.

A. A. Wright. *Hemifusus elongatus*, Lam., and *Pecten superbus*, Sowb.

REPORT OF THE CONSERVATOR OF ENTOMOLOGICAL SECTION.

The Recorder of the Entomological Section of the Academy takes pleasure in presenting to you a brief abstract of the transactions of the Section during the year just closing.

The Section at the present time numbers twenty-five members; no new members have been elected during the past year.

Nine monthly meetings have been held during the year, at which there has been an average attendance of seven members.

The meetings of the Section are held on the second Friday of each month, excepting in July and December.

Entomological papers intended for publication in the Transactions of the American Entomological Society are read at the meetings of the Section and referred to a publication committee, one portion of which is elected by the Society and the other portion by the Section.

During the year fifteen entomological papers have been passed upon affirmatively by this committee. Within the same time the committee has superintended the publication of 414 pages and 10 plates, finishing one volume, while another volume will soon be closed.

The library of the Entomological Section has been rearranged and catalogued during the year, and is now open to the common use of the members of the Academy.

The Society during the year has added several valuable works to its library, by purchase and otherwise.

The collections have been greatly improved both in condition and number of specimens. In June last the sum of $125 was voted to the Curators, for the special improvement of the collection of Hymenoptera; and that branch of the collection is at the present time the best in the country.

The collections of Coleoptera and Lepidoptera have been carefully gone over, and all the drawers containing the same thoroughly disinfected. The Curators are now engaged in the work of rearranging these orders, and hope to have the same finished in a short time.

As the great object is to secure, so far as may be possible, the best specimens, and as much matter is constantly accumulating in the hands of the Curators, they will endeavor to cull therefrom all worthless matter and use only such as will enhance the scientific value of the collection.

The cabinets are at all times open to inspection, under the supervision of the Curators.

It is hoped by the close of the coming year the collection will be in such a condition as will make it still further in advance of any similar collection in the United States.

At the meeting held December 10, 1877, the following gentlemen were elected officers for the year 1878:—

Director	John L. LeConte, M.D.
Vice-Director	George H. Horn, M.D.
Recorder	J. H. Ridings.
Treasurer	E. T. Cresson.

Publication Committee . . .	E. T. Cresson,
	J. L. LeConte, M.D.,
	Chas. Wilt,
	George H Horn, M.D.,
	C. A. Blake.

All of which is respectfully submitted.

J. H. Ridings, *Recorder.*

REPORT OF THE BOTANICAL SECTION.

Since the last—our first annual report—our meetings have been held regularly. Seven members of the Academy have been received into the Section during the year, making the total number of members of the Section twenty-nine.

The only paper of general interest submitted to the Section was the List of Ballast Plants made by Mr. Isaac Burk, and which has been published in the Proceedings of the Academy. At every meeting verbal communications of much interest to specialists in various branches of botany have been made by Messrs. W. M. Canby, J. H. Redfield, J. A. Ryder, Thomas Meehan, Isaac Burk, J. C. Martindale, and Prof. Rothrock.

Numerous additions to the herbarium have been made through the Section as per report annexed.

The Conservator's report to the Section is of such general interest that it is submitted herewith entire.

The Treasurer's report shows that all the expenses of the Section have been kept within its income.

The officers elected to serve for the ensuing year are as follows:—

Director	Dr. W. S. W. Ruschenberger.
Vice-Director	Thomas Meehan.
Conservator	J. H. Redfield.
Recorder	Isaac Burk.
Secretary	Dr. J. H. Leffman.
Treasurer	J. O. Schimmel.

Respectfully submitted.

Thomas Meehan,
Vice-Director.

Conservator's Report.—At the date of the last report of the Conservator to the Botanical Section of the Academy, the organization of the Section had but recently been perfected by the appointment of its committees and the allotment of their duties. As was then evident, the work which lay before the Committee on the Academy's herbarium was mainly that of completing its new arrangement, and of providing for ready and convenient access to each species of the large collection therein contained. This work has proved no slight task, but it has been vigorously prosecuted in both departments, viz., that of the General Herbarium and that of the N. American. In the former, tablets have been prepared for the several Natural Orders as far as to the end of the Monopelatous Division of the Exogenous Plants; these tablets showing at a glance the proper position of the order, and the genera referred to it; and, in the larger orders, presenting also an alphabetical index to the synonyms. In both departments, covers of stiff Manilla paper have been prepared and inscribed for the several genera, numbered to correspond with the "Genera Plantarum" of Bentham and Hooker, the latest and best authority for systematic arrangement. It is estimated that above 4000 of these covers have been thus used, and probably 2000 more will be needed to complete the work.

The Conservator and the Herbarium Committee have in this labor received most essential aid from Mr. Charles F. Parker, who, after the hours devoted to his regular duties in the Academy, has given his time to the covering of the tablets, and the inscribing of the genus-covers. Mr. Burk has been constant and industrious in carrying on the arrangement of the N. American Herbarium, while our Vice-Director, Mr. Meehan, has had the more delicate task of deciding difficult points in the determination of species. The sub-committee on duplicates have carried on their work of culling and selection, *pari passu*, with the other labor.

A few months more will complete the general arrangement, and the Conservator and the Herbarium Committee will then be able to turn their attention to the work of cataloguing the collection, of noting its wants, and of establishing correspondence for the purpose of procuring deficiencies. Something has already been done in this direction, and correspondence has been opened with botanists in Brazil, Venezuela, and Syria, which will result, it is believed, in benefit to the Academy.

Although so much has been accomplished during the year by volunteer laborers, who, from love of the science, have given such time as could be spared from other duties, it has become more and more evident that there is before us a vast amount of labor, in the way of careful revision and elaboration of species, and the proper mounting of plants, to which volunteer force is inadequate; and we look forward with hope to the day when the public spirit of our community shall sufficiently endow the Academy to enable it to secure the constant work of a competent botanist, and of an expert mechanical assistant. In no other way can our large collection be properly cared for, or be made to yield its full measure of utility.

Allusion has been made above to our North American Herbarium. Our lamented fellow member, Mr. Durand, spent many years in selecting from the general collection materials for the formation of a special herbarium to illustrate the Flora of N. America. The material for this purpose was ample, and of peculiar value, because it largely consisted of plants collected by Schweinitz, Pursh, Nuttall, Baldwin, Oakes, Torrey, Leconte, and others, many of which were type specimens of the early describers, to which have been added from time to time the later acquisitions made by government and individual explorations in our Western Territories. The convenience and value of such a collection cannot be questioned, and accordingly it has been partially provided for in our upper or working-room, where also is stored the valuable and splendidly mounted herbarium of the late Dr. Short. But to complete its proper arrangement we need an additional case of the same size and style as the two now appropriated to the purpose, and it is hoped that the Academy will find means to provide this needed accommodation.

John H. Redfield,
Conservator.

Additions to Botanical Museum and Herbarium, 1877.

Feb. Wm. M. Canby, Wilmington, N. C.; a series of specimens of *Darlingtonia Californica*, Torr., from Northern California, and a specimen of *Canbya candida*, Parry, from San Bernadino Co., California.

P. V. Leroy, Torrey Herbarium, N. Y.; *Primula suffrutescens*, Gray, from Sierra Nevada, California.

Dr. Asa Gray, Cambridge, Mass.; 13 species of exotic plants, and 2 of Californian plants; mostly new to us.

Rev. E. W. Hervey, through J. C. Martindale; *Aster Herveyi*, Gr., from New Bedford, Mass.

March. Dr. C. C. Parry, Davenport, Iowa; polished section of the wood of *Cercocarpus ledifolius*, from S. Utah.

John H. Redfield; polished section of *Bauhinia*, from Brazil, and specimen of *Gymnostomum Brandegei*, a new moss from Colorado.

Thos. Meehan; *Peraphyllum ramosissimum*, Nutt, from Southern Utah; cones of *Pinus palustris*, from Florida.

Isaac Burk; capsule of a large species of *Bignonia;* fruits of *Anacardia orientale*, *Ophiocaryon paradoxum*, and *Gordonia pubescens*, and some other seeds.

April. José Carlos Tracy, Peruvian Commissioner to Centennial Exhibition; 57 species of Peruvian woods.

H. C. Coates, Commissioner from Cape Colony; 54 species of medicinal plants and drugs; 6 species of barks; and samples of vegetable wax from *Myrica cordifolia*, all from South Africa.

Miss Mary B. Rodney, through J. B. Rodney, Germantown, Phila.; "Plantæ Oregonensis," one volume containing 125 species of plants, collected in Oregon by the donor.

Mariano Bárcena, Mexican Commissioner; 47 jars of medicinal plants from Mexico.

Prof. Jos. T. Rothrock, Phila.; 8 species of plants from Arizona, all new to the Herbarium.

May. Prof. W. G. Farlow, Cambridge, Mass; Fungus (*Æcidium pyratum*) on *Pyrus angustifolium.*

Hugh M. Hull, Tasmanian Commissioner; 16 specimens of Tasmanian woods, and 16 samples of Tasmanian seeds, Hobart Town.

Geo. Kemfe; samples of wheat from Upper Bagdad.

C. A. Franklin; Sassafras bark (*Atherosperma*).

Dr. J. Coverdale; gelatinous sea-weed from Port Arthur, and jelly made from the same.

J. W. Graves; native bread (*Mylitta australis*) from Hobart Town.

Mrs. John Thomson; native bread (*Mylitta australis*), Cormiston.

Mrs. Mitchell (through Australian Commission); gum from the Oyster Bay Pine (*Callitris australis*).

Commissioners of Lunatic Asylum, Hobart Town; oil from the Blue Gum Tree, *Eucalyptus globulus*.

Mrs. Paul Shirley; cone of the Cedar of Lebanon.

H. W. Mitchell; leaves of *Phormium tenax*, Forst, with samples of rope, bags, and brushes made from same, Auckland, N. Z.

June. T. R. Peale; *Fucus*, Ocean Grove, N. J.

Sept. Wm. M. Canby, Wilmington, Del.; *Symplocos tinctoria*, L'Her, in fruit, from Sussex Co., Delaware.

John H. Redfield; 15 species of N. American Ferns, mostly new to our N. American Herbarium; also three species of Californian phænogamic plants.

Eugene E. Frank, Wilkesbarre, Pa.; *Botrychium Virginicum*, Fr.

Charles C. Cresson; Rare Fungus (*Cynophallus caninus*, Fr.), Wissahickon woods.

Oct. Department of Agriculture, Washington, D. C.; 420 species of plants, collected in Utah by Second Division of U. S. Geological and Geographical Survey of the Territories, Maj. J. W. Powell in charge; L. F. Ward, collector.

Also 72 species of plants collected in Alaska by W. H. Dall, and 30 species collected in the islands of the Pacific by the same.

C. G. Pringle, Charlotte, Va.; *Gentiana Amarella*, L., *var.* (*acuta* Mx.), from Smuggler's Notch, Mount Mansfield, Vt.

Capt. Robert Wiltbank; fruit of the Ivory-nut Palm (*Phytelephas macrocarpus*), from Cardeck R., coast of San Blas, U. S. of Colombia.

Hampton L., Ann C., and Susan Carson, heirs of the late Dr. Joseph Carson; the botanical collections of Dr. Carson, consisting of dried plants, barks, resins, seeds, etc.

Dec. Dr. Asa Gray, Cambridge, Mass.; 29 species of exotic plants, principally of the order *Sapotaceæ*, and mostly new to our collection; also 35 species of N. American plants, principally from California and Oregon.

REPORT OF THE MINERALOGICAL SECTION.

The Director of the Mineralogical Section of the Academy of Natural Sciences would respectfully report that the Section was organized April 24, 1877, and the following officers elected:—

Director	Theodore D. Rand.
Vice-Director	Wm. H. Dougherty.
Recorder	Henry C. Lewis.
Treasurer	William S. Vaux.
Secretary	Henry C. Lewis.
Conservator	Jos. Willcox.

Meetings have been held every month since that date, except during July and August; the attendance has been good and interest great. The accompanying report of the Conservator shows the work done, which, considering the shortness of the time, must be regarded as highly satisfactory. The appearance of that part of the collection which has been rearranged and relabeled, has been favorably noticed by many members of the Academy.

It is expected that a summary of the scientific work of the Section will be presented to the Academy for publication. The Section numbers nineteen members.

Respectfully submitted,

THEO. D. RAND,

Director.

Report of the Conservator.—Since my election to the office of Conservator, the most important work, under my supervision, has been the rearrangement and classification of the mineral collection of the Academy. On the authority of a resolution of the Section, the arrangement has been made according to the system adopted in the last edition of Prof. Dana's Mineralogy. This operation has been completed, and already some progress has been made in relabeling the specimens upon cards of uniform style; and it is expected that this work will be fully performed during the winter. It is proposed to put the specimens in paper trays of suitable size; and it has been ascertained that under this plan the minerals will not occupy a greater space than under the existing arrangement, while the attractiveness of the collection will be greatly increased.

The additions to the collection of minerals during the past year have been as great as usual, and satisfactory. Appended is a list of the donations.

Mr. H. C. Lewis has completed the optical examination of the micas in the collection of the Academy, and the divergence of the optic axes thus determined will be appended to the new labels. Much credit is due to Mr. Charles F. Parker for his industry and care in rearranging the mineral collection.

JOSEPH WILLCOX,
Conservator.

Additions to Mineralogical Cabinet.—E. R. Beadle, in exchange. Two specimens of Pyroxene, 1 Scapolite, Slate Nodules, and 2 Hornblendes, 1 Black Tourmaline, 1 Tremolite, 1 Albite (Peristerite), 1 Stilbite, 1 Kieserite, 1 Hæmatite, 1 Magnesite, 2 massive Apatites (Osteolite), 1 Titaniferous Iron, Apatite, Feldspar, etc., from various localites; Fibrous Gypsums, and Elaterite (Elastic Bitumen) from Derbyshire, England.

C. S. Bement. Twenty-five specimens of minerals from various localities, consisting of Corundum, Menaccanite, Perofskite, Gahnite, Franklinite, and Willemite, Rutile, Göethite, Limonite, Chalcophanite, Garnet, Scapolite, Tourmaline, Brewsterite, and Strontianite, Apatite, Apatite in Calcite, Apatite with so-called fused Quartz and Pyroxene, Vanadinite, Pyrrhotite, with Chalybite, and Mesitite, and Cerussite, etc.

Prof. W. P. Blake, on behalf of the National Museum. Specimen of flexible Sandstone (Itacolumite), from Stokes Co., N. C.

E. M. Bye. Slab of polished Serpentine, Harford Co., Md.

Dr. J. T. Coates. Volcanic Rock, from the crater of "Misti," Arequipa Volcano, from 18,600 feet elevation, Peru.

H. C. Coates, Cape of Good Hope Commission. A number of specimens of ores of copper, Galena, Manganese, Coal, etc., Cape of Good Hope.

Lieut. E. Crawford. A small collection of rock specimens from the Black Hills, Wyoming Territory.

Prof. Domeyko, on behalf of the Chilian Centennial Commission, in exchange. Mineral specimens consisting of Chrysocolla Erythrite, Atacamite, Malachite, Coquimbite, Proustite, Chalcophillite, Cerargyrite, Arquerite, Fibroferrite, Argentiferons Tetrahedrite; Oxide, Sulphides, and Silicate of Copper. A large number of specimens of minerals, ores, and rocks, including fine examples of Quartz Crystals, Copper, and Silver ores, Cobalt, Sulphur, Galena, Tremolite, Hornblende, Cinnabar, Azurite, Hayesine, Prowstite in Limestone, Aragonite, Salt, Native Arsenic, Philippite, Kronkite, Nitrate of Soda, Efflooresence from the Laguna of Maricunga, and fifty rock specimens. All from Chili, Peru, and Bolivia.

W. H. Dougherty. Native copper in the Hecla and Calumet Conglomerate, Houghton Co., Mich.; Chalcopyrite, Christiania, Norway.

W. D. Eyre. Asbestos with fibres $3\frac{3}{4}$ ft. long, Val Tellina, Piedmont.

John Ford. Two specimens of Peacock Anthracite, Schuylkill Co., Pa.

E. Goldsmith. Specimens of Triassic Coal, Montgomery Co., Pa.

H. A. Green. Aragonite and Calcite in Geode, Warsaw, Illinois.

Julian Gutierrez, through M. Bárcena. Slab of Travertine Limestone (Mexican Onyx), from the Tecali Quarries, Puebla, Mexico.

J. Hazard. Specimen of Drusy Quartz, from Mine La Motte, Mo.

J. Heistand. Two Stalactites, Middletown, Dauphin Co., Pa.

Russell Hill. Dolomite Actinolite, Magnetic Iron and Pyrites, Garnets in Mica Schist, from the Soapstone Quarry, Manayunk, Phila.

Jos. Jeanes. Two specimens of Amethyst, two of Quartz on Chalcedomy, three of Chalcedomy, one of Tufa, and specimens of Sulphur, all from the National Park, Montana.

W. W. Jeffries, in exchange. Kyanite, Margarite on Corundum, Aquacreptite, Amazon Stone, Lennilite, Hallite, Chesterlite, and Chromite in Serpentine, from Chester and Delaware Counties, Pa.; Asbestos, Phlogopite, Sandstone, Feldspar, from various localities of Arberton; Tourmaline, Kammererite, Fibrolite, Magnesite, Actinolite, Kyanite, and Quartz.

Dr. Linn. Specimen of Apatite, Schischimsk, Siberia.

H. C. Lewis. Ripple marks in Medina Sandstone (No. 4), Blackleg Gap, Huntingdon Co., Pa., and Siderite, Dunbar, Fayette Co., Pa.; Biotite, Darby Creek, Darby, Phila.; Lepidomelane, Frankford, Phila.

Dr. Jos. Leidy. Spinel in Chlorite, from Franklin, Macon Co., N. C. Light Brown Tourmaline, St. Lawrence Co., N. Y. Green Tourmaline in granite, Paris, Me. Two terminated Crystals of Topaz, from Minas-Gereas, Brazil. Two Crystals of Green Tourmaline; two terminated Crystals of the same; one terminated Crystal of Black Tourmaline; one Crystal of Tourmaline (Indicolite); one Crystal of Rubellite; one section of Crystal of Rubellite and Green Tourmaline, all from Villa Rica, Brazil. Red and Green Tourmaline, with Cookeite, in quartz, from Mt. Mica, Paris, Maine. Kyanite, from Delaware Co., Pa. Crystalline Slag, from Swedes' Furnace, Upper Merion, Montgomery Co., Pa. . Laumontite, from east side of the Schuylkill, Philadelphia Park. Crystalline Slag from copper furnace, Baltimore, Md. Rock Milk, from Hot Springs, Gardner's River, National Park. Mica, Pennsbury, Chester Co., Albite, with Muscovite, near Media, Delaware Co., Muscovite, with Biotite, Laurel Hill, Phila. Sulphuret of Cadmium on Blende, from Friedensville, Lehigh Co., Pa. Jadeite and Talcose schist, from Easton, Pa. Calcite, from Martinsburg, Lewis Co., N. Y. Pyroxene and Feldspar, from Rossie, N. Y. Scapolite and Peristerite, from Pierrepont, N. Y.

From the same, in exchange. Hydrodolomite on Chromite, from Texas, Lancaster Co., Pa. Opal, from near the south fork of the American River, California.

H. W. Mitchell. Twenty-two Minerals and Rocks from Auckland, New Zealand.

W. A. Mintzer, U. S. N. Four large, black Tourmalines, 15 inches long. Four additional terminated Crystals, from 1 to 7 inches long, Harbor of Niantilik, Cumberland Gulf, north lat. 64° 56′, W. long. 66° 21′.

Galloway C. Morris. One specimen of Coorongite; three of Mineral Caoutchouc, from Southern Australia.

Mr. Julius Partz. Marecanite, near Benton, Mono Co., Cal. Acicular Obsidian. Three specimens of Partzite, one Blende, and one other mineral.

Chas. C. Phillips. Two specimens of Copalite, from Zanzibar, Africa; two of Asphaltum, Cuba.

Theo. D. Rand. Five Molybdenites, and a specimen of Stilbite from Frankford, Phila. Aragonite in Chlorite, and Millerite in Dolomite, Soapstone Quarry, Phila. Muscovite and Orthoclase, west of Fairmount Dam, Phila. A very fine collection of Rocks from the vicinity of Philadelphia, numbering 131 specimens. Molybdic Ochre, Upland, Delaware Co., Pa.; Metaxite, Lancaster Co., Pa. One specimen of Meerschaum; two Chalcedony; one Blue Apatite; one Quartz, Pseudomorph after Calcite; one Oct. Cryst. of Zinc Blende in Cryolite; one Carbonate of Iron in Cryolite, from Greenland. Also 114 specimens of minerals from the neighborhood of Philadelphia.

S. R. Roberts. Four samples of Coal Oil from Franklin, Pa.

W. E. Rowell. A small collection of minerals and rocks from Arkansas.

Samuel L. Smedley. Two specimens of Clay dredged from middle of Schuylkill at Penrose Ferry bridge at a depth of 30 to 36 feet below low water mark.

Adolph Lutro, through W. H. Dougherty. One hundred and seventy-seven specimens of the rocks traversed by the "Sutro tunnel" towards the Comstock silver lode at Virginia City, Nevada.

J. F. Tottenham, through A. D. Jessup. Twenty-two specimens of Beckite, from Devonshire, England.

José Carlos Tracy, of the Peruvian Commission. Two hundred and seventy-seven minerals, handsomely arranged in sixteen cases, from Peru.

Jos. H. Tull. Specimens of Sulphuret of Silver (Argentite). Ruby Silver (Proustite), from the New York Cañon, Lander Co., Nevada. Coke from accidental combinations of Lignite, Cottonwood Cañon, Humboldt Valley, Nevada.

W. S. Vaux. Two large Crystals of Scapolite, from St. Lawrence Co., N. Y.

Victoria Centennial Commission, through Sir Redmond Barry. A large mass of Garnierite from New Caledonia, Australia; also specimens of Lignite, Chalcopyrite, Bituminous Coal, and forty-six rock specimens from Victoria, Australia.

Dr. Jas. White. Garnets, Ceylon.

Jos. Wilcox. Tremolite, Quartz, Garnet, Feldspar, Crystals of Serpentine and Zircon from different localities. Tremolite from St. Lawrence Co., New York, and Blue Carbonate of Lime from Calumet Island, Canada. Large Sphene, N. Y.

Fine Crystals of Feldspar from Pike's Peak, Colorado. Thirteen minerals, including Feldspar, Muscovite, Actinolite, Staurotide, Corundum, Corundum with Ripidolite; Corundum, Margarite, and Tourmaline from various localities. Chlorite Pseudomorph after Magnetite from Spurr Mine, Michigan. Tourmaline, Alexander Co., N. C.

The following Tasmanian minerals were presented through H. P. Welch, Centennial Commissioner for Tasmania, on behalf of their respective donors :—

British and Tasmanian Charcoal Iron Co. Iron Ores, Pig Iron, etc.

Dr. J. Coverdale. Red Ochre, earth for paints, pipe clay, from Port Arthur.

F. Groom. Coal from Fingal. Harefield.

W. Hammond. Bismuth from Mount Ramsey, Hobart Town.

Jas. Harcourt. Iron Ore, Pig Iron, and Coal from Seymour.

Hæmatite Iron Works. Iron Ores, Blue and White Limestone, West Tamar.

H. J. Hull. Tin Ore, George's Bay, Hobart Town.

J. Hurst. Coal from Tasman's Peninsula.

J. H. Innis. Tin Ore from Ringarooma and George's Bay, Hobart Town.

T. C. Just. Magnetic Iron Ore, etc., Launceton.

W. A. Kermode. Salt, from Salt Pan Plains. Two blocks of Freestone, Mona Vale.

Jas. Laughton. Umber and Sienna Clay from Hobart Town.

Lyell & Gowen. Slate, Tin Ore, Marble, Limestone, and Coal, Melbourne.

E. Raynor. Limestone, with Fossils, Bridgewater.

Dr. Smart. Gold in quartz, Hobart Mine, Fingal, Hobart Town, Stanhope County. Tin Ore.

R. Strachan. Salt, from Salt Works, Cambridge.

The following purchases were made: Jasper, Vergennes, Vt.; Datolite; Analcite, Phœnix, Mich.; Amethyst, L. Superior; Millerite in Dolomite, St. Louis, Mo. Amazon Stone (Orthoclase), from near Pike's Peak, Colorado. Curved Crystals of Calcite, Amethysts, and Agate, from the Yellowstone Park, N. W. Wyoming.

The election of Officers for 1878 was held in accordance with the By-laws, with the following result:—

President . . .	W. S. W. Ruschenberger, M.D.
Vice-Presidents . .	Wm. S. Vaux, Thomas Meehan.
Recording Secretary .	Edward J. Nolan, M.D.
Corresponding Secretary	George H. Horn, M.D.
Treasurer . . .	Wm. C. Henszey.
Librarian . . .	Edward J. Nolan, M.D.
Curators . . .	Joseph Leidy, M.D., Wm. S. Vaux, Chas. F. Parker, R. S. Kenderdine, M. D.
Councillors to serve three years	Geo. A. Koenig, Ph. D., J. H. McQuillen, M.D., Chas. P. Perot, Geo. Y. Shoemaker.
Finance Committee .	Aubrey H. Smith, Robert Bridges, M.D. Edward S. Whelen.

ELECTIONS DURING 1877

MEMBERS.

January 30.—C. W. Cross, J. T. Montgomery, Jos. M. Stoddart, H. Ernest Goodman, M.D., Thos. Biddle, Jr., M.D., Wm. G. Audenried, Jos. Thomas, M.D., I. S. Moyer, M.D., and Clarence C. De Lannoy.

February 27.—Frank L. Scribner and Mrs. Mary Wagner.

March 27.—Charles Ashburner and Thomas Mackellar

April 24.—Jos. G. Rosengarten, Edgar F. Smith, Ph.D., J. Marshall Stoddart, Jr., and Gertrude K. Peirce.

May 29.—Andrew C. Craig, William John Potts, John E. Cook, Charles Zentmayer, Samuel L. Fox, Shippen Wallace, and Joseph D. Schoales, M.D.

June 26.—Rev. Chas. F. Thomas.

July 31.—Julia A. H. Walker.

August 28.—B. F. Lautenbach, M.D., and Frank Woodbury, M.D.

September 25.—A. J. Drexel, Alexis S. Cope, Miss Clementine Cope, and Miss C. E. Cope.

October 30.—C. Few Seiss, Miss E. B. Rice, Miss Mary B. Rice, Andrew J. Parker, M.D., J. D. Thomas, M.D., and S. H. Guilford, M.D.

November 27.—A. H. Franciscus, Henry Pemberton, Jr., Henry Cope Haines, Oswald J. Heinrich, and Wm. R. Wharton.

CORRESPONDENTS.

January 30.—J. M. Da Silva Coutinho, M.D., of Rio Janeiro; Wm. A. Mintzer, M.D., U. S. N.; L. Nicholsky, of St. Petersburg; Gen. A. Gadolin, of St. Petersburg; Nikolai V. Kokscharow, of St. Petersburg, and L. de Koninck, of Bruxelles.

February 27.—Alphonse Favre, of Geneva; Percival De Loriol, of Geneva; Baron Ferdinand Freiherr Von Richthofen, of Berlin; Dr. Fred. Von Hochstetter, of Vienna; Edouard Desor, of Neuchatel; Ludwig Rütimeyer, of Basel; Valerien De Moeller, of St. Petersburg; H. Trautschold, of Moscow; and Lieut. A. W. Vogdes, U. S. A.

March 27.—P. A. Von Kotschubey, of St. Petersburg.

August 28.—Wm. A. Buckhout, of Centre County, Pa.

September 25.—Clarence King, of Washington; Daniel C. Eaton, of New Haven; Count A. G. Marschall, of Vienna; Edward Von Mojsisovics, of Vienna; Dionys Stur, of Vienna; Franz Toula, of Vienna; A. Bastian, of Vienna; J. G. Rein, of Frankfurt on the Main; C. Arendts, of Munich; Spiridione Brusina, of Agram; Jos. Szabo, of Buda Pest; C. Stahl, of Stockholm; Philippe de la Harpe, of Lausanne; Elisée F. Reclus, of Paris; Emile Cartailhac, of Toulouse; Ernest Chantre, of Lyon; J. J. Collenot, of Semur; Henri Coquand, of Marseilles; Jules Gosselet, of Lille; Edmund Hébert, of Paris; Wm. Boyd Dawkins, of Manchester; Peter Martin Duncan, of London; A. H. Green, of Leeds; J. W. Judd, of London; John Morris, of London; Andrew Murray, of

London; Wm. Whitaker, of London; and H. B. Medlicott, of Calcutta.

October 30.—Sereno E. Watson, of Cambridge; Wm. G. Farlow, of Cambridge; Geo. L. Goodale, of Cambridge; John Duns, of Edinburgh; Dr. Ernst Candeze, of Liege; Dr. C. A. Dohrn, of Stettin; Baron E. Von Harold, of Berlin; Vicomte Henri de Bonvouloir, of Paris; Baron Maximilien de Chaudoir, of St. Petersburg; Henry W. Bates, of London; Etienne Mulsant, of Lyons; M. A. Chevrolat, of Paris; S. Solsky, of St. Petersburg; Alfred Preudhomme de Borre, of Bruxelles; Jules Putzeys, of Bruxelles; Chas. C. Parry, of Davenport, Iowa; A. Ernst, of Venezuela; G. V. Black, of Jacksonville, Ill; R. J. Lechmere Guppy, of Port of Spain, Trinidad; and Edw. Hull, of Dublin.

November 27.—H. Halloway, M.D., of Laporte, Ind.; Dr. Robt. Wiedersheim, of Freiburg i B.; Carl Semper, of Würzburg; Chas. Brongniart, of Paris; George Bowdler Buckton, of Weycombe, Haslemere, England; and Geo. W. Lawrence, M.D., of Hot Springs, Arkansas

ADDITIONS TO THE LIBRARY, 1877.

Adams, A. L. Notes of a Naturalist in the Nile Valley and Malta.
Field and Forest Rambles. I. V. Williamson Fund.
Observations on the Remains of the Mammoth and other Mammals from Northern Spain.
On a Fossil Saurian Vertebra (Arctosaurus Osborni) from the Arctic Regions.
On Gigantic Land Tortoises.
Monograph of the British Fossil Elephants. Part I. The Author.
Albertis, L. M. D'. Journal of the Expedition for the Exploration of the Fly River. Dr. Geo. Bennett.
Allen, J. A. The Influence of Physical Culture in the Genesis of Species. The Author.
Armstrong, J., John Young, and David Robertson. Catalogue of the Western Scottish Fossils. I. V. Williamson Fund.
Ashburner, C. A. Measured Section of the Palæozoic Formations in Middle Pennsylvania. The Author.
Ashhurst, J. Transactions of the International Medical Congress, 1876. The Editor.
Baillon, M. H. Dictionnaire de Botanique. Nos. 1–6. I. V. Williamson Fund.
Natural History of Plants. Vols. 2, 3, 4. I. V. Williamson Fund.
Baily, W. H. Figure of Characteristic British Fossils. Parts III. and IV. I. V. Williamson Fund.
Barber, E. A. Aboriginal Funeral Customs in the United States. By E. A. Barber. The Author.
Comparative Vocabulary of Utah Dialects. The Author.
Bárcena, M. Noticia Cientifica de una parte del Estado de Hidalgo. The Author.
Barker, J. N. Botanical Journal.
Barkow, H. C. L. Comparative Morphologie des Menschen und der Menschenähnlichen Thiere. 1er Th. I. V. Williamson Fund.
Barton, W. P. C. Compendium of Medical Botany.
Flora of North America.
Essays on Materia Medica.
Elements of Botany. Heirs of Dr. Jos. Carson.
Bartsch, S. Rotularia Hungariæ. Hungarian Academy of Sciences.
Bary, A. de. Ueber die Fruchtentwickelung der Ascomyceten. Rathmell Wilson.
Beck's Botany. Heirs of Dr. Jos. Carson.
Bellardi, L. I Molluschi dei terreni terziari del Piemonte e della Liguria. Parte I. and II. I. V. Williamson Fund.
Belt, T. The Drift of Cornwall and Devon.
On the Loess of the Rhine and the Danube.
Geological Age of the Deposits containing Flint Implements at Hoxne. The Author.
The Steppes of Siberia. The Author.
The Glacial Period in the Southern Hemisphere. The Author.
Benecke, E. W. Geognostisch-paläontologische Beiträge. 2er Bd, 3 Heft.

Benoit's Testacci Estramarini della Sicilia ulteriore. Quad. I. Rathmell Wilson.
Bentham and Hooker's Genera of Plants. Vols. I. and II. Conarroe Fund.
Berendt's Organische Reste im Bernstein. Rathmell Wilson.
Bergen's Museum. Samlingen af Norske Oldsager. Katalog over Dyrsamlingen. The Museum
Bertkau, P. Bericht über die Wissenschaftlichen Leistungen im Gebiete der Entomologie, 1871–72. Wilson Fund.
Besler, B. Hortus Eystettensis, 1613. Deposited by Messrs. Pawson and Nicholson.
Biedermann, W. G. A. Cheloniens Tertiaries des environs de Winterthur. Rathmell Wilson.
Bigelow's Plants of Boston. Heirs of Dr. Jos. Carson.
  Medical Botany. Heirs of Dr. Jos. Carson.
Binney, W. G. Nineteen Conchological Pamphlets. The Author.
Bischoff's Chemical and Physical Geology. Heirs of Dr. Jos. Carson.
Bischoff. T. L. W. Historisch-kritische Bemerkungen zu den neuesten Mittheilungen über die erste Entwickelung der Saugethiereier. I. V. Williamson Fund.
Blanchard, E. Les Insectes. Livrs 5–45. Wilson Fund.
  Un Naturaliste du Dix-Neuvième Siecle, Louis Agassiz. The Author.
Bland, T., and W. G. Binney. On the Systematic Arrangement of the North American Mollusks. T. Bland.
Bleek, W. H. I. Brief Account of Bushman Folk Lore. H. C. Coates.
Bleeker, P. Atlas Ichthyologique des Indés Orientales Néerlandaises. Livrs. 31–33. Wilson Fund.
  Same. Livr. 21. Rathmell Wilson.
Blytt, Axel. Norges Flora. 3e Dl. Royal Norwegian Society of Sciences.
Bohnenseig, G. C. W. and W. Burck. Repertorium Annuum Literaturæ Botanicæ Periodicæ. S. II. and III. I. V. Wiliamson Fund.
Bois-Reymond, Edw. Gesammelte Abhandlungen zur allgemeinen Muskel- und Nervenphysik. 2er. Bd. I. V. Williamson Fund.
Boissier, E. Flora Orientales. Vols. I.–IV., Fasc. I. I. V. Williamson Fund.
Bolton, H. C. Application of Organic Acids to the Examination of Minerals. The Author.
Bornet, E. and G. Thuret. Notes Algologiques. Fasc. 1er. I. V. Williamson Fund.
Bourguignot's Malacologie de l'Algerie. 6me. Fasc. Rathmell Wilson.
Brehm's Thierleben. 1 Bd 1 to 12 Heft; 2 Bd. 1–11 Heft; 3 Bd. 1–4 Heft; 9er Bd. 1–13 Heft. I. V. Williamson Fund.
Brereton's Flora Columbiana. Heirs of Dr. Jos. Carson.
Brightwell, Miss. Life of Linnæus. Rathmell Wilson.
British Museum Catalogues. List of the Specimens of Birds. Part II., Section 3 and 4; Part V.
  List of the Mollusca. Part II.
  Carnivorous Mammalia.
  Ruminants (Pecora).
  Handlist of Edentate Mammals.
  Catalogue of Seals, and Supplement.
  Handlist of Seals.
  Catalogue of Monkeys.
  Catalogue of Bones of Mammals.
  Catalogue of Shield Reptiles, Supplement 1, Appendix, and Part II.
  Handlist of Shield Reptiles.

Catalogue of Amphipodous Crustacea.
Catalogue of Sea Pens.
Catalogue of Lithophytes.
Catalogue of Marine Polyzoa. Part II.
Catalogue of British Birds.
Catalogue of Non-parasitic Worms. I. V. Williamson Fund.
Catalogue of Birds. Vol. 3. The Trustees.
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