abdomen; the importance, therefore, of ascertaining by close inspection whether the line and the viscid fluid in which it is enveloped proceed from the same spinning-tube or not will be immediately apparent. It is evident, from the materials of which they are composed possessing such widely different properties, that they cannot be produced by the same organ of secretion.

There is a difficulty also in comprehending how a cylindrical body of *viscid* fluid can be resolved by molecular attraction into a series of large and small globules disposed on the line *alternately* at minute and most regular distances from one another.

Had Mr. Beck been spared to continue his researches, he might perhaps have been enabled, by his well-known skill as a microscopist and by the advantage he possessed in having superior optical instruments at his command, to throw some light on the obscure phenomena here submitted to the consideration of arachnologists, which remain as problems yet waiting a solution.

XLVIII.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from p. 315.]

Section II. MOLLUSCA (PROPER).

The Mollusca are chiefly procured by dredging, examination between tide-marks, or the deep-sea lines of the fishermen, though certain storms sometimes strew the sands with many species in great profusion. Not a few of the rarer forms are found in the stomachs of fishes, such as the cod, haddock, and flounder. The remarks on the class may be arranged in three divisions, founded on the economical value, peculiar habits, and rarity.

By far the most important species in the first group is the common mussel (*Mytilus edulis*), which occurs in vast numbers in the form of mussel-"beds" on muddy flats, chiefly situated on the right bank of the estuary of the river Eden. Attached to stones, sticks, and to each other, these shell-fish luxuriate in abundance of Diatomaceæ, Infusoria, and other minute forms of animal and vegetable life. From their special value as bait the city derives a considerable annual revenue; and if the wise protection only lately enforced were supplemented by

skilful mussel-farming, great increase in revenue might be anticipated. Shell-fish, like other animals in civilized parts, cannot survive constant inroads without special restrictions. Multitudes of the young mollusks, moreover, are found incrusting the poles for the salmon-nets on the West Sands, and the rocks, stones, and tangle-roots elsewhere; but they do not attain a large size, apparently from overcrowding and the want of congenial food, which the purer water seems incapable of supplying. This species takes the place of the horse-mussel ("yoags") of the Zetlandic fishermen, and the worms of those in the Channel Islands. It is seldom eaten by the natives. The edible cockles, again, abound on the sandy flats near the entrance of the Eden into the sea, and are occasionally sold as food, though of late years their scarcity has rendered their appearance less frequent in the market. Periwinkles and limpets are constantly gathered for similar purposes. The only uses to which some of the other mollusks are applied are in the amateur manufacture of ornaments, such as shell pincushions from various univalves and bivalves, bracelets from *Nassa incrassata* and *Trochus cinerarius*, after the latter has had its nacreous layer exposed by an acid.

The rock-boring shell-fish are five in number, though only one exercises any great influence on the disintegration of the rocks—viz. *Pholas crispata*, which often swarms in the shale and sandstone, and takes the place of the *Pholas dactylus* of the chalk rocks of the south. *Pholas candida* occurs too rarely to require special mention in this respect; and the same may be said of *Saxicava rugosa*. The excavations of *Patella vulgata* and *Chiton fascicularis* in sandstone show that no special boring-organ is necessary for this purpose. The latter species sometimes scoops out considerable cavities in sandstone, in which it reposes. The only wood-borer is *Xylophaga dorsalis*.

In taking, under this head, a general survey of the boring forms, it is found that they belong to at least three invertebrate subkingdoms, viz. the Protozoa, Mollusca, and Annulosa. In the first are boring sponges; in the second, Bryozoa and various mollusks; in the third, sea-urchins, gephyreans, annelids, and cirripedes.

The sponges appear to bore only into calcareous substances, such as shells and limestone. The Bryozoa perforate shells; the mollusks proper, limestone, sandstone, aluminous shale, gneiss and other rocks, wood, wax, shells, &c.; the annelids tunnel shells and rocks of various kinds; the sea-urchins calcareous rocks, gneiss, granite, and other rocks; the gephyreans and cirripedes shells and limestone. Good opportunities are afforded at St. Andrews for studying the boring-action of the

mollusks and annelids. *Pholas crispata* and *Leucodore ciliata* are equally abundant, and must exercise as much influence on the disintegration of the sandstone and shale between tide-marks as the boring sponges amongst the shells in deep water; while *Patella*, *Chiton*, *Saxicava*, and *Dodecaceria* are also frequent.

The theories which have been promulgated to explain the mode by which these various creatures perforate materials so diverse may be ranged round two great centres, viz. the *chemical* and the *mechanical**. The advocates of the former seem to take for granted that the borings occur chiefly in calcareous substances; and with propriety, therefore, they make their solvent an acid. It is clear, however, that this agency is unable to account for the abundant perforations in media totally impervious to such action. Moreover no trace of acid is found in many borers; and though present in some, as in *Sabella saxicava* and *Pholas*, it is likewise characteristic of other marine animals which do not bore; and it is purely hypothetical at present to bring in the aid of the carbonic dioxide derived from sea-water, for the same reason.

The mechanical theory, again, supposes that the animals perforate by means of shells or gritty particles in the case of mollusks, teeth in the sea-urchins, bristles in the annelids, horny processes in certain cirripedes and gephyreans; but we are left in doubt concerning the extensive and wonderful perforations of the sponges, those of the Bryozoa, and the rest of the cirripedes. If, however, we regard the "macerating" theory as a modification of this, certain of the difficulties will be overcome. The grains of wood, however, found in the stomachs of *Teredo*, are interesting in this respect.

The whole subject of the boring of marine animals, indeed, is much in want of further elucidation; and it is hard to believe that the same *modus operandi* exists in all. In conclusion, the theories may be arranged under the following heads (for all the subkingdoms), after Forbes and Hanley and Gwyn Jeffreys:—

I. That in the shell-fish the perforations are made by rotations of the valves, like augers (Bonanni, Adanson, Born, J. E. Gray, Dr. Fleming, Osler, Forbes and Hanley, Cailliaud, Robertson, &c.); in the sea-urchins, by the teeth (Cailliaud).

This theory is not supported by an examination of the perforations of the sponges, Bryozoa, those of the annelids,

* We do not here allude to the boring by jaws or tongue (*e. g.* in *Limnoria* and *Trochus*).

gephyreans, and cirripedes, nor by a comparison of the shells and tunnels of the mollusks themselves. The epidermis of the latter in each case would likewise suffer.

II. That the holes are made by rasping effected by siliceous particles on the foot of the mollusk (Hancock), by grains of silex from the exterior (Bryson), by the foot in some way (Dr. Fischer), and by chitine in the cirripedes (Darwin) and gephyreans and the bristles of the annelids.

This explanation is not borne out by the case of the sponges, by that of the Bryozoa, and certain cirripedes; moreover such siliceous particles are rare in boring mollusks.

III. That the excavations are due to ciliary currents, aided by rasping (Garner).

The currents may assist, but seem to be insufficient to account for the borings in any group.

IV. That the perforations are produced by a chemical solvent: Gray, Osler (for *Saxicava*), Drummond, Cailliaud, Mantell, Thorent, Reeve, Bouchard-Chantereaux, Spence Bate, Darwin (for *Verruca*), E. R. Lankester, and Parfitt.

This will not explain the borings in wood, aluminous shale, gneiss, granite, sandstone, and wax. It is interesting, however, as my friend Mr. Ray Lankester has specially shown, that shells and calcareous rocks are much affected by burrowing marine animals.

V. That the borings are the result of a secreted solvent and rasping action (Thompson and Necker).

It seems improbable that the solvent should vary with the nature of the rocks attacked.

VI. That the perforations are caused by a macerating or simple solvent action of the foot in mollusks (Sellius, Deshayes, and Gwyn Jeffreys).

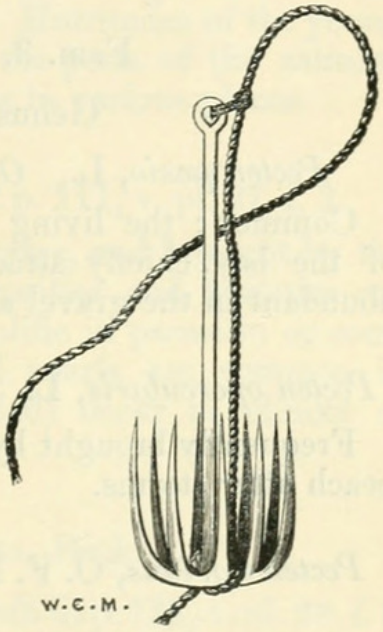
It is doubtful if this would be supported by the action in the sponges, Bryozoa, annelids, gephyreans, and cirripedes. The striæ in certain of the tunnels of the shell-fish are also somewhat at variance with this notion.

The most interesting species in regard to rarity are *Lima subauriculata* and *L. Loscombii*, which come from deep water, the characteristic *Lima hians* of our southern and western shores being absent. A worn valve of *Isocardia cor* found on the West Sands is purely accidental. *Tellina pusilla* and *Psammobia tellinella* are uncommon at St. Andrews. Amongst univalves, *Trichotropis borealis*, *Pleurotoma Trevelyana*,

Aplysia punctata, and *Philine pruinosa* are noteworthy. The smaller univalves, such as *Rissoæ* and their allies, are much less numerous in species than on the southern and western shores, the absence of *Trochus umbilicatus* being especially diagnostic when contrasted with the latter. The Nudibranchs are well represented at all seasons; and the individuals in the majority of the species are numerous. *Ommatostrephes* and *Loligo* amongst the cuttles often occur in great profusion on the West Sands after storms.

On the whole the species are northern, and stand in strong contrast to the molluscan fauna of the western shores, where *Thracia convexa*, *Tapes decussatus*, *Pecten varius*, var. *nivea*, *Teredo megotara* and *T. norvegica*, *Fissurella*, *Trochus umbilicatus* and *T. zizyphinus* in the littoral zone, and the abundance of *T. magus* and *T. tumidus* in the laminarian, *Phasianella*, *Akera bullata*, *Elysia*, swarms of large and small *Rissoæ*, and the pelagic *Ianthina* form conspicuous features of the marine fauna, just as the hosts of *Bulimus acutus* do on the sandy fields of Killipheder and other parts of the extreme west. Still more evident is the contrast with the rich southern species that cluster round the Channel Islands—such as the finely developed pectens, oysters, and *Anomiæ*, and the appearance of the former between tide-marks (*P. varius*), besides *Mytilus barbatus* (which takes the place of the bearded varieties of our *Mytilus modiolus*) in obscure crevices in the littoral zone, the frequency of *Arca tetragona* in fissures of the rocks, *Galeomma* on the under surface of stones in tide-pools at Herm, the boring *Gastrochæna* in shells, and the abundance of *Haliotis*, *Pandora*, *Venus verrucosa* and *V. ovata*, *Mactra glauca*, the *Psammobiæ*, and the "angel's wings" (*Lima*), which when disturbed flit with their brilliant orange fringes so nimbly in the tide-pools. Amongst univalves, again, the large size and abundance of *Chiton discrepans*, *Fissurella*, *Emarginula*, *Murex erinaceus*, *Aplysia punctata*, *Eulima polita*, *Trochus lineatus*, *Cerithium* and *Cerithiopsis*, and the predatory and cunning cuttles (*Octopus*) between tide-marks are noteworthy; while in the surrounding water are the rare prizes *Triton nodifer*, *T. cutaceus*, *Cardium papillosum*, *Argiope decollata*, and other forms which, with the foregoing, are thrown in such profusion on the shell-beach at Herm—e. g. *Calyptræa chinensis*, *Trochus Montacuti*, and *Murex aciculatus*. The fine *Pinna rudis* of South England is also entirely absent at St. Andrews. Neither do we find the swarms of *Trochus helicinus* and *T. grœnlandicus*, *Trichotropis borealis*, and their allies amongst the tangle-roots, as in Shetland, nor the *Terebratulæ*, *Lyonsia*, *Lepeta*, *Puncturella*, *Trochus amabilis*, the *Jeffreysiæ*, *Columbella haliœeti*, *Pleurotoma nivalis*, *P. carinata*, *Scaphander librarius*,

Philine angulata and *P. nitida*, *Rossia papillifera*, the Clios, and the half hundred new British forms discovered by Mr. Gwyn Jeffreys in his frequent cruises in the surrounding waters. The great beds, also, of *Mytilus modiolus* (called "yoags"), which occur in from 3 to 15 fathoms near the shore in many parts of the Zetlandic seas, present an interesting contrast. It is this mussel (esteemed but a coarse bait at St. Andrews) which is extensively employed by the Shetlanders; and in its collection many rare invertebrates are found amongst the roots of the tangles and stones, which with the mussels form huge muddy masses. The old ten-toothed "dreg" noticed by the accomplished Prof. Edward Forbes is still the chief instrument in procuring the shell-fish, and is much more serviceable to the zoologist on such ground than the dredge. In the figure given by the facile pencil of the great naturalist the rope is attached to the eye of the dreg; but in modern times the fishermen more correctly attach it to the head of the instrument (after the manner of the ordinary dredge), and fix the rope at the eye of the dreg by a piece of spun yarn; so that if the dreg gets entangled the spun yarn gives way, and the rope pulls the head of the dreg backwards, and disengages the teeth from the tangles and stones. In transverse section the teeth form a truncated ellipse round the central iron rod.



The nomenclature adopted is that of Mr. Gwyn Jeffreys in his valuable work on the British Mollusca; and I am specially indebted to him for his great courtesy in frequently aiding me in doubtful cases, and also carefully investigating shell-débris containing minute species, which otherwise might have been overlooked.

Class CONCHIFERA.

Order LAMELLIBRANCHIATA.

Fam. 1. **Anomiidæ**, Gray.

Genus ANOMIA, L.

Anomia ephippium, L. Jeffreys, Brit. Moll. ii. p. 31, v. pl. 20. f. 1, 1 *a*–1 *e*.

Not uncommon in the débris of the fishing-boats.

Anomia patelliformis, L. *Op. cit.* ii. p. 34, v. pl. 20. f. 2, 2*a*–2*c*.

Common in the same region, as well as between tide-marks

Fam. 2. **Ostreidæ**, Broderip.

Genus Ostrea, L.

Ostrea edulis, L. *Op. cit.* ii. p. 38, v. pl. 21.

Living examples are rare. The "rock" variety with purplish streaks, however, is occasionally found at the East Rocks on the under surface of stones in pools near low water.

Fam. 3. **Pectinidæ**, Lamarck.

Genus 1. Pecten, Pliny.

Pecten pusio, L. *Op. cit.* ii. p. 51, v. pl. 22. f. 1 & 1*a*.

Common; the living specimens come from the deep water of the bay, chiefly attached to bivalves. Worn valves are abundant in the gravel at the East Rocks.

Pecten opercularis, L. *Op. cit.* ii. p. 59, v. pl. 22. f. 3 & 3 *a*.

Frequently brought by the fishing-boats, and thrown on the beach after storms.

Pecten tigrinus, O. F. Müller. *Op. cit.* ii. p. 65, v. pl. 23. f. 2 & 2 *a*.

Perfect specimens from the coralline ground and the stomachs of haddocks and flounders; single valves on the beach in gravel and after storms.

Pecten similis, Laskey. *Op. cit.* ii. p. 71, v. pl. 23. f. 5.

Frequent in the stomachs of flounders and haddocks; more rarely procured from the coralline ground.

Pecten maximus, L. *Op. cit.* ii. p. 73, v. pl. 24.

Occasionally brought up on the deep-sea lines of the fishermen.

Genus 2. Lima, Bruguière.

Lima subauriculata, Mont. *Op. cit.* ii. p. 82, v. pl. 25. f. 3.

Not common; from the deep water of the bay.

Lima Loscombii, G. B. Sowerby. *Op. cit.* ii. p. 85, v. pl. 25. f. 4.

Single valves occasionally appear in the fishing-boats; perfect specimens are found in the stomach of the cod.

Fam. 5. **Mytilidæ**, Fleming.

Genus 1. Mytilus, L.

Mytilus edulis, L. *Op. cit.* ii. p. 104, v. pl. 27. f. 1.

Forming by their vast numbers a most important mussel-bed at the estuary of the river Eden. Multitudes of the young animals, besides, form a coating to the posts of the salmon-nets, to rocks, stones, and tangle-roots in various places.

Mytilus modiolus, L. *Op. cit.* ii. p. 111, v. pl. 27. f. 2.

Frequently thrown ashore after storms, and brought by the fishermen from deep water. Monstrosities and varieties are common; and there is no shell so prolific in parasitic or commensalistic growths; pea-crabs and pearls are common in their interior. Young forms (bearded) occur in chinks of the rocks between tide-marks.

Genus 2. Modiolaria, Beck.

Modiolaria marmorata, Forbes. *Op. cit.* ii. p. 122, v. pl. 28. f. 1.

Abundant in the tests of *Ascidia sordida*, and sometimes found in a free condition on the West Sands after storms.

Modiolaria discors, L. *Op. cit.* ii. p. 126, v. pl. 28. f. 3.

Occasionally attached to the roots of Fuci near low water, and to the top-shaped fronds of *Himanthalia lorea*.

Modiolaria nigra, Gray. *Op. cit.* ii. p. 128, v. pl. 28. f. 4.

Fine specimens occur in the deep water of the bay, and also in the stomachs of cod.

Genus 3. Crenella, Brown.

Crenella decussata, Montagu. *Op. cit.* ii. p. 133, v. pl. 28. f. 6.

Not rare in the stomachs of cod and haddocks, though perhaps swallowed in the first instance by other fishes.

Fam. 6. **Arcidæ**, Lowe.

Genus 1. NUCULA, Lamarck.

Nucula nucleus, L. *Op. cit.* ii. p. 143, v. pl. 29. f. 2.

Common in the bay; brought in by the fishing-boats, and frequent in the stomachs of cod and haddocks.

Nucula nitida, G. B. Sowerby. *Op. cit.* ii. p. 149, v. pl. 29. f. 3 & 3 *a*.

Not rare off the East Rocks in sandy gravel between the rocky ridges, and in the stomachs of haddocks and cod.

Nucula tenuis, Mont. *Op. cit.* ii. p. 151, v. pl. 29. f. 4.

From deep water and the stomachs of cod and haddocks.

Genus 2. LEDA, Schumacher.

Leda minuta, Müller. *Op. cit.* ii. p. 155, v. pl. 29. f. 6.

Common in deep water and the stomachs of flounders.

Genus 4. PECTUNCULUS, Lamarck.

Pectunculus glycymeris, L. *Op. cit.* ii. p. 166, v. pl. 30. f. 2.

Abundant in the bay; generally brought in by the fishing-boats.

Genus 5. ARCA, L.

Arca tetragona, Poli. *Op. cit.* ii. p. 180, v. pl. 30. f. 6.

Instead of the clusters in which it appears in the chinks of the rocks in the Channel Islands, solitary examples only are dredged off the bay in deep water.

Fam. 8. **Kelliidæ**, Forbes & Hanley.

Genus 2. MONTACUTA, Turton.

Montacuta bidentata, Mont. *Op. cit.* ii. p. 208, v. pl. 31. f. 8.

Abundant in shell-débris on the West Sands.

Montacuta ferruginosa, Mont. *Op. cit.* ii. p. 210, v. pl. 31. f. 9.

Common in the deep water of the bay and in the stomachs of cod, haddocks, and flounders; also in the shell-débris on the West Sands after storms.

Genus 3. Lasæa, Leach.

Lasæa rubra, Mont. *Op. cit.* ii. p. 219, v. pl. 32. f. 1.

Abundant amongst algæ, in crevices under stones in rock-pools, and in the cavities of shells between tide-marks.

Genus 4. Kellia, Turton.

Kellia suborbicularis, Mont. *Op. cit.* ii. p. 225, v. pl. 32. f. 2.

Common under stones in rock-pools, and in the cavities of old limpet- and other shells.

Fam. 9. **Lucinidæ**, D'Orbigny.

Genus 2. Lucina, Bruguière.

Lucina borealis, L. *Op. cit.* ii. p. 242, v. pl. 32. f. 7.

Frequently brought in by the fishing-boats, though the majority of the specimens are imperfect (single valves).

Genus 3. Axinus, J. Sowerby.

Axinus flexuosus, Mont. *Op. cit.* ii. p. 247, v. pl. 33. f. 1.

Single valves occasionally from the fishing-boats, and on the West Sands after storms.

Fam. 10. **Carditidæ**, Gray.

Genus Cyamium, Philippi.

Cyamium minutum, Fabricius. *Op. cit.* ii. p. 260, v. pl. 33. f. 5.

Common in shell-débris on the West Sands.

Fam. 11. **Cardiidæ**, Broderip.

Genus Cardium, L.

Cardium echinatum, L. *Op. cit.* ii. p. 270, v. pl. 34. f. 2.

Very abundant on the West Sands after storms, and in the débris of the fishing-boats.

Cardium fasciatum, Mont. *Op. cit.* ii. p. 281, v. pl. 35. f. 3.

Not uncommon on the West Sands after storms, and in the stomachs of cod, haddocks, and flounders.

Cardium nodosum, Turton. *Op. cit.* ii. p. 283, v. pl. 35. f. 4.

Dead valves occasionally dredged off the East Rocks in 3 to 4 fathoms.

Cardium edule, L. *Op. cit.* ii. p. 286, v. pl. 35. f. 5.

Abundant in the muddy sand at the mouth of the river Eden. Cockle-gathering forms the occupation of some of the fisherwomen.

Cardium norvegicum, Spengler. *Op. cit.* ii. p. 294, v. pl. 35. f. 7.

Not uncommon; generally brought by the fishermen from deep water.

Fam. 12. **Cyprinidæ**, Geinitz.

Genus 2. Cyprina, Lamk.

Cyprina islandica, L. *Op. cit.* ii. p. 304, v. pl. 36. f. 2.

Common in deep water, and thrown ashore after storms. Some have rows of small adherent pearls.

Genus 3. Astarte, J. Sowerby.

Astarte sulcata, Da Costa. *Op. cit.* ii. p. 311, v. pl. 37. f. 1 & 2.

Frequently brought up by the deep-sea lines of the fishermen. Semifossil valves of *A. borealis* are also not uncommon.

Astarte compressa, Mont. *Op. cit.* ii. p. 315, v. pl. 37. f. 3 & 4.

Frequent in deep water.

Genus 4. Circe, Schumacher.

Circe minima, Mont. *Op. cit.* ii. p. 322, v. pl. 37. f. 6.

Not uncommon in deep water, and in the stomachs of cod, haddocks, and flounders.

Fam. 13. **Veneridæ**, Leach.

Genus 1. Venus, L.

Venus exoleta, L. *Op. cit.* ii. p. 327, v. pl. 38. f. 1.

Abundant in deep water, and on the beach after storms.

Venus lincta, Pulteney. *Op. cit.* ii. p. 330, v. pl. 38. f. 2.

Common in deep water, and thrown plentifully on the West Sands after storms.

Venus fasciata, Da Costa. *Op. cit.* ii. p. 334, v. pl. 38. f. 4.

In 3 to 4 fathoms off the East Rocks, and from the deep-sea lines of the fishermen. Dead valves are common amongst the gravel at the East Rocks.

Venus casina, L. *Op. cit.* ii. p. 337, v. pl. 38. f. 5.

Occasionally procured in a perfect state from the deep-sea lines of the fishermen. Single valves are most abundant.

Venus ovata, Pennant. *Op. cit.* ii. p. 342, v. pl. 39. f. 1.

Common in deep water; generally procured from the fishing-boats.

Venus gallina, L. *Op. cit.* ii. p. 344, v. pl. 39. f. 2 & 3.

Abundant on the West Sands after storms, and in a few fathoms water on a sandy bottom all round.

Genus 2. TAPES, Mühlfeldt.

Tapes virgineus, L. *Op. cit.* ii. p. 352, v. pl. 39. f. 5.

Common in deep water and in the fishing-boats.

Tapes pullastra, Mont. *Op. cit.* ii. p. 355, v. pl. 39. f. 6.

Abundant between tide-marks amongst the muddy sand, and occasionally in cavities bored by *Pholas crispata*.

Genus 3. LUCINOPSIS, Forbes & Hanley.

Lucinopsis undata, Pennant. *Op. cit.* ii. p. 363, v. pl. 40. f. 1.

Common on the sandy ground, and thrown in vast numbers on the West Sands after storms.

Fam. 14. **Tellinidæ**, Latreille.

Genus 2. TELLINA, L.

Tellina crassa, Gmelin. *Op. cit.* ii. p. 373, v. pl. 40. f. 4.

Single valves of good size are not uncommon in the débris of the fishing-boats.

Tellina balthica, L. *Op. cit.* ii. p. 375, v. pl. 40. f. 5.

Abundant on the sandy beach at the mouths of the Eden and Tay, and on the West Sands after storms.

Tellina tenuis, Da Costa. *Op. cit.* ii. p. 379, v. pl. 41. f. 1.

Very common on the sandy ground everywhere; and dead valves occur on the West Sands throughout the year.

Tellina fabula, Gronovius. *Op. cit.* ii. p. 382, v. pl. 41. f. 2.

Only less common than the last species on the same ground.

Tellina pusilla, Philippi. *Op. cit.* ii. p. 388, v. pl. 41. f. 5.

Rather frequent in deep water, and in the stomachs of haddocks and flounders.

Genus 3. PSAMMOBIA, Lamarck.

Psammobia tellinella, Lamk. *Op. cit.* ii. p. 392, v. pl. 42. f. 1.

Worn valves occasionally found amongst the deep-sea lines of the fishermen.

Psammobia ferröensis, Chemnitz. *Op. cit.* ii. p. 396, v. p. 187, pl. 42. f. 3.

Abundant and in fine condition on a sandy bottom off the West Sands. Often thrown ashore in large numbers near the estuary of the Eden.

Genus 4. DONAX, L.

Donax vittatus, Da Costa. *Op. cit.* ii. p. 402, v. pl. 42. f. 5.

Very abundant on the West Sands after storms, and on sandy ground in a few fathoms.

Fam. 15. **Mactridæ**, Fleming.

Genus 2. MACTRA, L.

Mactra solida, L. *Op. cit.* ii. p. 415, v. pl. 43. f. 2.

Abundant on the sandy ground off the West Sands, and thrown in great numbers on the beach after storms.

Var. *elliptica* is common.

Mactra subtruncata, Da Costa. *Op. cit.* ii. p. 419, v. pl. 43. f. 3.

Equally common with the last species, and from the same ground.

Mactra stultorum, L. *Op. cit.* ii. p. 422, v. pl. 43. f. 4.

Very abundant on the same ground as the last two species.

Var. *cinerea* is common.

Genus 3. LUTRARIA, Lamarck.

Lutraria elliptica, Lamk. *Op. cit.* ii. p. 428, v. pl. 44. f. 1.

Common on the West Sands after storms, and in muddy sand at the mouth of the river Eden.

Genus 4. SCROBICULARIA, Schumacher.

Scrobicularia prismatica, Mont. *Op. cit.* ii. p. 435, v. pl. 45. f. 1.

Not rare in deep water; on the West Sands after storms, and in the stomachs of cod and haddocks.

Scrobicularia alba, Müller. *Op. cit.* ii. p. 438, v. pl. 45. f. 3.

Less common than the foregoing, from the same ground, and in the stomachs of the same fishes.

Scrobicularia piperata, Bellonius. *Op. cit.* ii. p. 444, v. pl. 45. f. 5.

Common amongst the muddy sand at the mouth of the Tay, and frequently thrown on the West Sands after storms; also procured from the fishing-boats.

Fam. 16. **Solenidæ**, Latreille.

Genus 3. SOLEN, L.

Solen pellucidus, Pennant. *Op. cit.* iii. p. 14, v. pl. 46. f. 4.

Common on the sandy ground, and thrown ashore in large numbers after storms; occasionally in the stomachs of cod and haddocks.

Solen ensis, L. *Op. cit.* iii. p. 16, v. pl. 47. f. 1.

Frequent on the sandy ground, and after storms on the West Sands.

Solen siliqua, L. *Op. cit.* iii. p. 18, v. pl. 47. f. 2.

Abundant amongst the sand uncovered by the low tides. The fishermen collect them for bait; and the children use them as scoops for digging in the sand.

Fam. 18. **Anatinidæ**, D'Orbigny.

Genus Thracia, Leach.

Thracia papyracea, Poli. *Op. cit.* iii. p. 36, v. pl. 48. f. 4 & 4 *a*.

Common on the sandy ground off the West Sands, and cast ashore plentifully after storms.

Fam. 19. **Corbulidæ**, Fleming.

Genus 3. Corbula, Bruguière.

Corbula gibba, Olivi. *Op. cit.* iii. p. 56, v. pl. 49. f. 6.

Off the East Rocks in a few fathoms, and on the beach after storms; good specimens are also procured from the fishing-boats.

Fam. 20. **Myidæ**, Fleming.

Genus Mya, L.

Mya arenaria, L. *Op. cit.* iii. p. 64, v. pl. 50. f. 1.

Frequent in the muddy sand at the mouth of the Eden. Distorted valves are common.

Mya truncata, L. *Op. cit.* iii. p. 66, v. pl. 50. f. 2.

Abundant off the mouth of the Eden, and on the beach after storms.

Fam. 21. **Saxicavidæ**, Swainson.

Genus 2. Saxicava, Fleurian de Bellevue.

Saxicava rugosa, L. *Op. cit.* iii. p. 81, v. pl. 51. f. 3 & 4.

Common at low-water mark amongst the rocks in crevices and holes in sandstone and shale, as well as inside empty limpet-shells and *Balani*. Often firmly adherent to its cavity by a byssus.

Fam. 23. **Pholadidæ**, Gray.

Genus 1. Pholas, Lister.

Pholas candida, L. *Op. cit.* iii. p. 107, v. pl. 52. f. 2.

Rarely found in shale at the Castle Rocks; commonly met with on the beach after storms, sometimes in a perfect condition.

Pholas crispata, L. *Op. cit.* iii. p. 112, v. pl. 53. f. 1.

Abundant in the soft shale and sandstone at East and West Rocks, and especially opposite the castle. Sometimes the siphons are observed protruding through sand which coats some of the ledges. Young specimens are often cast ashore on the West Sands in water-logged and decayed wood, whence they are extracted by the sea-fowl.

Genus 3. Xylophaga, Turton.

Xylophaga dorsalis, Turton. *Op. cit.* iii. p. 120, v. pl. 53. f. 4.

Not common; several living specimens occurred in the wood of a submerged thorn tree.

Order Solenoconchia.

Fam. **Dentalidæ**, H. & A. Adams.

Genus Dentalium, L.

Dentalium entalis, L. *Op. cit.* iii. p. 191, v. pl. 55. f. 1.

Occurs on the West Sands in a living state after some storms. The specimens procured from the fishing-boats are generally tenanted by *Sipunculi*. Common.

[To be continued.]

XLIX.—*A Revision of the Genera* Epicharis, Centris, Eulema, *and* Euglossa, *belonging to the Family* Apidæ, *Section* Scopulipedes. By Frederick Smith, Assistant in the Zoological Department of the British Museum.

[Continued from p. 322.]

Genus Centris.

Centris (pt.), Fab. Syst. Piez. p. 354 (1804).
Trachina, Klug, Illig. Mag. vi. p. 226 (1807).
Hemisia, Klug, *ibid.* p. 227 (1807).
Ptilotopus, Klug, Berlin Mag. p. 32 (1810).

Generic characters.

Head not so wide as the thorax; eyes large, lateral, elongate-ovate; ocelli placed in a curve on the vertex; antennæ geni-