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to *Rissoa*, are derived from an observation of Lovèn, who did not, however, regard them as species of those genera, but only intended to show that an affinity existed between them, as far as the outer form of the animal was concerned.

I am, Gentlemen,

Your obedient Servant,

J. E. GRAY.

XXXVI.—*A few Remarks on the Brachiopoda.*

By THOMAS DAVIDSON, Esq., F.G.S. &c.

[With a Plate.]

1. *On the Systematic Arrangement of Recent and Fossil Brachiopoda.*

SHORTLY after the publication of the *General Introduction* to my work on 'British Fossil Brachiopoda,' to which Prof. Owen and Dr. Carpenter each contributed most valuable chapters, M. Deslongchamps and his son proposed to make a French translation of the third chapter treating especially of *Classification*, which the Linnæan Society of Normandy had in the most liberal manner offered to publish in the tenth volume of their Transactions. About the same period I received a similar offer from M. Suess and Count Marschall of Vienna with respect to a German translation. But although highly flattered by such liberal propositions, I felt that much could be done to improve the original by corrections, as well as by considerable additions, both in text and illustrations. I therefore entirely revised my English work, printed in 1853, before it went through the process of translation, and owing to the exertions of my friends, I am happy to say that both editions are now printed, and I trust will be ready for issue by the end of the present year.

As stated in my English work, we are not yet in a condition to offer a really complete and permanent classification of the numerous species composing the class; for to be able to do so effectually, one would require to be still better acquainted with the recent animals as well as with the interior of many obscure fossil species; and it is therefore of the greatest importance not to allow ourselves to be led into proposing *genera* or *subgenera* on trifling modifications or unimportant details which exist only in certain abnormal forms*.

* For example, the genus *Seminula* (M'Coy) is founded on the more developed state of the dental plates, while otherwise the shells in question possess all the essential characters of Lhwyd's original genus *Terebratula*.

The following is an improved Table of Families and Genera as published in the Foreign editions of my "Introduction":—

Families.	Genera and Subgenera.	Author.	Date.	Examples.
I. TEREBRATULIDÆ ...	{ TEREBRATULA	Lhwylld ...	1699 ...	<i>virrea, maxillata, diphyia, hastata, &c....</i>
	Subgenus Terebratulina	D'Orb.	1847 ...	<i>caput-serpentis, substriata, gracilis</i>
	— Waldheimia .	King 1849	.....	<i>flavescens, ornithocephala, cardium</i>
	— — Meganteris..	Suess 1855	.....	<i>Archiaci</i>
	TEREBRATELLA	D'Orb. 1847	.....	<i>Chilensis, dorsata, Coremeca</i>
	Subgenus Megerlea	King 1849	.....	<i>truncata, lima</i>
	— Kraussia	Dav. 1852	.....	<i>rubra, cognata, Lamarckiana</i>
	— Magas	Sow. 1818	.....	<i>pumila, orthiformis, Davidsoni</i>
	— Bouchardia ..	Dav. 1849	.....	<i>tulipa</i>
	— Morrissia	Dav. 1852	.....	<i>Anomioides, Davidsoni</i>
	ARGOPE	Deslong. 1842	.....	<i>decollata, megatrema, cistellula</i>
	Subgenus ? Zellamia ..	Moore..... 1854	.....	<i>Davidsoni, liasiana, Laboucherei</i>
	STRINGOCEPHALUS	Defrance... 1828	.....	<i>Burtini, giganteus</i>
	{ THECIDIUM	" "	" "	<i>radiatum, digitatum, sinuatulum</i>

[illegible]

This arrangement, although still imperfect in some respects, will I hope be found to possess advantages over the one published in 1853, being more simple and perhaps nearer to the truth. In the first place, we have got rid of all the subfamilies; the genera are located into eight families; that of *Calceolidæ*, which formed the ninth, being suppressed, on account of the great uncertainty still existing, as to whether or not *Calceola* is a true Palliobranch. M. Suess seems to believe that it is not so; but as much doubt remains as to where the shell should be located among the Mollusca, we have left the name provisionally in the Table, and must refer the reader to the German edition for more ample details on this point. Mr. S. P. Woodward, in whose knowledge on all appertaining to the Mollusca the greatest reliance may be placed, has also adopted eight families in his excellent 'Manual of the Mollusca,' and the only difference in opinion between us is whether the fourth family should be termed *Strophomenidæ* or *Orthidæ*. I adopted the first name simply on account of priority, but quite agree that my friend is right when he states that the names of families should be formed from those of the typical genera; the only question which might arise in the present case being, which of *Orthis* or *Strophomena* is in reality the typical genus.

Among the *genera* and *subgenera* we have proposed the following changes :—

1. *Terebratulidæ*. *Kraussia*, *Magas*, *Bouchardia* and *Morrisia* have been placed among the *subgenera* of *TEREBRATELLA*, as this last may be considered the great typical *genus* to which the *subgenera* mentioned are more nearly related than to that of any other group. *Trigonosemus* we have consented to erase on M. Suess's proposition, as it possesses all the essential internal characters of *Terebratella*, of which it is only a synonym; the largely developed cardinal process of *T. elegans* is not found in all the other forms which had been located with *Trigonosemus*, nor has the beak always the peculiar shape of the last-named species. *Lyra* (Cumberland) = *Terebrirostra*, D'Orb., appears to be composed partly of shells belonging to *Terebratella* and perhaps *Waldheimia*, and as the greater or lesser length of the beak is of very little generic importance among the Brachiopoda, that *section* can be advantageously dispensed with. *Stringocephalus* and *Thecidium* have also been admitted into the present family, which seems to be their most natural resting-place.

2. *Spiriferidæ*. The changes we have made in this family consist in re-establishing Prof. McCoy's genus *ATHYRIS* as typified by such shells as *T. concentrica*, *lamellosa*, &c., and adopting the subgenus *Merista*, Suess, for *T. Herculea*, *scalprum*, *tumida*, and other such shells. This last mode has been adopted by Mr. S.

P. Woodward,—the name *Spirigera*, D'Orbigny, will therefore require to be considered a synonym of *ATHYRIS*; but I must also mention that continental palæontologists seem more disposed to prefer D'Orbigny's denomination, on account of the zoological contradiction attached to that published by Prof. M'Coy in 1844. It has also been found desirable to reduce the value of DeFrance's genus *Uncites* by placing it among the subgenera depending upon *ATHYRIS*.

The family and place of the genus *KONINCKINA* (Suess) is to my mind still uncertain; some would place it among the *Spiriferidæ*, others among the *Strophomenidæ*; but I prefer to leave the question open for the present; and may say the same relative to Dr. Sandberger's newly proposed genus *ANOPLOTHECA*, which has been considered both by the author and by M. Suess to be nearly related to *KONINCKINA*.

3. Among the *Rhynchonellidæ* I can propose no changes.

4. *Strophomenidæ*. To this family I have added Pander's genus *PORAMBONITES*, and placed *Orthisina* as a subgenus of *ORTHIS*; but it may also perhaps be advisable to retain as a subgenus of *Orthis* Prof. King's section *Streptorhynchus* for such shells as *S. pelargonatus*, Schloth.;—*Leptæna* filling a similar position relative to *STROPHOMENA*. The genus *DAVIDSONIA* is also admitted into this group; and I must here express my regret at not being able to coincide with my friend M. de Koninck, who has in his last paper (1855) on the subject considered it as a genus of the family *Productidæ*: it does not possess the reniform impressions (supposed to be vascular) of the last-named family, but agrees in this particular and in several others with the *Strophomenidæ*, among which it had been already located both by Professor King and Mr. Woodward.

5. *Productidæ*. Here I have effected no further change than that of placing *Strophalosia* as a subgenus of *PRODUCTUS*; but I must add, that I consider Prof. M'Coy greatly mistaken in removing *Strophalosia*, *Aulosteges* and *Chonetes* from the *Productidæ*, and placing them among the *Strophomenidæ*; nor can I agree for the same reasons with M. Semenow, who has also lately proposed to remove Fischer's genus *Chonetes*, as had been done by Prof. M'Coy before him. By following such a system the clearly defined characters appertaining to the present family are destroyed, and the great similarity of the interior, and particularly that of the reniform impressions, common to *Productus*, *Aulosteges*, *Strophalosia* and *Chonetes*, completely lost sight of, as this last character has not hitherto been observed in any of the shells which belong to the *Strophomenidæ*. If those genera or subgenera require to be removed, *PRODUCTUS* will require to

follow, and the family to which this last-named genus gives its name be completely dispensed with.

In the sixth, seventh and eighth families we have made no further changes than to entirely expunge D'Orbigny's genus *Orbiculoidea*, there existing at present no valid grounds for its adoption.

It is difficult to see much order or interdependence in the succession of groups. It seems that the hingeless genera, *Lingula*, *Obolus*, *Crania*, *Discina* and *Productus*, which commenced in the earliest æra, soon attained their climax, since only three of them, *Crania*, *Discina* and *Lingula*, have passed the limits of the palæozoic age. They are also least unlike the Lamellibranchs (e. g. *Anomia*, *Hippurites*, *Spondylus*). Of the hinged genera those provided with calcareous spires were certainly developed first, no example having as yet been found above the lower portions of the Jurassic strata; while, on the contrary, the genera provided with loops become important in the Jurassic period and continue up to the present time. For in all the Palæozoic epoch we are acquainted with but few species which possessed loops, and until M. Suess's discovery of the interior of *T. Archiaci* no species with a long loop had been discovered, if we except *Stringocephalus*.

Thus taking our present Table as a basis for our conclusions, we find the genera and subgenera distributed in time as follows:

In the *Silurian* 20. In the *Devonian* 25. In the *Carboniferous* 19. In the *Permian* 12. In the *Triassic* 12. In the *Jurassic* 14. In the *Cretaceous* 12. In the *Tertiary* 10. In the *Recent* 14.

These details vary but little from those published in 1853, but it is to be expected that future discoveries will still slightly modify our statistics, as there are many obscure forms which have hitherto resisted our investigation.

It would take up too much space to enter here upon the numerous additions made to the two foreign editions, but we cannot pass in silence the interesting discovery of the perfect interior of that shell known under the name of *Rhynchora Davidsoni* (De Koninck), and of which the *Anomia spathulata* of Wahlenberg is another similar form, this last being the second type of Dalman's objectionable genus *Rhynchora**. During the

* Dalman proposed his genus *Rhynchora* in 1827, with the following diagnosis:—"Smaller valve truncated at its base, larger valve with a nearly straight? elongated beak: *Rhynchora costata* (Wahl.), *Rhyn. spathulata*:" but it is certain that neither of those shells has a lengthened beak like *Lyra*; and if Dalman intended to refer his species to Cumberland's genus (as Hisinger would lead us to believe), he was there again in error, as it is certain that they do not even belong to the group.

minute and elaborate investigations made by M. Bosquet for his fine work (now in the press) on the Brachiopoda of the Cretaceous beds of Maestricht and its vicinity, that able palaeontologist discovered that the interior of the shell in question (apart from its peculiar hinge-plate) was exactly similar to *Magas*, and with his kind permission we have reproduced (in fig. 4) the drawings kindly forwarded by the Belgian author. That the genus *Rhynchora* should be expunged there can remain but little doubt, since it was based on no valid characters, and those which have been supposed to exist have proved incorrect.

We will now revert to the principal object of this communication, which was intended to call attention to certain interesting observations published abroad, but which appear unknown to, or to have been overlooked by British naturalists.

2. *On the Claims to Priority in the discovery of the peculiar function of certain Muscles in the opening and closing of the Shell of Terebratula.*

Prof. Sedgwick in pages xi and xii of his Introduction (British Palæozoic Rocks and Fossils, October 1855) still appears to consider the merit of the above-mentioned discovery to be due to Prof. M'Coy, since we find stated in the work quoted, "I avail myself, however, of this occasion to state *why* I believe that Prof. M'Coy was the original discoverer of the peculiar muscular action on a leverage supplied by what he calls the 'entering valve,' which, in the absence of the cartilage, enabled the Brachiopoda to open their shells 'in a manner unexampled in Lamellibranch Bivalves'" (p. 191). He however admits that Mr. Woodward had discovered and published this remarkable fact (in his Manual) a year before Prof. M'Coy's 2nd Fasciculus was out of the press, but seems to base the Professor's claims on the statement of his having found it out in 1848 or '49, and *mentioned* the circumstance to Mr. Hopkins and Mr. Morris, but who nevertheless did not communicate on the subject with any other person with whom I am acquainted. Knowing the high value Prof. Sedgwick attaches to historical statements, and his wish to see justice done to every one, I will add a few details which I trust will help to clear up and terminate this subject. It will not be necessary here to repeat what I published in the Introduction to my work on British Fossil Brachiopoda, pp. 54 and 55, 1853, any further than to say that I believe it was there demonstrated, *that Prof. M'Coy could not claim priority on this point*; but at that period I was myself unacquainted with Prof. Quenstedt's still more ancient claims, which I found out shortly after, while reading Dr. Gratiolet's paper entitled "Note sur les

muscles des Térébratules, et en particulier de la *Terebratula australis*" (Académie des Sciences, Paris, 11 July 1853), but printed some short time after our Introduction had gone through the press. My object not being to enter upon a detailed account of the muscles, which have been fully described elsewhere, I must refer the reader to the French author's paper*; contenting myself with reproducing in this place a translation of that portion only which relates to the subject under discussion. After referring to the different opinions advanced by authors as to the mode in which *Terebratulae* open their shell, Dr. Gratiolet states that "all these hypotheses are more or less ingenious, but do not satisfy a severe investigator. Prof. Quenstedt alone seems to me to have arrived at the true explanation (Wiegmann's Archiv, vol. ii. p. 220, 1835). This able anatomist, founding his views on very precise reasons derived from the mode of articulation of the valves, was the first to point out *two orders of muscles, of which the one closed, while the other opened the valves*. Unfortunately Prof. Quenstedt's paper is both short and without plates" (this last statement is not strictly correct, since we find three diagrammatic figures), "so that the opinion of this clever author did not make way, and is not even alluded to in MM. Siebold and Stannius's Manual, which is otherwise so complete. This unjust forgetfulness has appeared to me worthy of being noticed; besides which, among the descriptions which have been given of the muscles of the *Terebratulae*, not one is to my mind intelligible, and I have therefore deemed it useful to revert again to a subject so interesting." After having read the above, I lost no time in procuring a copy of the paper so highly spoken of by the French savant, and of which I now offer the entire translation.

On the mode in which Brachiopoda open and close their Shell.

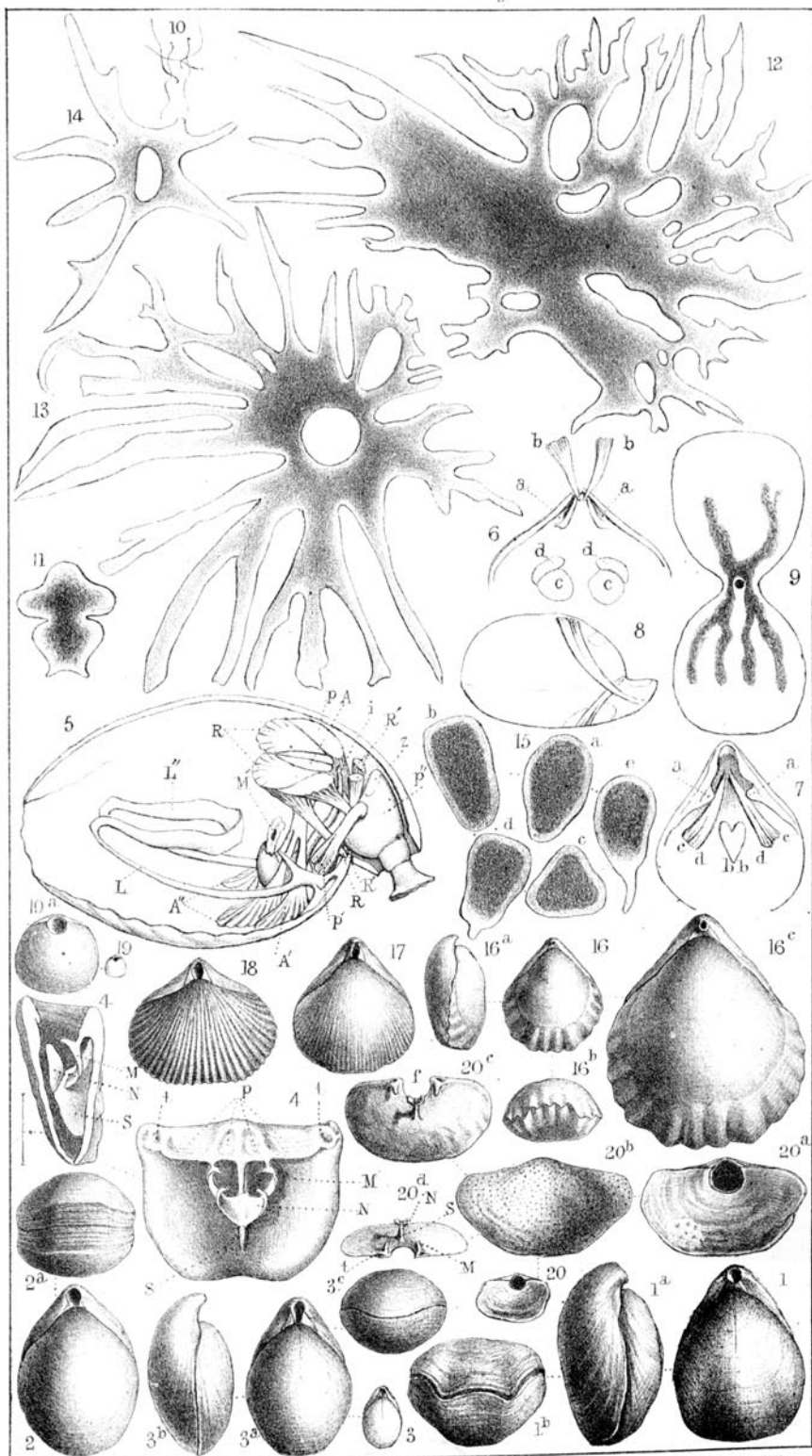
By Prof. QUENSTEDT †. Pl. X. figs. 6, 7, 8.

"Prof. Owen's anatomy of several *Terebratulae* has excited the greatest interest ‡. In general we may place the utmost confidence in the researches of that author, on account of his beautiful works and investigations on other subjects. But when,

* In the explanation of the Plate I have reproduced the names given by M. Gratiolet to the muscles, also those by Prof. Owen, and those used by myself.

† Ueber das Oeffnen und Schliessen der Brachiopoden. Wiegmann's Archiv, vol. ii. pp. 220-222. pl. 4. f. 4, 5, 6, 1835.

‡ Prof. Quenstedt means Prof. Owen's first paper published in the Transactions of the Zoological Society. 4to. Vol. i. 1835.



T. Davidson. lithog.

Printed by J. Baillie

in his theoretical considerations, he is of opinion that the elasticity of the calcareous appendages [of *Terebratula*] is sufficient to enable the animal to raise the reflected portion [of the loop] so as to force open the opposite valve, it must be remarked, that he has himself demonstrated that in the greater number of cases this explanation is not applicable. I believe, moreover, that in the instances indicated, the calcareous appendages had no other function than to protect the soft internal organs, and that they can hardly furnish the proper means of opening the shell.

"If we examine the non-perforated or ventral valve (*dorsal* of Owen*) of any *Terebratula* whatever, we immediately remark that the inner and incurved extremity of the beak (*umbo*) is entirely hidden under the deltidium of the dorsal valve (*ventral* of Owen). On opening the shell this extremity is deeply sunk (or hid) under the deltidium, since the points of attachment on which the ventral (*dorsal*) valve is moved are formed by the two lateral teeth of the dorsal (*ventral*) valve; these teeth are perfectly established at the height of the auricular expansions, and correspond with the sockets of the ventral (*dorsal*) valve. Since this point of support is placed on each side towards the middle of the beak, it follows, that a force applied to this beak must open the valve as a lever would do. In effect we remark also at this extremity two well-defined muscular impressions, which lead us to suppose the presence of muscles which must often have been largely developed, so as to have transformed the extremity of the beak into a large surface. These muscles direct themselves from thence towards the large anterior impressions of the dorsal (*ventral*) valve, and by the most direct road, without crossing each other. These contractions must, therefore, have determined the opening of the shell, and it is with justice that they have received the denomination of opening muscles (*Oeffnungsmuskeln*). The double muscular impression situated on either side of the dorsal line (*septum*) might be easily explained, inasmuch as each of the two opening muscles divided itself into two bundles or branches in order to obtain a larger surface of attachment.

"The closing muscles, on the contrary, direct themselves from the ventral (*dorsal*) valve under the point of support towards the bottom of the beak, so as to produce the closing of the valves by their contraction; they also divide themselves each at its point of attachment to the ventral (*dorsal*) valve into two branches. *Terebratulæ* therefore possess two closing muscles and two opening

* Prof. Quenstedt makes use of the old system of calling the perforated valve the *dorsal* one, &c. I have placed within brackets Prof. Owen's (and now generally admitted) mode of denominating the valves.

ones, each of which is divided into two bundles or branches after leaving its points of attachment, towards the middle of the shell. They unite the valves by direct means, and we find moreover some muscles which intersect or cross each other, but these last have rather for function the movement of the portions of the body than those of the valves. The perfectly dried condition of the muscles generally permits of these being distinguished in specimens preserved in collections, and are so disposed that we are enabled to follow their mechanism with the eye. *This mode of opening constitutes for the Brachiopoda a most suitable and proper distinguishing character, and renders needless any other more complicated definition for them.*

"If nature has thus meant to furnish the *Terebratula* with a mechanism so suitable, then Cuvier's opinion that *Lingula* opened its valves by means of these fleshy oral arms, using them as a wedge, is no longer tenable. If things had so operated, the arms would constantly find themselves in a constrained position from the compression of the valves, and would become inconvenient organs. It seems to us much more evident, that both valves in the animal (*Lingula*) must not bear the same denomination, since the dorsal (*ventral*) valve possesses (as in *Terebratula*) a longer beak, and its sides present equally a kind of auricular expansion, so that these are situated low enough to allow that the ventral side may separate from the dorsal one on the principles of a lever.

"Cuvier also expressly points out that we find at the summit of the hinge a muscle which unites the valves in the most direct manner: it is probably the *opening muscle*. On the contrary, the two muscles which unite the valves towards the middle of their length have for function the closing of the valves.

"It is probable that in *Crania* and *Orbicula* (*Discina*) the mechanism is more difficult to explain: however, it is certain that it must be analogous, since those animals possess so many analogies."

This evidence is so clear, that no comment will be required to demonstrate that it is to Prof. Quenstedt the merit devolves of having *first discriminated and published what Prof. McCoy now claims*—no doubt from not having been acquainted with the paper of which we have given a translation; but had even these observations, published in 1835, not existed, I still maintain that the claims of the author of the 'British Palæozoic Fossils' could not be maintained.

I have added in Plate X. fig. 5. a reduced copy of the improved diagram illustrating the muscular system in *Terebratula* by Mr. Hancock, to help those who are not so familiar with the

subject to better understand the position of the muscles than can be made out in Prof. Quenstedt's diagrammatic figures. Before quitting the subject of the muscles, I may likewise remind the reader, that Mr. Hancock has objected to the hypothesis of "the sliding action of *protractor* and *retractor* muscles;" he regards the decussating muscle as a "compensator for the want of teeth at the hinge; a means of keeping the valves opposite to each other:" he says, "The valves would appear to be opened somewhat in the manner of the Bryozoa by the aid of fluids. The *posterior adductor* contracts, the anterior relaxes; the fluids are pressed forwards, the valves separate. The protrusion of the arms will also help."—Hancock, MS.

The justness of these remarks, at least in *Crania*, would appear to be confirmed by Mr. Barrett's observation, "that the valve opens by moving upon the straight side, as on a hinge without sliding the valve."

3. On the Sexes and Ova of the *Brachiopoda*.

In the first chapter of the Introduction to my work on the British Fossil Brachiopoda (p. 21), Prof. Owen adds many interesting observations he had made on the "*Generative System*;" it will therefore not be devoid of interest to give here a translation of what Prof. Oscar Schmidt has also published on the same subject*.

"From his examination of the animal of *Terebratula* preserved in spirits of wine, Prof. Owen arrived at the conclusion that the sexes were separate, and lately M. J. Müller† has brought forward a similar supposition. I had also become certain of this point after my examination of the living *Terebratula* which I obtained in the Oexfjord during my journey to Norway in the summer of 1850, and I have already published these observations in the second edition of my '*Comparative Anatomy*,' p. 314, 1852, as well as in p. 295 of my '*Manual of Zoology*,' 1854. The sexual glands are found in the mantle, and their shape varies according to individuals (Pl. X. fig. 9). In the species of *Terebratula* examined by myself‡ the testicles

* "Die neuesten Untersuchungen über die Brachiopoden von Owen, Carpenter und Davidson, mit einigen Zusätzen." (Printed in the Zeitschrift für die gesammten Naturwissenschaften, p. 327, pl. 11, 12. May 1854.)

† "See the reports of the meetings of the Naturforschende Freunde of Berlin."

‡ "This species was often obtained by myself in the Oexfjord, and is not mentioned in Lovén's '*Index der Scandinavischen Mollusken*.' From the structure of the shell it can hardly be distinguished from the *Waldheimia australis*.

"The *Terebratula* from the septentrional shores of Norway, according

and ovaria resemble each other; the zoosperms are in the shape of a thread with a small head (fig. 10). Prof. Owen was likewise able to observe the first commencement of the development of the ova in the *Lingula* (fig. 15); the embryos, first of an elliptical shape, form a stem a little later, without any change having been effected in the ulterior organization or development. The embryos of the said *Terebratula* differ from this very considerably (fig. 11); they resemble a *Euastrum* composed of two unequal halves (for instance, the *E. gemmatum* or *ansatum*, Focke); the rounded portion seems to be the anterior; the posterior part is a little wider, and is prolonged into two points. What is the following development? In none of the ovaries observed by myself—for it is there that the embryo is found—was the development more perfect. Considering our total ignorance relative to the development of *Terebratula*, every observation must prove acceptable.”

4. On certain calcareous Plates found in the mantle, oral arms, and cirri of *Terebratulina caput-serpentis*.

In the same paper, Prof. Schmidt observes, “that the mantle, oral arms and cirri in *Terebratulina caput-serpentis* contain an innumerable number of calcareous plates, generally flattened, dilated and irregularly denticulated, situated in close vicinity to each other, as seen in the examples figs. 12, 13 & 14. It is easily conceived that these calcareous masses stiffen the parts which contain them, and seem particularly to serve this function in the hollow cirri, thus preventing their sides from sinking down. In the Norwegian *Terebratula* I examined they are not to be found, nor have I obtained any in *Terebratella dorsata*; but further investigation conducted on a larger number of species will show whether they are or are not peculiar to the *T. caput-serpentis*.”

We may here mention that M. E. Deslongchamps has observed a somewhat similar occurrence in his new species of *Morrisia*, for we find stated in a note he has added to my description of *Morrisia* (French edition): “Having placed in water during several hours a *Morrisia*, which contained in its larger valve a portion of its cirriferous arms, as well as their desiccated membrane, we were able, after their immersion, to extend them more than before: in placing these remnants under the microscope we saw that they contained irregular scattered granulations to M. Lovén, are the *Ter.* (*Rhynchonella*) *psittacea*, *T. caput-serpentis*, *T. cranium*, and *T. septigera*. Mine answers better to *T. septigera* than to the others, but it does not possess the characteristic septum in the smaller valve.”

touching each other by their angles, but which left here and there free spaces. After having dried up these remains of the animal on the slide of the microscope, their granulations had not changed in appearance, but seemed to us of a calcareous nature: one may compare these membranaceous parts furnished with calcareous granulations to the skin of certain star-fish, but the granulations in *Morrisia* do not present regular shapes, nor are they symmetrical in their arrangement."

These facts are of great value (as justly stated by M. Suess) in helping us to understand that beautiful calcareous network which is observed in the interior of many species of *Thecidium*.

5. *Waldheimia septigera*, Lovèn, sp. Pl. X. f. 1.

Terebratula septigera, Lovèn, Index Moll. Scand. p. 29, 1846.

Waldheimia septigera, Catalogue of the Mollusca in the British Museum, p. 59. 1853.

Shell inequivalve, tumid, ovato-triangular or somewhat obscurely pentagonal, truncated in front; colour almost white, subpellucid, smooth, marked only by a few lines of growth. Beak moderately produced, slightly incurved and obliquely truncated by a circular foramen of moderate dimensions, partly completed by and separated from the hinge-line by a deltidium in two pieces; beak-ridges well defined. The smaller or *dorsal valve* is not so deep as the opposite one, the convexity originating at the umbone continued by a gentle curve until it attains about the centre of the valve, when the remaining half declines more rapidly, and especially when approaching to the front, producing a slight medio-longitudinal convexity, with a moderate depression on either side; the two lateral portions of the valve presenting more elevated rounded curves. The larger or *ventral valve*, on the contrary, is biplicated, the mesial *concavity* corresponding with the median *convexity* of the opposite valve. The simple attached reflected loop extends to about three-quarters of the length of the shell; a median septum exists along the bottom of the valve, whose presence is betrayed by a dark line on the outer surface of the valve. Length 12, width 9, depth about 7 lines.

Hab. Norway: Finmark.

Obs. This remarkable shell (named by Lovèn in his Index Moll. Scand.) does not appear to have been hitherto figured or sufficiently described. It seems rare, since the only example with which I am acquainted, and from which the above description and illustrations are taken, was originally in the possession of Mr. Hanley, who, in the most liberal manner,

added it to Mr. Cuming's unique collection of recent species. Messrs. M'Andrew and Barrett have also informed me that during their two months' dredging along the Norwegian coast last summer they never had the good fortune of seeing it, although much looked for, while *Waldheimia cranium* (fig. 2) was obtained several times during that period. I therefore thought it useful to figure this interesting form, which presents more than ordinary interest on many accounts.

It appears the reverse of *Terebratula biplicata*, having the biplication on the larger or *ventral valve* instead of on the *dorsal* one, as in Brocchi's species. It also approaches much in shape to some fossil oolitic species, and especially to one termed *Leufroyi* by M. E. Guéranger in his 'Répertoire Palæontologique du Dép. de la Sarthe' (1853).

It resembles also somewhat the figures of the *Ter. septata* of Philippi (Mon. Sicil. ii. p. 68. t. 18. p. 7, 1844), and Prof. O. Schmidt moreover states that he believes he met with it during his dredgings at Oexford in 1850.

6. *Terebratella Spitzbergensis*, Dav. 1852. Pl. X. fig. 3.

A description of this shell was published in the Proceedings of the Zoological Society of London for May 25, 1852, but the illustrations were omitted. I therefore avail myself of this opportunity to repair that deficiency.

Shell ovate, slightly pentagonal, longer than wide; valves almost equally convex; beak produced, incurved, and truncated by a middle-sized foramen; deltidium in two pieces, partly surrounding the aperture; beak-ridges not very sharply defined; smaller valve slightly depressed near the front; surface smooth, strongly punctate, and marked by a few concentric lines of growth; colour light yellow; apophysary system composed of a central longitudinal septum, extending to a little beyond half the length of the shell, in the form of a narrow plate somewhat elevated at its extremity, to which and to the hinge-plate are attached the calcified riband-like reflected lamellæ forming the loop. Length 4, width 3, depth 2 lines.

Hab. Spitzbergen.

Obs. This small *Terebratella* seems distinguishable from all the other recent forms of the genus, by its dimensions, regular ovate shape, thinness of shell, and comparatively short doubly attached loop, which does not exceed half the length of the valve. I have hitherto been able to examine but one specimen, presented by R. M'Andrew, Esq., to Mr. Cuming's collection.

7. On a new species of *Morrisia*.

By EUGÈNE EUDES DESLONGCHAMPS.

Morrisia Davidsoni, E. Desh. Pl. X. figs. 20, 20 *a, b, c, d*.

Shell thin, subpellucid, of a light yellowish colour, varying in shape, but generally transversely oval and irregular. Structure largely punctate, exterior surface covered with small spinose asperities, which are particularly visible near the edges of the shell, and marked by lines of growth. Larger or *ventral* valve convex, with a straight hinge-line and narrow area; deltidium very small, edging only the very small portion of the foramen existing in this valve. Smaller or *dorsal* valve almost flat, assuming the shape of the objects to which it lies in close contiguity, and deeply notched at the umbo by a large circular aperture, which constitutes by far the greatest portion of the foramen. Valves articulating by means of minute teeth and sockets. Apophysary system consisting of two lamellæ originating at the base of the sockets, and united to a small elevated process or septum which arises from near the centre of the valve. Length 3, width 5 lines.

Hab. Found adhering to large specimens of the *Caryophyllia ramea*, probably derived from the coral fisheries near Tunis.

Obs. This species is at once distinguished from the *Morrisia anomioides* of Scacchi (fig. 19) by its larger dimensions, transversely oval shape, and the flatness of its *dorsal* valve, as well as by the minute spinose asperities which cover its surface; the foramen in the present form also encroaches to a much larger extent on the *dorsal* valve than on the *ventral* one, or than is the case in Prof. Scacchi's species, which is, besides, almost circular, smooth, with both valves moderately convex. In *M. Davidsoni* the smaller valve is also at times very irregular, occasioned by the shortness of the peduncle, which forces the shell to lie in close contiguity with the objects to which it is moored, and take more or less the impress of their irregularities.

From a superficial examination of the animal in its dried-up condition, my father and myself were enabled to convince ourselves, that in the species under description the oral arms seem to be connected with the apophysary system by a kind of very delicate calcareous network, reminding one of the descending apparatus of *Thecidium*, which in some species is formed in its upper portions by a calcareous network freely suspended above the visceral cavity. MM. O. Schmidt and Suess have already recognized the tendency to a disposition somewhat similar in the subgenus *Terebratulina*. This important fact will, in all probability, at a future period help to identify the different parts

of the calcareous processes in *Thecidium* with the corresponding portions in the other genera of the family *Terebratulidæ*.

I limit myself at the present moment to the simple announcement of this point, not having as yet sufficiently studied the question, but which I shortly intend to do more fully, when entering upon the internal details of the apophysary system of the *Morrisia Davidsoni* in a paper now in hand, and which also relates to other new *Brachiopoda* to be published in the Memoirs of the Linnæan Society of Normandy.

8. *Description of a new species of recent Rhynchonella.*

By S. P. WOODWARD, Esq., F.G.S.

Rhynchonella Grayi, n. sp. Pl. X. fig. 16.

Shell light horn-colour, dull, trigonal, depressed; sides rounded; front truncated; beak small, acute; valves smooth, obscurely marked by lines of growth, and strongly plaited near the margin with four central plaits and three or four on each side, the furrows obscurely striated; margins of the valves sinuated in front and strongly toothed; foramen minute, completely tubular. Long. 15, lat. 13, alt. 8 mill.

This interesting and at present unique shell was sent with other natural-history objects from the Feejee Islands by J. M'Gillivray, Esq., Naturalist to the Surveying Expedition under Capt. Denham of H.M.S. Herald. No particulars as to its habitat have been received; it differs from both the known species of living *Rhynchonella* (figs. 17 & 18) in its lightness of colour, the others being black; in the plication of the borders of its valves, which reminds us of the fossil *Rh. subplicata* (Mantell) and *Rh. lineolata*, Phil.; and especially it differs in having a foramen quite separate from the hinge-line by the development and union of the two elements of the deltidium, in this respect agreeing with the ordinary adult condition of the fossil *Rhynchonella*. Were it not for the remains of the pedicle and traces of the mantle in its interior, we might have taken it for a pliocene fossil, being exactly similar in its colour and dull translucency to the specimens of *Rh. psittacea* found in the Crag at Norwich. The muscular impressions are like those of the type, and the interior has traces of unsymmetrical vascular markings.

If only the recent species were known, the genus *Rhynchonella* might be thought a remarkable exception to the law of *continuity of generic areas*, but like many other widely scattered types, its distribution is rendered intelligible by the knowledge of the existence of so many fossil forms in the wide intervals between the localities of the living species.

EXPLANATION OF PLATE X.

- Fig. 1. *Waldheimia septigera*, Lovén, sp.
 Fig. 2. — cranium, Müller, sp.
 Fig. 3. *Terebratella Spitzbergensis*, Dav.
 Fig. 4. *Magas (Rhynchora) Davidsoni*, De Koninck, sp. Interior of the dorsal or smaller valve, from drawings by M. Bosquet of Maestricht. 4 *a*, longitudinal section of both valves; *p*, pedicle muscular impressions; *t*, sockets.
 Fig. 5. *Waldheimia australis*, muscular system, from an improved diagram prepared by Mr Hancock.
 A. Adductor (*adductores longi*, Owen), attached to the ventral valve.
 A'. Adductor (*adductor longus posticus*, Owen. *Muscle adducteur principal*, Gratiolet).
 A". Adductor (*adductor longus anticus*, Owen. *Muscle adducteur principal*, Gratiolet).
 R. Cardinal muscle (*adductor brevis*, Owen. *Muscles diducteurs principaux*, Gratiolet).
 R'. Accessory cardinal muscle (*cardinales*, Owen. *Muscles diducteurs accessoires*, Gratiolet).
 P. Ventral pedicle muscles (*retractor inferior*, Owen. *Muscles du pédoncule paire supérieure*, Gratiolet).
 P'. Dorsal pedicle muscles (*retractor superior*, Owen. *Muscles du pédoncule paire inférieure*, Gratiolet).
 P". Pedicle sheath.
 Z. Capsular muscle (*capsularis*, Owen).
 M', mouth; *i*, intestine; *L*, loop; *L'*, reflected portion of the same.
 Fig. 6. Dorsal valve of a *Terebratula*: *a*, the sockets; *b*, the opening muscles; *c* & *d*, the muscular impressions. (Figs. 6, 7 & 8 are taken from Prof. Quenstedt's paper.)
 Fig. 7. Ventral valve of the same *Terebratula*: *a*, the lateral teeth; *b*, the muscular impressions; *c* & *d*, the two bundles of the closing muscle (adductor). The letters correspond to those in fig. 6, so that by the inspection of the following one—
 Fig. 8. seen in profile—the mechanism of the opening and closing of the valves may be easily understood.
 Fig. 9. The male sexual glands of a *Terebratula*. Figs. 9, 10, 11, 12, 13 & 14 are taken from Prof. Schmidt's paper.
 Fig. 10. Spermatozoa of the same.
 Fig. 11. Embryo of the same *Terebratula*, magnified.
 Figs. 12, 13 & 14. Calcareous structure (or plates) from the mantle and brachial cirri of *Terebratulina caput-serpentis*.
 Fig. 15. Embryos removed from the ovarian cavity in the pallial sinus of *Lingula anatina*: magnified 120 diameters (Owen).
 Fig. 16. *Rhynchonella Grayi* (Woodward). 16 *c*, enlarged.
 Fig. 17. — *psittacea*.
 Fig. 18. — *nigricans*; these are the only three recent *Rhynchonellæ* at present known.
 Fig. 19. *Morrisia anomioides*, Scacchi, sp. 19 *a*, enlarged.
 Fig. 20. *Morrisia Davidsoni*, E. Deslongchamps. 20 *a*, *b*, enlarged. 20 *c*, *d*, enlarged views of the interior of the smaller or dorsal valve, part of the lamellæ being broken off; *f*, foramen; *t*, sockets; *m*, departure of the crural lamellæ; *n*, broken lamellæ attached to the summit of the septum, *s*.