

NOTES ON THE TETRAODONTOIDEA.

IV

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(With Plate XXXIV.)

I.

After the completion of my "Note on the genus *Chonerhinus* or *Xenopterus*," it appeared to me to be desirable to review several other questions concerning other genera of *Tetraodontoidea* and the taxonomic values of the included forms.

All the *Tetraodontoidea* were included by Linnaeus in a single genus and are still so included by Günther. Gill proposed to differentiate them under three families. The gradations between those extremes are many.

II.

No deliberate attempt was made to subdivide *Tetraodon* among genera till nearly four decades of the present century had elapsed. Swainson, in 1839, gave generic names to five sections under which Cuvier segregated the species.* Johannes Müller soon after proposed other generic names, some of which were anticipated by Swainson. Bleeker, Bibron, and Peters added other genera. Bibron especially had skeletons of many species prepared for a contemplated monograph of the group which he first recognized as a family, "*Tétraodonius*." These skeletons were utilized by Hollard in 1857 in *Études sur les Gymnodontes*, in which he recognized six genera on osteological characters, scientifically appreciated the relative values of their characters, and combined them in a *tribu* or subfamily. Bleeker disregarded the osteological characters, and based the genera admitted by him on characters derived from the carination or planeness of the back, extent of the snout, form of nostrils,† and dermal appendages. The next step was violently retrograde. Günther ignored all the excellent work done by Hollard, and reduced all the *Tetraodontoidea* to two genera combined with the *Diodon*-

*The genera proposed by Lacépède for two species, *Spherooides* and *Oroides*, were due to unmitigated ignorance and strange blundering respecting their characters.

†"Nares utroque latere foraminiiformes in papilla concava plus minusve elevata perforata" in *Tetraodon*; "Nares utroque latere tentaculum simplex vel duplex" [etc.] in *Crayracion*; "Nares utroque latere infundibuliformes imperforatae" in *Leiodon*, *Chonerhinus*, and *Ephippion*.

tidae to constitute a single group of his family called *Gymnodontes*. He subsequently made another retrograde step and reverted to the Linnæan conception of the genus, combining all in one genus, *Tetrodon*.

Meanwhile the work of Hollard remained unknown or neglected. In 1884, Gill recognized this work, utilized his material for a systematic revision of the group, elevated the Linnæan and Güntherian genus *Tetrodon* (*Tetraodon*) to superfamily rank, and divided it into three families distinguished by osteological characters. In the framework thus reared, Jordan and Edwards, in 1887, intercalated all the species of American *Tetraodontoidea*, but degraded the group to family rank and the families to subfamilies.

Jordan and Edwards's memoir is excellent and the first one in which scientific principles were applied at the same time generally and in detail to the consideration of the group. The range of the genera, so far as the American species are concerned, appears to be natural and their nomenclature nearly correct. There are some questions involved, however, which merit reconsideration and I propose to now pass in review all the genera that appear to be well established.

III.

1758) TETRAODON. (Linnæus.

Jordan and Edwards have reached the same conclusions as I formerly did respecting the application of the name *Tetraodon*, but by a different route. I should not have considered it necessary to discuss the question involved if a fallacy had not found way in their argument which might be repeated in various other cases. Under the circumstances, a review of their argument may be useful. I first give their own words:

The name *Tetraodon* first appears as a generic term, so far as known to us, in Hasselquist's Travels in Palestine, edited by Linnæus, in 1757. We have not examined this work, but our impression is that it is binomial in form, and that the name *Tetraodon* is here associated only with *Tetraodon fahaka*, the *Tetraodon lineatus* of the *Systema Naturæ*, and a member of the group called *Arothron*.

If this work of Hasselquist be taken in consideration, the name *Tetraodon* must be assigned to the present group.

But the conventional starting point of binomial nomenclature is later, and in the *Systema Naturæ*, Linnæus includes all the species of the present family known to him, in the genus *Tetraodon*.

We must then consider the later attempts at restriction of the group.

In 1839, Swainson made the first attempt at generic division.

Retaining the name *Tetrodon* for the bulk of the species (including our genera *Sphæroides* and *Tetraodon*), he separated from it *Lagocephalus*, *Leiodon* (or *Leisomus*), *Cirrhisomus*, and *Canthigaster* (or *Psilonotus*).

The first and last of these were well defined. The others, *Leiodon* (based on the absence of prickles) and *Cirrhisomus* (based on the presence of eirri), rest on characters of no systematic importance. Under the generic name of *Tetrodon*, four species are mentioned as types. Three of these belong to the *Arothron* group; the other is a *Chelonodon*. But none of them are Linnæan species, although one of them (*testudi*

neus Bloch, not L.) was supposed by Swainson to be such. If we regard, with Dr. Gill, this subdivision to be properly a restriction of the Linnæan genus, the name *Tetraodon* would again be synonymous with *Arothron*. But it may be objected that the *Tetrodon* of Swainson contained no species known to Linnæus, and hence its composition can not be considered as a proper restriction. This objection seems to us a valid one.

The next subdivision seems to be that of Müller (1811), who retained the name of *Tetrodon* for none of his divisions.

Next (1855) we have the subdivision of Bibron. By him the group was divided into a large number of genera, part of them without definition and all of them with French names only. For one of his sections the name *Tetraodon* was retained. This group, as arranged by Bibron, included a single Linnæan species as type. This one, *lineatus*, is a member of the group called by Müller *Arothron*. This seems to be the first proper restriction of *Tetrodon*, and, so far as we can see, it must stand, making *Tetraodon* the equivalent of *Arothron*.

Later, 1857, Hollard worked over the material of Bibron, and adopted—on skeletal characters only—an arrangement of genera, not unlike that given in the present paper. His genera are *Xenopterus* (not American), *Rhynchotus* (= *Cantivagaster*), *Batrachops* (= *Colomesus*), *Brachycephalus* (= *Tetraodon*), *Apsiccephalus* (= *Spharoides*) and *Lagocephalus*, *Monotretu* (not American).

Hollard supplies a Latin form to the French names of Bibron, and using the name *Tetrodon* as a general term, he places Bibron's *Tetraodon* as a subgenus under his own *Brachycephalus*.

In 1867, Bleeker, probably regarding *lineatus* as the proper type of *Tetraodon*, seems to have suppressed the latter name as a synonym of the name *Crayracion*, used by Klein before the date of the *Systema Naturæ*. Other ichthyologists do not give Klein's names precedence over those of Linnæus, and under the rules of nomenclature which we adopt, *Crayracion* must be disregarded.*

In 1873, Prof. Gill used the name *Tetrodon* as synonymous with *Lagocephalus*, and in 1885 as synonymous with *Arothron*. In 1883, Jordan and Gilbert regarded *T. testudineus* as its type, thus making it synonymous with *Spharoides*.

It seems evident to us, from the above data, that it is best to regard *Tetraodon lineatus* as the type of *Tetraodon*, and thus make the latter name the equivalent of *Arothron*.

The fallacy in this argument is in considering the name *Tetraodon* in the same light as a new generic name. Swainson did not pretend to enumerate all the species of the genus. He simply selected some, of which there existed figures in a couple of illustrated works accessible to himself. Inasmuch as those so selected were congeneric with Linnæan species, those Linnæan species were by implication included and actually do belong to the genus as limited by Swainson. Of course, if Swainson had given a new generic name, the name could only have been retained for species actually included by him under the genus named; as it was, he simply limited a genus already established, and the genus so limited included, by the terms of its diagnosis, two of the five original species of *Tetraodon*, while not more than one Linnæan species belongs to any other genus.

I revert, with Jordan and Edwards, to the name *Tetraodon* for this

* *Tetraodon* and *Crayracion* were both used by Bleeker, the former being applied to the genus *Lagocephalus* and the latter being essentially equivalent to *Arothron* of Müller, or *Tetraodon* of Jordan and Edwards and American authors.

genus, that being the form originally used by Linnæus (1758, p. 352). The change of the name to *Tetrodon* by Linnæus, Günther and other authors was unnecessary, inasmuch as the original form is sanctioned by classical usage, as in the case of *τετραοδία* and *τετραοδος* (quadrivium), *τετραόργγιος* (four fathoms in extent), *τετραορία* (four-horsed chariot), etc.

The genus appears to contain few species. Four have been referred to it by Bibron, (1) *T. lineatus* Linn.; (2) *T. patoca* Horn (Buchanan); (3) *T. dorso-unicolor* Bib.; and (4) *T. bouronensis* Bib. The last two have never been described, and it is not known what they are. The *T. patoca* has been referred to a distinct section of the genus by Dr. Günther. The absence of specimens in the National Museum prevents me from forming an opinion.

1798.) SPHEROIDES. (Lacépède) Duméril.

The nomenclature of this genus has been considered by Jordan and Edwards,* Jordan† alone, Gill,‡ and again by Jordan§ alone, and Bollman,|| and we have now no points of difference; all American authors who have expressed their sentiments¶ are of the same opinion. Reluctant as I am to adopt the name given under the conditions *Spheroides* was, there seems to be more possibility of agreement by so doing than by any other course.

A notice of *Anchisomus* has been overlooked. It occurs in remarks by Richardson on "*Anchisomus reticularis* (Kaup)."

"The species of this genus mentioned in Dr. Kaup's list are *Anchisomus Spengleri*, *angusticeps*, *multistriatus*, *reticularis*, *scalaris*, *geometricus*, and *turgidus*. *Anchisomus*, *Gastrophysus*, *Cheilichthys*, and *Leiosomus* form a group of *Tetrodontidæ*, in which the nasal cavity is small and flat, with two nostrils."**

1839.) LAGOCEPHALUS. (Swainson.)

The nomenclature of this genus is now clear, and therefore needs no consideration here.

1839.) CANTHIGASTER. (Swainson.)

Canthigaster is now accepted by me in place of *Psilonotus*, formerly used. Richardson (in 1854)†† and Bleeker (in 1859) employed *Psilonotus*, and in 1876 and 1884 I followed them in so doing. Jordan and Ed-

* Jordan and Edwards < Proc. U. S. N. M., 1886, p. 233.

† Jordan, < o. c., 1887, p. 481.

‡ Gill, < o. c., 1888, pp. 607, 608.

§ Jordan, < o. c., 1889, pp. 183, 651.

|| Jordan and Bollman, < o. c., 1889, p. 183.

¶ Gilbert, < o. c., 1890, p. 455. Evermann and Jenkins, < o. c., 1891, p. 165.

** Zoöl. Voyage Herald, 1854, p. 162.

†† Richardson described the typical *P. rostratus* as "*Prilonotus* (or *Anchisomus*) *caudacinctus*." *Prilonotus* was evidently a slip for *Psilonotus*.

wards, however, have shown good reason for not doing so longer, and also reason not good. Their own words may be reproduced :

The proper name of the genus has been involved in some confusion, owing to the use by Swainson of two different names for it.

On page 194 of his miserable work on the classification of fishes, Swainson gives an analytical key to the genera, and applies to the present group the name of *Canthigaster* (correctly written *Acanthogaster*). No species are here mentioned by Swainson, but in this case his diagnosis is accurate and sufficient. On page 328, these genera are again defined, the present one in nearly the same way, but under the name of *Psilonotus*. Two species (*rostratus*: *electricus*) are here mentioned as types.

Professor Gill has preferred to adopt the last-mentioned name, regarding *Canthigaster* as unidentifiable except through the medium of the species mentioned under the diagnosis of *Psilonotus*. Dr. Bleeker has preferred to take the earlier name of *Canthigaster*. In this case it is certainly true that no doubt could exist as to what Swainson intended to include under *Canthigaster*, even had the second diagnosis been omitted; moreover, the name *Psilonotus* is preoccupied. We see, therefore, no sufficient reason for setting this name aside, objectionable as it is.

I can only account for Jordan and Edwards's assertion that Swainson's diagnosis of *Canthigaster* is "sufficient" by the surmise that they have considered the diagnosis of *Psilonotus* instead of *Canthigaster*. The sole diagnosis of Swainson's *Canthigaster* is in the words: "*Canthigaster*: Muzzle prolonged and narrow; belly with spines." Now, if Messrs. Jordan and Edwards consider this sufficient, I do not, and I find it as applicable to some species of "*Spharoides*," especially *S. angusticeps*, as to the species recently referred to *Psilonotus*. Indeed, the resemblance of *S. angusticeps* to the *Psilonoti* is so great as to have misled two incomparably better ichthyologists than Swainson—Richardson and Steindachner—who actually referred that species to the genus, the former calling it *Anchisomus angusticeps* and the latter *Canthogaster lobatus*.*

Nevertheless, Jordan and Edwards were quite right in correcting me for adopting the name *Psilonotus*, but only because that name had been preoccupied in Hymenoptera, a fact of which I was not aware in 1884.

Under the circumstances, however, it may be doubtful what name to take up for the genus in question. *Canthigaster*, with its apparent etymology, is a very objectionable name, and its application, as already urged, could not have been certainly determined "except through the medium of the species mentioned under the name of *Psilonotus*." But as it can be so determined, I am disposed, after Bleeker, Jordan, and Edwards, and some others, to adopt it. It would naturally be supposed that the name was intended to allude to the spiniferous belly, and Swainson undoubtedly labored under the delusion that "*canthi*"—or, "*canthus*" was a good Greek derivative for spine.† Swainson, however,

*The external difference between the species of *Canthigaster* are marked but they are not indicated by the words of Swainson.

†See *Canthophrys* (vol. 1, p. 364; vol. 2, p. 310), *Canthileptes* (vol. 2, pp. 7, 52, 179, 261), *Genicanthus* (vol. 2, pp. 170, 212), *Polycanthus* (vol. 2, pp. 175, 242), etc. Another delusion was that *leptes* was a Greek derivative for scale or sealed.

did not actually give the etymology of his name and those who would be distressed by the form of the name may derive it from *Canthus*, one of the Argonauts, and *gaster*, belly, and assume it to refer to the ability to swell the belly* and thus float along. Bleeker attempted to correct the word to *Canthogaster* and used the name *Canthogastrini* as the designation of a "phalanx" in his system. Jordan and Edwards have preserved the form *Canthigaster* and used *Canthigasterinæ* as a subfamily name. I propose also to retain the name *Canthigaster* and derive from it the family name *Canthigasteridæ*.†

1839.) LEIODON. (Swainson.

In 1839 Swainson introduced a new generic name with the following diagnosis:

Leisomus Sw.—Head short; the body entirely smooth.

T. lavissimus. Sch.§

marmoratus. Hamilt. pl. 18, fig. 3, *T. (Monotretus) cutcutia*, G. viii, 290.

On a previous page he had, in the same sequence under *Tetraodinae*, the following genus:

Leiodon.—Head short; body entirely smooth.

No species was mentioned.

Leisomus marmoratus was a substitute for *T. cutcutia* of Hamilton. There is no "*T. lavissimus*" in Bloch and Schneider's "Systema Ichthyologiae," and Swainson has simply copied the name from the Règne Animal of Cuvier, who, in his second section of the genus *Tetraodon*, characterized by the entire body smooth, grouped two species: "*T. lavissimus* Bl., Schn.;" and "*T. cutcutia*, Buchan, XIII, 3."

There is a *Crayracion lavissimus* of Klein‡ (the *Spheroides maculatus*), and Cuvier may have, by slip of memory, substituted "Bl., Schn." for Klein. But, as it is, the first species of Swainson's genus is indeterminate and the merits of his genus (for practical purposes) must be determined by the only species identifiable. That species is typical of a good genus and, for a wonder, Swainson's diagnosis is applicable and almost distinctive, though the full force of it can only be appreciated by one who knows the crania of the genera of *Tetraodontinae*.

In 1855 Bibron introduced a new generic name, *Monotrète*, for the *T.*

*Unfortunately the species of the genus are less endowed with this capacity than the typical *Tetraodontida*.

†According to Richardson (Zoöl. Herald, p. 162), "*Prilonotus* is a name invented by Müller, and is mentioned by him in his 'Fortsetzung der Myxinoden,' and the Archiv für Naturgeschichte für 1841, but I have not found his detailed account of the characters. Dr. Kaup enumerates the following species: *Pril. rostratus* Lin. (*margaritatus* Rüppell, *solandri* Richardson), *millepunctatus*, *occipitalis*, *oculifer*, *insignitus*, *caruleo-punctatus*, and *pictus*." The appearance of the nasal depression is fully described as it appeared to Richardson. As already indicated, *Prilonotus* is a slip for the Swainsonian name *Psilonotus*, and does not occur in Müller's work.

‡*Crayracion lavissimus* Klein Hist. Pisc. Nat. prom. Miss. tertius, p. 18, pl. 3, f. 5, 1742.

cutentia, and the genus was subsequently well defined from cranial characters by Hollard, as *Monotreta*.

Bibron diagnosed a genus in the following terms:

8.° G. *Monotrète*, Bib. (*μότρος*, seul, *τροτός*, troné, percé). "Narines n'ayant chacune qu'une seule ouverture circulaire à bord non saillant. — Point d'épines sur aucune partie du corps, qui est complètement lisse. — Nageoires impaires arrondies; épitère et hypoptère courtes."

Espèce unique: *T. cutentia*, Ham. (Buchanan).

In 1865 Bleeker united *Monotreta* with *Leiodon*, expressing the following opinion respecting Hollard's views:

Il fit un seul genre des *Crayracion* et des *Leiodon*, tout en conservant le genre *Monotreta* Bib. qui cependant ne diffère pas des *Leiodon*.

Bleeker adopted the genus *Leiodon* of Swainson rather than *Leisomus* or *Leiosomus* or *Liosomus*, for the following reasons:

Le nom générique de *Leisomus* mériterait donc d'être conservé s'il n'avait pas été employé, avant Swainson, en 1831, pour un genre de Coléoptères. Or, Swainson dans son *Natural History of Fishes*, etc., employa aussi (p. 194), pour indiquer son genre *Leisomus*, le nom de *Leiodon*, et c'est par conséquent ce nom, qu'il aurait dû du reste écrire *Liodon*, qui a le droit de priorité sur celui de Joh. Müller.

I can not corroborate the statement that *Leisomus* or *Leiosomus* or *Liosomus* had been employed in zoölogy before its use by Swainson, although *Leisoma* and *Liosoma* had been frequently used. While I for myself should have preferred the name *Liosomus*, I acknowledge Bleeker's right to choose one of two names simultaneously given, and consequently accept *Leiodon*, as that name does not appear to have been *previously* used, either in that form or under the guise of *Liodon*.

In 1870 Günther accepted the name, under the modified form *Monotretus*, for a section of *Tetrodon*, including only the *T. cutentia*, with the following diagnosis:

D. A simple circular nasal cavity. Body smooth: *Monotretus* (Bibr.)

The other species of *Leiodon* noticed by Bleeker were referred to another section, viz:

C. A simple, not perforated nasal cavity with a fringed edge. Body spiny: *Cheilonodon* (Mül).

The genus thus appears to have been based on decided external as well as cranial characteristics and is therefore adopted.

The history of the genus is summarized in the synonymy.

LEIODON.

= *Leiodon* Swainson, *Nat. Hist. Fishes*, etc., vol. 2, p. 194, 1839.

= *Leisomus* Swainson, *Nat. Hist. Fishes*, etc., vol. 2, p. 328, 1839.

= *Monotrète* Bibron, *Rev. et Mag. Zoöl.* (2), vol. 7, p. 281, 1855.

= *Monotreta* Hollard, *Ann. Sc. Nat.* (1), vol. 8, p. 322, 1857.

< *Leiodon* Bleeker, *Atlas Ich. Nierland Ind.*, vol. 5, p. 47, 1865.

= *Monotretus* Günther, *Cali. Fishes*, B. M., v. 8, pp. 272, 280, 1870 (Section of *Tetrodon*).

= *Liosomus* Gill, *Proc. U. S. Nat. Mus.*, vol. 7, p. 422, 1884.

Tetraodon sp., *Hamilton et al.*

Leiodon sp., *Bleeker* (1865).

1841.) CHELONDON. (J. Müll.

This name has been already considered in my article on *Chonerhinus* and therefore needs no further discussion here. It is very desirable, however, that a renewed examination of proper material should be undertaken to solve the doubtful questions that still exist.

1841.) AROTHRON. (J. Müller.

In 1839 Johannes Müller, in his "Vergleichende Anatomie der Myxinoiden," (published in 1841,*) gave new generic names to several types of Tetraodontids, *Physogaster*, *Chelonodon*, *Cheilichthys*, and *Arothron*, presenting the following diagnosis of the last:

Noch andere, wie *Tetrodon testudinarius*† haben statt der Nasen jederseits ganz solide Tentakeln, in welche der starke Geruchsnerve geht. Diese haben auch einen Ringmuskel um das Auge und eine Art Augenlieder, die Untergattung *Arothron*.

Coördinate with the ring muscle is the deflection of the postfrontals, and especially the prefrontals, to describe the segment of a circle.

In 1855 a diagnosis of a genus was published in the following terms:

2° *G. Dilobomyctère*, Bib. (δύς, deux, λοβός lobe, μυκτίρη, parine). "Tête courte. Narines se présentant sous la forme d'un double tentacule aplati.—Des épines au ventre et sur diverses autres parties du corps. Nageoires impaires arrondies; épiptère et hypoptère courtes.

To this genus were referred eleven species, (1) *T. reticularis* Schn., (2) *T. hispidus* Bloch (including six varieties), (3) *T. maculatus* Lac. (including four varieties), (4) *T. meleagris* Lac., (5) *T. nigropunctatus* Schn., (6) *T. mappa* Less., (7) *T. diadematus* Rüpp., (8) *T. longicauda* Bib. (named *T. manillensis* Marion de Procé and *T. strigosus*, Benn.), (9) *T. sordidus* Rüpp., (10) *T. immaculatus* Lac., and (11) *T. Ruppellii* (= *T. Honkenii* Rüpp., not Bloch).

This genus has been confounded by Jordan and Edwards, as well as others with *Tetraodon*, but it differs decidedly in osteological characters. and has been associated with the Bibronian genera *Aphanacanthus*, *Amblyrhynchotus*, *Stenometopus*, *Geneion*, *Epipedorhynchus*, and *Promecocephalus* in a comprehensive group, to which a new generic name, *Apsicephalus*, was given by Hollard, while the typical *Tetraodon* was united with *Dichotomycter* in another supergeneric group called *Brachycephalus* by Hollard.

Arothron, being the prior name and based on the typical species of *Dilobomycter*, should be adopted.

1854.) CHONERHINUS. (Bleeker.

The facts respecting this genus have already been detailed in a previous article on the genus and therefore need not be repeated here.

* Abhandl. Berlin Akad., 1839, p. 252, 1841.

† *Tetrodon testudinarius* (see Archiv für Naturg., 9. Jahrg., p. 330, 1843) is the *Tetrodon reticularis* Schn. (See Gthr. Cat. fishes, v, 8, p. 296.)

1855.) AMBLYRHYNCHOTUS. (Bibron.)

In 1855 A. Duméril published from the MSS. of Bibron the following diagnosis of a genus of *Tetraodontidæ*.

4° *G. Amblyrhynchote*, Bib. (ἀμβλύς, obtus, ρυγχος, museau). "Narines ayant la forme d'un tube court, clos au sommet, mais percé latéralement de deux ouvertures opposées. Museau obtus, un peu déclive.—Épiptère et hypoptère pointues, opposées l'un à l'autre."

Il y a quatre espèces: *T. Honckenii*, Bloch, *oblongus*, Bloch, *Richi*, Fremenville, *albo-guttatus*, Bib.

The National Museum has skeletons of *T. Honckenii* and *T. oblongus*, and also of *T. pardalis* (Temm. and Sch.), and these indicate a genus distinct from *Lagocephalus* to which they would be generally referred on account of agreement in the nasal structure. But further they indicate that there is considerable difference between *T. oblongus* and *T. pardalis* on the one hand and *T. Honckenii* on the other. I reserve the consideration of these differences and the nomenclature for a future occasion.

1855.) EPHIPPION. (Bibron.)

In 1855 Bibron's name *Ephippion* was published with the following diagnosis:

9° *G. Ephippion*, Bib. (Ἐπιππιον, selle). "Narines en cupule profonde; de ses bords s'élèvent trois tentacules aplatis, dont un est plus large, mais moins long que les autres.—Des épines au ventre; tête et queue lisses; dos et flancs revêtus d'une cuirasse de même nature que celle qui enveloppe la totalité du corps des *Cypræ*.—Épiptère et hypoptère pointues, courtes; uroptère à rayons externes plus longs que les autres."

Espèce unique: *E. maculatum*, Bib.

The *E. maculatum* was not described.

In 1865 Bleeker, in a review of Bibron's system, concluded that *Ephippion* was the only genus with which Bibron enriched science and gave the following note on *E. maculatum*:

J'ai examiné, à Paris, des individus d'*Ephippion maculatum* Bibr. provenant de Tanger et de Gorée. La diagnose de Bibron est d'une rigoureuse exactitude. Les lames osseuses s'étendent jusques sur la queue. Les épines du ventre ont des racines divergentes. Il n'y a point de ligne latérale visible. D. 2/8. A. 2/7. C. 1/8/2. Couleur brun-olivâtre en dessus et blanchâtre en dessous. Dos et dessus des flancs ornés d'ocelles naérés épars. Une large bande sousoculaire transversale brun-olivâtre. Nageoires roses; la base de la pectorale noirâtre.

In 1870, Günther recognized in the genus "*Tetrodon*" a section based on the *Tetraodon guttifer* of Bennett, to which he gave the new name *Hemiconiatus*. The section was defined in the following terms:

1. The dermal ossifications are in the form of spines and of scutes, the latter forming a continuous carapace round the trunk, *Hemiconiatus*.

The notices of Bibron and Bleeker of *Ephippion* were completely overlooked and ignored in the synonymy of the species, section, and genus *Tetrodon*. *Hemiconiatus* is in fact a synonym of *Ephippion*, and in order to learn the essential characters of *T. guttifer*, such as the

structure of the nostrils, the number of fin rays, and the color, recourse must be had to the previous notices of the *E. maculatum* of Bibron and Bleeker.*

The synonymy of this form will then be as follows:

EPHIPPION.

= *Ephippion* Bibron, Rev. et Mag. Zool. (4), v. 7, p. 281, 1855.

= *Ephippion* Bleeker, Atlas Ich. Néerland. Ind., v. 5, pp. 47 (also printed *Ephippium*), 49, 1865.

= *Hemiconiatus* Günther, Cat. Fishes, B. M., v. 8, p. 272, 1870.

The type *E. guttifer* (= *Tetrodon guttifer* B.) is the only known species, and is confined to the northwest and west African coast.

Ephippium was apparently a mere slip for *Ephippion*. *Ephippium* had been twice used before 1854—by Bolten in 1798 for a genus of mollusks, and by Latreille in 1802 for a genus of dipterous insects. *Ephippion* had not been previously used, is sufficiently distinct from *Ephippium*, and has classical sanction, as in *logarion*.

1884.) COLOMESUS. (Gill.)

This genus was instituted in 1855 by Bibron and well diagnosed and illustrated in 1857 by Hollard. Its establishment therefore dates from 1855, but unhappily a name previously used in ichthyology (*Batrachops*) was taken by those excellent naturalists. In 1884 I was therefore obliged to give a new name. As the nomenclature is now clear, no further remarks are necessary.

Only one species is known, the *C. psittacus*, found in the northern streams of South America.

It is noteworthy that the first use of the name *Tetraodon* in ichthyology (so far as I know) occurs in connection with the type of this genus, which was called *Ostracion tetraodon* in Seba's work.

OTHER GENERA.

Such are the genera that appear to have undoubted claims for recognition in a scientific arrangement of the *Tetraodontoidea*. There is reason to believe, however, that among the genera named by Bibron there may be several others that require admission into the system. The "new species" named by that naturalist have never yet been described. More than a generation has passed away since they were announced, and it certainly is not to the credit of French ichthyologists that they have never been determined. We might reasonably have expected that two learned ichthyologists (Hollard and Bleeker), who have examined the collection, would have determined them. Hollard left his meri-

*Dr. Günther can not be blamed, however, for not having given such information, as his specimen (20 inches long) was "stuffed," and anyone who has to do with stuffed gymnodonts will acquit him of blame, since he tried to find the characters, as indicated by his queries as to the "nostrils?" and the number of dorsal rays, "nine-rayed. (?)."

torious work incomplete in that he did not do so, and must accordingly be especially blamed therefor. It may be hoped that the accomplished naturalist now in charge of the collection (Prof. Leon Vaillant) will soon have the work done, or, still better, do it himself.

IV. SYSTEMATIC RELATIONS.

In 1884 I expressed the hope that naturalists might "make use of their reasoning powers in considering [the three families of *Tetraodontoidea* then recognized] and not *assume* that they are unjustifiable because previous students had not appreciated their value." The hope, however, has not yet been realized. President Jordan, from whose vigorous and progressive intellect most might have been anticipated, reduced the families to subfamily rank, and thus reverted to my system of 1878. A few remarks seem to be called for in defense and support of my later views.

Such families as the *Percidae*, *Serranidae*, *Pristipomidae*, *Spuridae*, and *Squamipinnes*, with varying limits, are recognized by almost all ichthyologists of the present time. Now what are the differences between them, compared with those between the three families into which the Tetraodontoideans have been distributed? They depend, *as generally defined*, on slight differences in the dentition, armature of the opercular bones, and extension of the scales on fins. Even if we look into the internal structure, no very salient differences are observable; we become, from such an examination, convinced that the characters that have been generally used to differentiate the families are almost worthless as expressions of real affinities, but there is a striking general resemblance in the crania and in all other parts. Contrast with such characters the differences exhibited by the crania of representatives of the three families of *Tetraodontoidea*. The difficulty is, then, not to *ascertain the differences*, but to *appreciate the resemblances*. Many anatomists would fail at first glance to understand the comparative homologies of the bones exhibited by the several types of Tetraodontoideans if they commenced their examination without any previous information. And yet, forsooth, the families of Acanthopterygian fishes are generally admitted, while one eminent ichthyologist unites all the Tetraodontoideans in a *single genus*! Could inconsistency go farther?

The differences between one of these tetraodontoidean families (*Chonerhinidae*) and the others extend to the vertebral column in a marked degree; most have a greatly diminished number of vertebrae; therefore the order, to accommodate them, has been said to have "the vertebrae in small number;"* the *Chonerhinids* have more vertebrae than a large proportion of the acanthopterygian fishes and certainly do not

* Günther, Int. Study Fishes, p. 683, 1880.

have them "in small number." Various families of acanthopterygians have been distinguished on account of the numbers of vertebræ; the Carangids, for example, have been distinguished because they have "ten abdominal and fourteen caudal vertebræ." Fishes closely allied in other respects to the Carangids have been excluded because they have twenty five* or more vertebræ.†

Let it be borne in mind that the differences in the number of vertebræ are *not* coördinated in the special cases of the acanthopterygians had in mind, with any other modifications. Yet an eminent ichthyologist unites the Tetraodontids and Canthigasterids having "the vertebræ in small number" (less than "ten abdominal and fourteen caudal vertebræ") with the Chonerhinids having the vertebræ in increased number ("more than ten abdominal and more than fourteen caudal vertebræ") in one and the same genus, although those differences *are* coördinate with numerous other structural modifications.

It is because President Jordan has probably been influenced by the treatment of the group under review by an eminent authority, and not allowed his own excellent and candid judgment to have full sway, that I feel constrained to comment on the inconsistency and want of scientific method involved in the examples in question. Far from fearing that I have gone too far in subdivision of the Tetraodontoideans, I feel that I have scarcely gone far enough. I should perhaps raise the Colomesines to family rank, and if I do not so do it is because I am desirous to appear not to go to an extreme. The recognition of the family value of the Colomesine group may be left to another or to some other time. Perhaps Mr. Boulenger, the learned herpetologist of the British Museum, may so elevate it.

That distinguished and really scientific herpetologist has employed a character, analogous to the principal one which distinguishes the Colomesines from the bulk of the Tetraodontids, to diagnose several families of lacertilians.‡ The Colomesines have the "postfrontals" so elongated and extended forwards as to unite with the "prefrontals" and thereby exclude the narrowed frontals from the orbits, while the Tetraodontines have wide frontals entering into the roofs of the orbits. Three families of lizards are distinguished chiefly on account

* Many true Carangids have twenty-five or other than twenty-four vertebræ.

† The strict accuracy and absence of exaggeration of the statements here made may be inferred from facts. Dr. Günther, in his Catalogue of Fishes, referred *Naucrates* to the *Scombridae* because it had Vert. 10-16 (p. 374), and referred *Seriola* (p. 462) and *Naucleus* (p. 469) to the Carangidae because they were supposed to have Vert. 10-14. Soon afterwards I demonstrated that two of the nominal species of *Seriola* and the six nominal species of *Naucleus* were based on different stages of the youth of *Naucrates* and that probably all belonged to a single species. The correctness of this statement has long been universally accepted—even by Dr. Günther—and the genus *Naucrates* is now retained by all in the Carangidae next to *Seriola*, where I placed it. (See Proc. Acad. of Nat. Sc. Phila., 1862.)

‡ See Boulenger, Cat. Lizards B. M., v. 1, pp. 1, 2.

of analogous extensions of the postfrontals and prefrontals* and thereby the contraction of the frontals to the middle of the cranium—the *Pygopodidae*,† the *Anniellidae*‡ and *Helodermatidae*.§

V.

In conclusion I submit the revised synonymy and definition of the superfamily *Tetraodontoidea* and diagnoses of the three families. They are essentially the same as those published in 1884.

I add copies of the illustrations of the crania of the six genera of *Tetraodontoidea* published by Hollard. Those who may think I have gone too far in estimating the values of the groups so figured may judge from an attempt to recognize the homologies of the bones, how distant some of them are from each other. If they ought all to be combined in one genus, surely there should be no difficulty in recognizing the bones at once.

TETRAODONTOIDEA.

Synonym as superfamily name

- <Tetraodontoidea Gill, Cat. Fishes E. Coast N. A., p. 6, 1873.
=Tetraodontoidea Gill, Proc. U. S. Nat. Mus., v, 7, p. 419, 1884.

Synonyms as family names.

- <Ostéodermes Duméril, Zoöl. Anal., p. 109, 1806.
<Odontini Rafinesque, Indice d'Ittiolog. Siciliana, p. 40, 1810.
<Osteodia || Rafinesque, Analyse de la Nature, p. 89, 1815.
<Gymnodontes Cuvier, Règne Animal, le éd., t. 2, p. 115, 1817; 2d éd., t. 2, p. 364, 1829.
<Gymnodontes Latreille Jour. Nat. Régne An., p. 115, 1825. §
<Tetraodontidae Bonaparte, Giorn. Arcad. di Scienze, v. 52 (Saggio Distrib. Metod. Animali Verteb., a Sangue Freddo, p. 39), 1832.
<Tetraodontidae Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 131, 1838; t. 4, p. 186, 1840.
<Première famille [des Plectognathes] Daresse, Ann. Sc. Nat. (3), v. 11, p. 117, 1850.
<Gymnodontidae Adams, Manual Nat. Hist., p. 95, 1854.
=Tetraodontiens Bibron, Revue et Mag. Zool., (2), t. 7, p. 279, 1855.
<Gymnodontidae Girard, Expl. and Surv. for R. R. Route to Pacific Ocean, v. 10, Fishes, p. 339, 1878.

* It is not meant, by the use of the words prefrontals and postfrontals, to imply that the bones so called in fishes are the same as those of the same name in reptiles. Indeed, there appear to be few (and possibly no) bones precisely homologous in reptiles and fishes, homoplasy (in the word of Ray Lankester) prevailing rather than homology. But the homonymous bones cover corresponding regions and there is apparently no reason why their modifications are not of approximately equal value in the two cases.

† The *Pygopodidae* have "the præ- and postfrontals in contact, separating the frontal from the orbit." (B., o. c., v. 1, p. 239). "The structure of the skull is most similar to that of *Geekos*, but differs in two points: (1) the separation of the frontal from the orbit by the union of the præ- and postfrontal, a character which is shared by *Heloderma*; (2) the reduction of the number of bones in the mandible, in which respect they resemble the snakes." (B., o. c., p. 239.)

‡ The *Anniellidae* are said to have the "præ- and postorbital in contact, separating the frontal from the border of the orbit." (B., o. c., v. 2, p. 299.)

§ The *Helodermatidae* have the "præ- and postfrontals in contact, separating the frontal from the orbit." (B., o. c., v. 2, p. 301.)

|| *Osteodia* = *Gymnodontes* + *Ostracodermi*.

- <Physogastroidei *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xiv, 1859.
 <Sphérosomes *Hollard*, Annales des Sci. Nat. (4), t. 8, p. 326, 1860.
 <Tetraodontoidei *Bleeker*, Atlas Ich. des Indes Néerland, t. 5, p. 45, 1865; Nederl. Tijdschr. Dierk., v. 3, p. 17, 1866.
 <Gymnodontes *Günther*, Cat. Fish. B. M., v. 8, p. 269, 1870.
 =Tetrodontidæ *Cope*, Proc. Am. Assoc. Adv. Sci., v. 20, p. 340, 1872.
 <Tetrodontidæ *Gill*, Arrangement Fam. of Fishes, p. 1, 1872.
 =Tetrodotes *Fitzinger*, Sitzungsber. K. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 47, 1873.
 <Tetrodontidæ *Jordan and Gilbert*, Syn. Fishes N. Am., pp. 853-859, 1883.
 =Tetraodontidæ *Jordan and Edwards*, Proc. U. S. Nat. Mus., v. 9, p. 230, 1886.

Synonyms as subfamily names.

- <Odopsia* *Rafinesque*, Anal. de la Nat., p. 89, 1815.
 ×Orbidia† *Rafinesque*, Anal. de la Nat., p. 89, 1815.
 <Tetraodontini, *Bonaparte*, Nuovi Annali deile Sci. Nat., t. 2, p. 131, 1838; t. 4, p. 186, 1840.
 <Tetraodinae, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 194, 328, 1839.
 =Tetrodontiformes, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xiv, 1859.
 =Tetrodoniens, *Hollard*, Annales des Sci. Nat. (4), t. 8, p. 327, 1860.
 =Tetraodontiformes, *Bleeker*, Atlas Ichthyol. Indes Orient. Néerland., v. 5, p. 49, 1865; Nederl. Tijdschr. Dierk., v. 3, p. 18, 1866.
 <Tetrodoutina, *Günther*, Cat. Fishes Brit. Mus., v. 8, pp. 269, 270, 1870.
 =Tetrodoutinae, *Jordan and Gilbert*, Syn. Fishes N. Am., p. 859, 1883.

Diagnosis.

Gymnodontes without either pelvis or ribs,‡ with a normally developed caudal region,§ with the intermaxillary and dentary bones severally connected by suture at middle, the supramaxillaries curved outwards behind the intermaxillaries, the ethmoid more or less projecting in front of the frontals, and the postfrontals extended outwards as far at least as the frontals.||

SYNOPSIS OF FAMILIES.

1. Vertebrae numerous, *i. e.*, 12+17 pm.....Chonerhinidæ.
2. Vertebrae few, *i. e.*, 7—8+8—13.
 - a. Medifrontines separated from the supraoccipitine by the postfrontals meeting in the middleCanthigasteridæ.
 - b. Medifrontines articulated with the supraoccipitine and the postfrontals confined to the sidesTetraodontidæ.

TETRAODONTIDÆ.

Diagnosis.

Tetraodontoidea with the medifontines articulated with the supraoccipitine and the sphenotics (postfrontals) confined to the sides, the pros-

* Odopsia=Gymnodontes.

† Orbidia=Orbidus (=Spheroides) +Oonidus (=Ovoide Lac.)

‡ The *Triodontoides* have ribs.

§ The *Moloidea* have an aborted and excessively modified posterior region.

|| The *Diodontoidea* are distinguished by the union of the jaw bones of the opposite sides, and great modifications of the cranium.

ethmoid little prominent to view above and short or narrow, the vertebræ in small number (7, 8+9-13), the head (typically) wide and with a heavy wide snout, and the dorsal and anal fins short and pauciradiate.

CANTHIGASTERIDÆ.

Diagnosis.

Tetraodontoidea with the medifrontines separated from the supraoccipitine by the intervention of the sphenotics, which are connected together and laterally expanded but short, the prosethmoid prominent above, enlarged and narrowed forwards, the vertebræ in normal number (about 8+9), the head compressed and with a projecting attenuated snout, and the dorsal and anal fins short and pauciradiate.

CHONERHINIDÆ.

Diagnosis.

Tetraodontoidea with the medifrontines separated from the supraoccipitine by the intervention of the sphenotics (postfrontals), which are much enlarged and assume a quadrangular form, the prosethmoid little prominent to view and very short, the vertebræ in increased number (12+17), the head wide and with a blunt wide snout, and the dorsal and anal fins long and multiradiate (D 32-38; A 28-32).

VI.

The genera of *Tetraodontoidea* certainly very much needs revision, and many species yet require to be referred to their proper systematic places. The paucity of the material in the National Museum prevents my undertaking the task at present. Mr. Barton Bean, the assistant curator of fishes, to whom I am indebted for efforts to bring together the material, has only been enabled to find thirty-three species. There are skeletons of twelve species, viz.:

TETRAODONTIDÆ.

TETRAODONTINÆ.

1. SPHEROIDES MACULATUS = *Tetraodon hispidus* var. *maculatus* Schn.
2. SPHEROIDES TESTUDINUS = *Tetraodon testudineus* Linn. = *Stenomotopus testudineus* Bib.
3. SPHEROIDES POLITUS = *Tetraodon politus* Girard.
4. AMBLYRHYNCHOTUS PARDALIS = *Tetraodon pardalis*, T. & S.
5. AMBLYRHYNCHOTUS OBLONGUS = *Tetraodon oblongus* Black = *Amblyrhynchotus oblongus* Bib.
6. AMBLYRHYNCHOTUS HONCKENII = *Tetraodon Honckeni* Black = *Amblyrhynchotus Honckeni* Bib.
7. LAGOCEPHALUS LEVIGATUS = *Tetraodon levigatus* L. = *Promecoccephalus levigatus* Bib.
8. LAGOCEPHALUS LUNARIS = *Tetraodon lunaris* Schn.
9. AROTHRON MELEAGRIS = *Tetraodon meleagris* Lac. = *Dilobomycter meleagris* Bib.
10. AROTHRON HISPIDUS = *Tetraodon hispidus* Bl. = *Dilobomycter hispidus* Bib.

COLOMESINÆ.

11. COLOMESUS PSITTACUS=*Tetraodon psittacus*, Schn.=*Batrachops psittacus* Bib.

CANTHIGASTERIDÆ.

12. CANTHIGASTER PUNCTATISSIMUS=*Tetrodon punctatissimus* Gthr̄.

My knowledge of the cranial characters of *Chonerhinus* is derived solely from the description and figures of Hollard. There is only one specimen of *C. naritus* in alcohol in the National Museum.

Any additional material will be welcomed and equivalents given in exchanges by the National Museum.

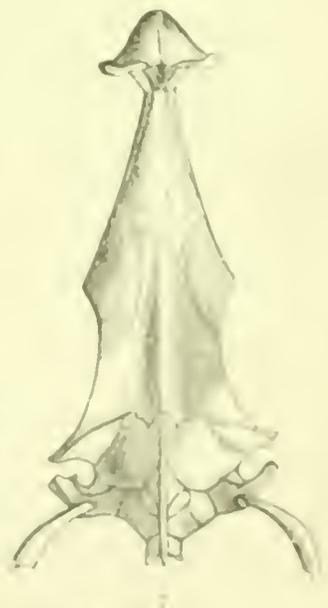
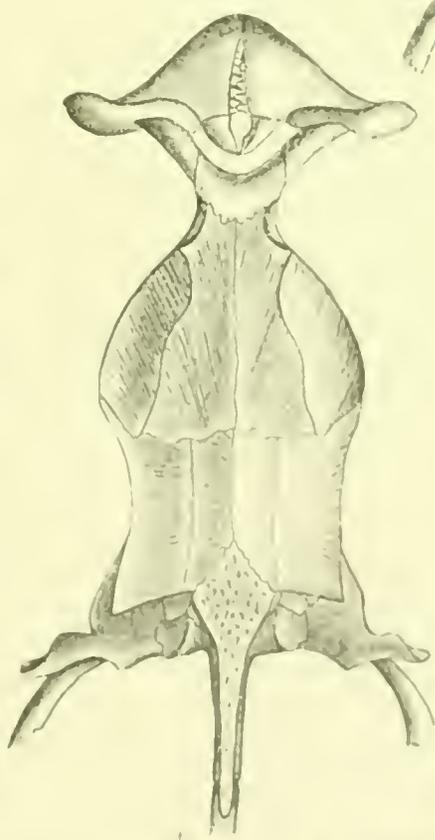
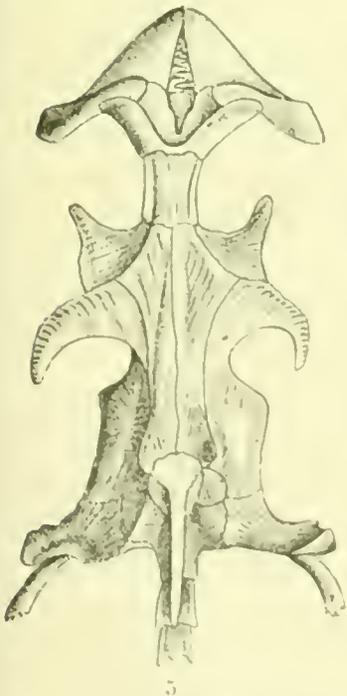
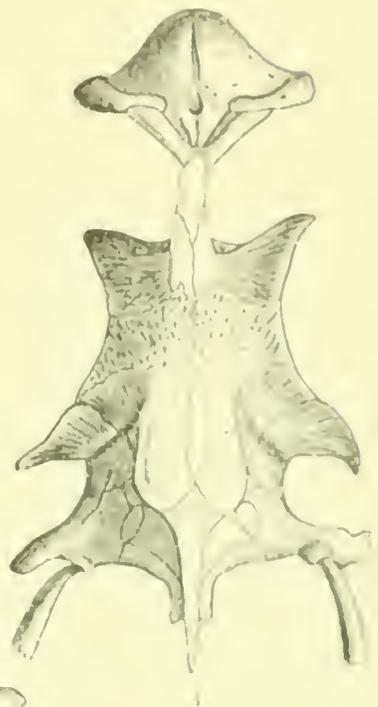
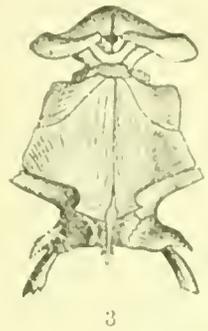
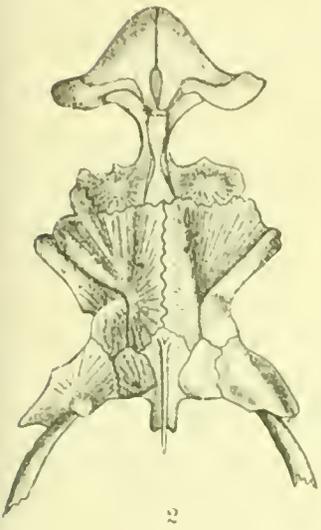
The value of the skeleton, even for specific distinctions, is well illustrated in the case of *S. testudineus* and *S. politus*. Messrs. Jordan and Edwards record the *S. politus* as a "doubtful species," probably the adult form of *S. testudineus*.* They also state that the old specimens of *T. politus* "differ from *S. testudineus* (*annulatus*) only, so far as we can see, in the absence of prickles,"† and consequently "see little reason to doubt that *Spheroides politus* is simply the adult of *S. testudineus annulatus*."

The National Museum has skeletons of *S. testudineus* and *S. politus* of nearly the same length, and the differences between the crania of the two is very marked, the former having the interorbital area comparatively narrow, and the prefrontal grooves narrow, while the latter has the interorbital area very broad and the prefrontal grooves shallow and wider‡

* Proc. U. S. Nat. Mus., v. 9, p. 247.

† Proc. U. S. Nat. Mus., v. 9, p. 239.

‡ Profs. Evermann and Barton have reached the same conclusion respecting *S. politus* and *S. testudineus* and have remarked that "the interorbital space is flat" in *S. politus* and "concave in *S. testudineus annulatus*." (Proc. U. S. Nat. Mus., v. 14, p. 165, 1891.) No one, however, has noticed the difference in the width of the interorbital space. It will be interesting to compare the anatomy of *S. testudineus* (typical) and *S. testudineus annulatus*.



- 1. *Chomichinus nuda*
- 1a. *Chomichinus nuda* (mouth)
- 2. *Tetraodon*
- 3. *Leioidon* or *Momotracta*

- 4. *Leioidon* or *Tetraodon*
- 5. *Leioidon*
- 6. *Leioidon*
- 7. *Leioidon*

The illustrations of crania are reproduced from the work of Howard's (1880).