

II.—*Additions and Corrections to the Arrangement of the Families of Bivalve Shells.* By J. E. GRAY, Ph.D., F.R.S., V.P.Z.S. &c.

ONE of the advantages, and not the least, of preparing and publishing a revision of the state of our knowledge on any special subject, such as the animals of Bivalve shells, are the additions to that knowledge which its publication induces. During the time my former paper was in the press and since its publication, I have had an opportunity of looking over more than a thousand molluscos animals, and of examining the animals of more than fifty species of Bivalves belonging to nearly as many genera, some of them not before observed, which has rendered it necessary to make several corrections and important additions to my former communication.

There must be added to the family *Veneridæ* the genus *Cypricardia* of Lamarck and its subdivisions: all these animals have two short separate siphons and a small pedal opening. I have examined the animal of *Trapezium angulatum*.

Mittre has described the animal of what he calls *Coralliophaga dactyla*, but M. Petit informs us that the shell intended is the *Cardita Lithophagella* of Lamarck found in the Mediterranean, and not the *Cypricardia Coralliophaga* of that author, which is only found in the West Indies. This animal greatly resembles that of *Trapezium angulatum*, and should be the type of a new genus which may be called *Lithophagella*. The *Cypricardia vellicata* and *Coralliophaga oblonga* have similar animals, but all these genera require revision.

In the Revision, vol. xiii. p. 410, I placed *Astartidæ* in the order *Veneracea*, because Prof. E. Forbes in the 'British Mollusca,' i. 451, described the animal of the genus as having "the mantle freely open with plain margins; slightly united posteriorly at two points, so as to form two siphonal orifices with simple edges," and at pl. M. fig. 5. figures the animal of *Astarte sulcata* with two siphonal apertures; at p. 455, he further observes on this species, "the siphonal openings are quite sessile, and but slightly separated from each other;" and at p. 466, he states that the animal of *A. compressa* has "sessile siphonal orifices."

I was aware that Philippi (Wiegmann's Archiv, 1839, 125, copied Ann. and Mag. Nat. Hist. vol. iv. p. 297) had described the animal as like *Cardita*, with only a single anal opening, but placed more faith in the latter description. I have however had an opportunity of examining the animal of *Astarte striata* from Greenland, which appears to be the same as the *A. compressa* of the 'British Mollusca,' and find the description of Philippi cor-



rect, and that it has only a single opening like *Crassatella* and *Cardita*. The family must, therefore, be removed to the order *Unionacea*, between *Carditidæ* and *Crassatelladæ*, differing chiefly from the latter in the external position of the cartilage.

Most probably, when the animal of *Astarte* is alive, the hinder portion of the mantle near the anal aperture forms a siphon-like aperture, as is the case in *Crenella* and in many of the other *Lucinacea*. It has been suggested that perhaps the leaves of the mantle are united together and form a siphonal aperture when the animal is alive, but separate when the specimen has been kept in spirits; however, there is not the slightest appearance of any such union on the surface of the mantle, and it certainly is not the case with *Crenella*, *Mytilus*, *Unio*, *Anodon*, and other animals which are without a branchial siphon, and which have an imperfect siphonal aperture for the entrance of the water to the gills.

**CARDITIDÆ.** This family may be thus divided:—

A. *The elongate hinder cardinal tooth in left valve single, trigonal, upper lamina of it rudimentary or quite wanting. Shell strongly costate, cordate or ovate.*

1. *Venericardia*. Shell short, cordate, hinder cardinal tooth triangular. *V. australis*, *V. ajar*.

2. *Cardita*. Shell elongate, ovate, hinder cardinal tooth elongate. *C. antiquata*.

B. *The elongate hinder cardinal tooth in left valve double, both laminae equally developed, elongate. Shell elongate, oblong.*

3. *Mytilicardia*. Shell oblong, strongly costate; front hinge-tooth triangular, diverging; anterior lateral none. *M. Jeson*, *M. concamerata*.

4. *Lazaria*. Shell oblong, strongly costate, front hinge-tooth compressed, anterior lateral tooth distinct. *L. Pectineus*, *L. radiata*.

5. *Azarella*. Shell roundish, compressed, dilated behind, striated; front hinge-tooth elongate, compressed, similar and parallel to hinder; lateral teeth none. *A. semiorbiculata*, *A. gubernaculum*.

In *Astartidæ* I inserted "*Cypricardia* sp. according to D'Orbigny;" this was a mistake for *Cardita* sp. M. D'Orbigny both describes and figures *Cardita spurca*, t. 82. f. 13, as having two distinct siphonal apertures. I have not been able to see the animal of this shell. M. Quoy describes the animal of *Venericardia australis*. Deshayes figured the animal of *Cardita calyculata* as having only a single anal siphonal opening, and this is the case with the animal of the several species of *Cardita*



I have examined; but if there is not some mistake in M. D'Orbigny's description and figure of *Cardita spurca*, it must be a distinct genus; however, perhaps he has been misled by the hinder part of the mantle being expanded behind during life, so as to represent a second siphon, which is only a false appearance.

*Tellinidæ*.—The genera *Sanguinolaria* and *Soletellina*, which have been referred to *Solenidæ*; *Fragilia* and *Capsa*, arranged with *Veneridæ*, should be referred to this family; they have, like them, two elongated separate siphons, with large distinct fan-shaped retractile muscles, and the gills not produced into the siphons.

*Anatinidæ*.—In the May Number of the 'Annals' (p. 413), I referred the genus *Mytilimera* of Conrad to the family *Modiolarcadæ* with doubt. In an examination which I have been enabled to make of typical specimens of *Mytilimera Nuttalli*, I think I have discovered the mark left by the shelly plate over the large subinternal cartilage; and on comparing it with *Anatina cuneata*, I have as little doubt as one can have from the examination of shells alone (especially in an imperfect condition), that they belong to the same genus and the family *Anatinidæ*. As *Mytilimera* was published before the *Byssonia* of Valenciennes, it ought to be retained for these shells. They both have the habit of living imbedded,—*Byssonia cuneata* in *Ascidia*, and *Mytilimera* in sponges.

*Muteladæ*.—In *Mutela* the lips are very large, semioval, attached by the straight side without the free point existing in *Unio* and *Anodon*.

*Cardiadæ*.—The gills are united together behind the body or base of the foot.

*Solenidæ*. This family may be thus divided:—

A. *Cardinal teeth* 1 · 1. *Siphons produced, united; siphonal muscles moderate; siphonal inflection deep, truncated.*

1. *Solen*. Shell truncated in front; umbo anterior; anterior adductor muscle elongate, horizontal. *S. marginatus*.

2. *Hypogella*. Shell rounded at each end; umbo subanterior; anterior adductor muscle round. *H. ambigua*, *H. vaginata*.

B. *Cardinal teeth* 2 · 3. *Shell rounded at each end.*

a. *Siphons moderate, separate; siphonal muscles small; siphonal inflection small, truncated.*

3. *Ensis*. Siphons not produced, separate; umbo anterior; anterior adductor muscle elongate, horizontal. *E. Ensis*.



4. *Pharella*. Siphons shortly produced, separate; umbo sub-anterior; anterior adductor muscle elongate, subtrigonal; shell subcylindrical. *P. javanica*, *P. Michaudi*, *P. acutidens*.

5. *Pharus*. Siphons produced, separate; shell compressed; umbo subcentral; anterior adductor muscle elongate, horizontal; umbonal ribs rudimentary. *P. legumen*.

6. *Cultellus*. Siphons —? anterior adductor muscle rounded, hinder triangular; shell compressed; umbo subanterior. *C. lacteus*.

b. *Siphons much produced, large, united, covered with a thick periostraca; retractor siphonal muscles small; siphonal inflection very small.*

7. *Cyrtodaria*. Anterior adductor muscle elongate; umbo sub-posterior. *C. glycimeris*.

c. *Siphons elongate, with large fan-shaped retractor muscles; siphonal inflection deep, rounded.*

\* *Siphons very large, united, covered with a hard periostraca. Shell compressed. Hinge-teeth 3·3, compressed.*

8. *Siliqua*.

\*\* *Siphons large, united at the base, covered with a hard periostraca. Shell subcylindrical. Hinder teeth conic.*

9. *Glycimeris*. 10. *Adacna*.

\*\*\* *Siphons very large, united at the base, upper part free, ringed.*

11. *Macha*. Shell obliquely sulcated. *M. strigillatus*.

12. *Azor*. Shell smooth. *A. antiquatus*.

\*\*\*\* *Siphons elongated, cylindrical.*

13. *Tagelus*. \* Umbo submedial; siphonal inflection very deep, beyond the umbo. *T. viridiæneus*. *T. Carabæus*.

\*\* *Novaculina*. Umbo subposterior; siphonal inflection deep, not reaching the umbo. *T. Novaculina*, India. *T. Dombeyi*, Peru. *T. fragilis*, Europe. *T. constrictus*, China.

*Elizia*.—Animal unknown. Shell suborbicular, oblong, equivalved, compressed, thin, covered with a hard shining periostraca; umbo not prominent, subanterior. Cardinal teeth oblique, in right valve two, hinder bifid elongate, in left valve three, central bifid. Pallial impression submarginal. Siphonal inflection deep, oblong, rather contracted at the outer edge, descending from the upper part of the hinder margin to the centre of the disk.

*Elizia orbiculata* = *Solen orbiculatus*, Gray in Wood Cat. Supplement, t. 1. f. 4.



*Lucinidæ*.—As our knowledge of the animals of Univalve shells has increased, we have found that shells which have a great resemblance to each other are formed by very different animals, until it has become almost impossible to pronounce with certainty on the genera of several Gasteropodous Mollusks, unless we are in possession of the animal and operculum as well as the shell. The same fact is every day forcing itself on our notice with respect to the Bivalves. It is nearly impossible to separate the *Muteladæ* from the *Uniones*, the *Modiolarcæ* from the *Modiola*, though the animals are very unlike.

All conchologists considered that the *Lucinidæ* were a very natural group, yet we learn that *Ungulinæ* of Daudin, which are scarcely to be separated from them, except by their irregular outline from living in holes in rocks, have four gills and distinct labial palpi, while the *Lucinæ* have only two gills and no labial palpi. This appeared so improbable when I printed my paper in the May Number of the 'Annals,' that I placed a mark of doubt after the description, but I have since had an opportunity of verifying the accuracy of the observations.

One of the most striking instances occurs in the shell referred to the genus *Mysia*, or *Diplodonta*. In the paper above referred to I described the animal of a Philippine species of this genus, which has two siphonal apertures and a lanceolate foot, and referred it to the suborder *Veneracea*. M. Mittré in 'Journ. de Conchyliologie,' 1850, t. 238, described and figured the animal of a Brazilian species, which he calls *Diplodonta Brasiliensis*, having only a single anal siphonal aperture and a cylindrical foot like the *Ungulinæ*; and which, indeed, appears chiefly to differ from that genus in the anal aperture being further from the pedal one, and in the adductor muscle being roundish instead of linear and elongate: the difference in form of this part probably explains the relative position of these two apertures.

The examination of the animal of *Ungulina*, and M. Mittré's description and figure, show the necessity of forming for these genera, as recommended by M. Mittré, a family, which may be called *Ungulinadæ*, characterized by the single anal siphonal aperture, and the presence of two pairs of gills and distinct labial tentacles, which will contain the genera, 1. *Ungulina*, Lamk., 2. *Scacchia* of Philippi, and 3. a new genus which may be called MITTREA, having *Diplodonta Brasiliensis* for its type. One of our English shells, *Tellina rotundata*, Montague, has been referred to the genus *Diplodonta*, but I have not been able to examine its animal, and according to the description of Mr. Clark, quoted by Messrs. Forbes and Hanley, it differs essentially from any of the preceding: "the mantle plain, somewhat closed posteriorly and anteriorly, but with a large opening for the foot in



the centre of the ventral range: no siphonal process is to be found, not even an orifice, except the pedal one."—Brit. Moll. ii. 67. Should any of your readers have a specimen of this animal, I should be happy to have the opportunity of examining it; and also of the animals of any of our species of *Lucina*.

I may further remark, that the species of the genus *Diplodonta* have been confused with the *Cyrenellæ*, but the latter may be known by a careful examination of the teeth of the hinge, and the animal differs in having two siphons.

If M. Mittré's description of the animal of *Venus diaphana*, on which Recluz has formed his genus *Felania*, is correct, it will also have to be referred to the *Ungulinidæ*.

While on the subject, I may state, that the genus *Myllita* of D'Orbigny and Recluz, 'Journ. de Conch.' 1850, 88. t. 11. f. 12-14, is the same as *Pythina* of Hinds, 1844, Voy. Sulph. 70, and I believe established on the same species.

*Etheriadæ*.—The lips are very large, semioval, and attached by the straight side without any free point, as in *Mutela*. There is in fact no distinct muscular foot in the adult specimens. The body containing the liver projects into the cavity of the mantle, and has been described by Rang as a foot. The foot may be present in the young state before the shell is attached.

Through the kindness of M. D'Orbigny, who has sent me the original specimen of his genus *Acostea*, I am enabled to state that it is identical with the *Mulleria* of Férussac and Sowerby, and it appears to be the American form of this family.

*Mytiladæ*.—The pedal opening of *Crenella* is small, forming the hinder half or third of the basal margin.

MALLEACEA should be divided into three families:—

1. *Pinnadæ*. Mislead by Rang (Manual Moll. 292), this family was erroneously referred to *Mytilacea*. Anterior adductor muscle well developed. Gills narrow, very much produced behind, free from each other and the mantle, but fitting against a fold on its inner surface. Rectum with a long tubular process at its base. Vent medial. *Pinna*.

2. *Pteriadæ*. Anterior adductor muscle none. Gills narrow, much produced behind, free from each other and the mantle, but fitting against a fold on its inner surface. Rectum simple.  
 α. *Avicula*, *Meleagris*, *Malleus*, and *Perna*. β. *Crenatula*.

In *Avicula* the hinder pedal muscle is separate from and in front of the large adductor muscle, with a separate scar; in *Meleagrina* it is close to and forms part of the large scar. There are some other small scars, two in front and one behind the cir-



cular central scar, formed by the ligaments of the muscles which suspend the mantle and gills.

3. *Vulsellidæ*. Anterior adductor muscle none. Gills narrow, much produced behind, united together and to the inner surface of the mantle, dividing the mantle-cavity into two parts. Rectum simple. *Vulsella*.

In all these families the body forms a single mass, the tube of the rectum passes over the back of the adductor muscle, the vent being free and medial.

*OSTREINA*. Add, vent medial, free; the body forms a single central mass.

*Ostreidæ*. Gills united together and to the inner edge of the mantle. Shell, hinge toothless.

*Plicatulidæ*. Gills free behind and free from the mantle, suspended from the body by a membrane. Shell, hinge with two diverging cross-grooved cardinal teeth.

The genus *Plicatula*, which has been hitherto placed with *Spondylus*, should be removed to the tribe *Ostreina* and formed into a separate family, as the animal has no appearance of any foot, which is so peculiar in the former genus. The animal is very like *Ostrea*, has four equal suspended gills united together, acute, and produced beyond the lower side of the adductor muscle. Lips four, rather small, united together above the rather large mouth. The shell is attached by the outer surface of the left valve, and the hinge is furnished with two diverging teeth, with the cartilages in a triangular pit between their base.

*ANOMIAINA*. Foot distinct, small, truncated at the end; ovaries separated from the mass of the body and attached to the inner surface of the right leaf of the mantle. Vent nearer to or attached to the right leaf of the mantle. Gills united together behind, suspended by membranes to the inner side of the mantle.

*Anomiadæ*. Animal attached, rather distorted; foot on the right side of the body, with a very large byssal pore at the base; byssus horny or stony, formed of parallel laminæ, emitted through a notch in the right valve of the shell. Pedal muscles large, leaving two or three large scars on the left valve. The byssus, or plug, is placed in exactly the same situation in the animal as the beard or byssus of *Mytilus*, *Pinna*, &c., and the animal is only rather distorted by being more closely attached to the marine body than in those genera.

It shows that what is called the foot of the Arcs is in fact an enlargement and production of this byssus-forming organ, while the real foot is greatly reduced.



*Placentadæ*. Animal free. Foot cylindrical, compressed, medial, without any byssal pore. Vent attached to the right leaf of the mantle. Pedal muscle small, leaving a small round scar between the diverging cardinal plates.

This family must be removed to the tribe of *Anomiaina*, having a distinct foot. The mantle leaves free, margin closely bearded. Foot when contracted in spirits compressed, elongate, larger at the end, truncated, and with a deep linear cavity at the end, apparently produced by the withdrawing of the tip, probably cylindrical, and much elongated and produced when alive. Gills suspended, occupying the front and lower edge. Anus tubular, conical, elongate at the hinder basal margin, attached to the inner side of the right mantle leaf. Lips elongate, attached by their hinder edge. Body surrounding the cardinal ribs and cartilages.

*Pectenidæ*.—The foot of *Pedum* is elongate, cylindrical, clavate, rather enlarged and rounded at the tip, without any appearance of a byssal groove.

III.—*Supplement to a Catalogue of British Spiders, including remarks on their Structure, Functions, Economy and Systematic Arrangement.* By JOHN BLACKWALL, F.L.S.

[Continued from vol. xi. p. 120.]

Tribe OCTONOCULINA.

Family SALTICIDÆ.

Genus *Salticus*, Latr.

AFTER *Salticus notatus* in the supplement to the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 114) add

*Salticus promptus*.

*Salticus promptus*, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xiii. p. 173.

In October 1853, an immature female of this species, which is nearly allied to *Salticus frontalis* and *Salticus reticulatus*, was received from the Rev. Hamlet Clark, who took it near Northampton in the autumn of the same year.

After *Salticus reticulatus* in the supplement to the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 114) add





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