REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

Sir C. WYVILLE THOMSON, Knt., F.R.S., &c.

REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH

DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

AND NOW OF

JOHN MURRAY, F.R.S.E.

ONE OF THE NATURALISTS OF THE EXPEDITION

ZOOLOGY—VOL. IV.

Published by Order of Her Majesty's Government

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE

AND SOLD BY

LONDON:—LONGMANS & CO.; JOHN MURRAY; MACMILLAN & CO.; SIMPKIN, MARSHALL, & CO.

TRÜBNER & CO.; E. STANFORD; J. D. POTTER; AND KEGAN PAUL, TRENCH, & CO.

EDINBURGH:—ADAM & CHARLES BLACK AND DOUGLAS & FOULIS.

DUBLIN:—A. THOM & CO. AND HODGES, FIGGIS, & CO.

1882

Price Fifty Shillings

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the HOLOTHURIOIDEA dredged by H.M.S. Challenger during the years 1873-1876. By HJALMAR THÉEL. Part I.

INTRODUCTION.

WHEN, at the request of Sir Wyville Thomson, F.R.S., I undertook to work out the HOLOTHURIOIDEA dredged during the Challenger Expedition, I had not the least idea of the value and richness of the material confided to my care. But the first inspection made it evident that the forms from great depths, now displayed for the first time, were of the greatest interest by making it manifest that Holothurians are living there not merely in great numbers but belonging to many species, and that a large majority of them present certain peculiarities that render them strikingly different from the littoral forms hitherto known, and make them constitute perhaps the most characteristic group of the whole abyssal fauna. As will be seen further on, I have considered myself justified in placing them under a new order—*Elasipoda*,[1] equivalent to the *Pedata* and *Apoda* already known. Of that order I shall here give the systematic and anatomical description.

During the Swedish expedition to the Yenisei, in the year 1875, several specimens of a singular animal were found in the Kara Sea, on the north-east coast of Novaya Zemlya. On a closer examination it was found to be a Holothurid, which I have described[2] under the name of *Elpidia*, the single representative of a new family, the Elpidiidæ.

[1] This seems a more correct name than "Elasmopoda" used in the Preliminary Report.

[2] Mémoire sur l'Elpidia, nouveau genre d'Holothuries. Avec cinq Planches. Présenté à l'Académie Royale des Sciences le 8 Mars 1876. Kongl. Svenska Vetenskaps-Akademiens Handlingar, Bandet 14, No. 8, Stockholm, 1877.

This discovery was the introduction to the knowledge of the order Elasipoda. The Norwegian Atlantic Dredging Expeditions, from 1876–1878, also brought home from the extreme depths of the North Atlantic two curious forms, *Irpa*[1] and *Kolga*,[2] which have been most carefully described by Danielssen and Koren, and considered by them as belonging to the same family as *Elpidia*.

The obscurity which involved the abyssal fauna was first fully dispelled by the dredgings during the Challenger expedition; and honour is due to its scientific staff, but above all to its director, Sir C. Wyville Thomson, F.R.S., for having brought to light numerous forms hitherto unimagined, equally surprising in outer form and inner organisation. While hitherto only three Elasipoda were known, this report contains descriptions of no less than fifty-two species and three varieties, divided into nineteen genera. Besides the three forms before mentioned, sixteen were described in the Preliminary Report on the Holothuridæ of H.M.S. Challenger.[3]

The Elasipoda are true deep-water forms, and they may with all the more reason be said to characterise the abyssal fauna, as no single representative, as far as at present known, has been found to exist at a depth less than 50 fathoms. Only one form, viz., *Elpidia glacialis*, Théel, has been dredged at this inconsiderable depth; but then I would point out that this was found in the Arctic Ocean, where it may be supposed that deep-sea forms are able to live at a comparatively trifling depth. *Elpidia glacialis*, Théel, at the same time appears to be a true abyssal form, and capable of existing at a great variety of depths. One specimen was, for instance, found living at a depth of 900 fathoms near the coast of Greenland, and a great number of individuals were dredged during the Norwegian Expeditions in the North Atlantic, at considerable depths; and finally, the Challenger Expedition brought home an individual dredged from Station 160, at a depth of 2600 fathoms.

A glance at the list given below will show that four species only are found at depths varying from 50 to 500 fathoms, and as many from 500 to 1000 fathoms, but that all the rest are obtained from dredgings exceeding 1000 fathoms. Thus we learn that the Elasipoda abound over the floor of the ocean at great depths, and that the number of species and of individuals is greatly reduced shorewards. The greatest depth at which any living Holothurid has been obtained is 2900 fathoms.

[1] Echinodermer fra den Norske Nordhavsexpedition. Nyt Magazin for Naturvidenskaberne, 24-de Binds 3 Hefte, Christiania, 1877.

[2] Echinodermer fra den Norske Nordhavsexpedition. Nyt Magazin for Naturvidenskaberne, 25-de Binds 2-det Hefte, Christiania, 1879.

[3] Bihang till Kongl. Svenska Vet. Akad. Handlingar, Band 5, No. 19, Stockholm, 1879.

LIST OF SPECIES FOUND IN DEPTHS FROM 50 TO 2000 FATHOMS.

Depth in Fathoms.	
50–150	*Elpidia glacialis*, Théel.
95–100, 129, 150	*Ilyodæmon maculatus*, Théel.
345	*Lætmogone wyville-thomsoni*, Théel.
450	*Orphnurgus asper*, Théel.
555, 950	*Lætmogone violacea*, Théel.
565	*Lætmogone spongiosa*, Théel.
700, 950	*Pannychia moseleyi*, n. sp.
900	*Elpidia glacialis*, Théel.
1050	*Icpa abyssicola*, Danielssen & Koren.
1090	*Benthodytes typica*, n. sp.
1090, 1375	*Euphronides depressa*, n. sp.
1100	*Enypniastes eximia*, n. sp.
1100, 1200	*Kolga hyalina*, Danielssen & Koren.
1250, 1260	*Kolga nana*, Théel.
1260	*Scotoplanes murrayi*, Théel.
1260	*Elpidia incerta*, n. sp.
1375	*Psychropotes lovéni*, n. sp.
1375, 1400	*Benthodytes papillifera*, n. sp.
1375, 1950	*Oneirophanta mutabilis*, Théel.
1375, 1600, 1800	*Lætmogone wyville-thomsoni*, Théel.
1450	*Peniagone vitrea*, n. sp.
1500	*Benthodytes mamillifera*, n. sp.
1500	*Benthodytes sanguinolenta*, n. sp.
1600	*Peniagone affinis*, n. sp.
1600	*Achlyonice lactea*, n. sp.
1600, 1950	*Elpidia purpurea*, n. sp.
1800	*Benthodytes sanguinolenta*, var. *marginata*, n.
1800	*Peniagone challengeri*, n. sp.
1800	*Peniagone naresi*, n. sp
1800, 1950, 1975	*Benthodytes sordida*, n. sp.
1900	*Psychropotes semperiana*, n. sp.
1900	*Scotoplanes albida*, n. sp.
1950	*Elpidia ambigua*, n. sp.
1950	*Scotoplanes globosa*, Théel.
1950	*Scotoplanes robusta*, n. sp.
1950	*Peniagone horrifer*, n. sp.
1950	*Psychropotes longicauda*, var. *monstrosa*, n.
1950	*Psychropotes longicauda*, var. *fusco-purpurea*, n.
1950, 1975	*Psychropotes longicauda*, n. sp.
1975	*Elpidia willemöesi*, n. sp.
1975	*Scotoplanes insignis*, n. sp.
2000	*Deima fastosum*, Théel.

LIST OF SPECIES OBTAINED FROM DEPTHS EXCEEDING 2000 FATHOMS.

Depth in Fathoms.	
2050	*Deima validum*, Théel.
2160	*Porelpidia elongata*, Théel.
2160	*Elpidia verrucosa*, Théel.
2160	*Scotoplanes globosa*, Théel.
2160, 2225	*Benthodytes mamillifera*, n. sp.
2160, 2300, 2385, 2600, 2650, 2900	*Oneirophanta mutabilis*, Théel.
2225	*Parelpidia cylindrica*, n. sp.
2225	*Benthodytes sordida*, n. sp.
2225	*Benthodytes sanguinolenta*, n. sp.
2225	*Benthodytes abyssicola*, n. sp.
2225	*Psychropotes longicauda*, n. sp.
2300	*Elpidia rigida*, n. sp.
2300	*Achlyonice paradoxa*, Théel.
2425	*Peniagone wyvillii*, n. sp.
2425	*Benthodytes papillifera*, n. sp.
2500	*Peniagone lugubris*, n. sp.
2500	*Psychropotes semperiana*, n. sp.
2600	*Elpidia glacialis*, Théel.
2600	*Scotoplanes globosa*, Théel.
2600	*Scotoplanes mollis*, Théel.
2600	*Peniagone atrox*, n. sp.
2600	*Scotoanassa diaphana*, n. sp.
2600	*Benthodytes sanguinolenta*, var. *marginata*, n.
2650	*Scotoplanes papillosa*, Théel.
2750	*Benthodytes sclenkiana*, n. sp.
2750	*Psycheotrephes exigua*, n. sp.

With regard to the geographical distribution of the Elasipoda, it must be noted that our information with respect to it is too defective, and the number of deep-sea dredgings even now too small to admit of any general results being attained. However, it will be apparent from the following list that the Elasipoda are distributed throughout all seas. Some of them are very widely distributed over the bottom of the deep sea. *Elpidia glacialis*, Théel, is found in the Arctic Ocean and in the North Atlantic, in addition to which one individual has been brought home from Station 160, south of Australia. *Lætmogone violacea*, Théel, was dredged by the Challenger Expedition, close to Sydney, and during the cruise of the "Knight Errant" between the Faroe Islands and the coasts of Scotland in the summer of 1880, Mr Murray brought home more than a hundred specimens. It cannot be doubted that those two almost antipodal forms will be found at many interjacent localities when a larger area of the oceanic abysses has been explored. Of all the Elasipoda *Oneirophanta mutabilis* seems to have the widest distribution and occurs without doubt all round the world; it has been obtained from the South Atlantic Ocean, Station 325; from the South Indian Ocean, Stations 146, 157, an

160; from the South Pacific Ocean, Stations 281 and 299, and from the North Pacific Ocean, Stations 241 and 244.

GEOGRAPHICAL DISTRIBUTION OF THE ELASIPODA.

North Atlantic Ocean.

Station V.—Lat. 35° 47′ N., long. 8° 23′ W. Depth, 1090 fms. Mud.
Benthodytes typica, n. sp.
Euphronides depressa, n. sp.

Station 23.—Off Sombrero Island. Depth, 450 fms. Globigerina ooze.
Orphnurgus asper, Théel.

Station 50.—Lat. 42° 8′ N., long. 63° 39′ N. Depth, 1250 fms. Grey ooze.
Kolga nana, Théel.

Station 101.—Lat. 5° 48′ N., long. 14° 20′ W. Depth, 2500 fms. Mud.
Psychropotes semperiana, n. sp.

Station 104.—Lat. 2° 25′ N., long. 20° 1′ W. Depth, 2500 fms. Grey ooze.
Peniagone lugubris, n. sp.

South Atlantic Ocean.

Station 133.—Lat. 35° 41′ S., long. 20° 55′ W. Depth, 1900 fms. Globigerina ooze.
Psychropotes semperiana, n. sp.

Station 325.—Lat. 36° 44′ S., long. 46° 16′ W. Depth, 2650 fms. Grey mud.
Scotoplanes papillosa, n. sp.
Oneirophanta mutabilis, Théel.

South Indian Ocean.

Station 143.—Lat. 36° 48′ S., long. 19° 24′ E. Depth, 1900 fms. Globigerina ooze.
Scotoplanes albida, n. sp.

Station 146.—Lat. 46° 46′ S., long. 45° 31′ E. Depth, 1375 fms. Globigerina ooze.
Psychropotes lovéni, n. sp.
Oneirophanta mutabilis, Théel.

Station 147.—Lat. 46° 16′ S., long. 48° 27′ E. Depth, 1600 fms. Globigerina ooze.
Elpidia purpurea, n. sp.
Peniagone affinis, n. sp.
Achlyonice lactea, n. sp.
Lætmogone wyville-thomsoni, Théel.

Station 152.—Lat. 60° 52′ S., long. 80° 20′ E. Depth, 1260 fms. Diatom ooze.
Elpidia incerta, n. sp.
Scotoplanes murrayi, Théel.

Station 156.—Lat. 62° 26′ S., long. 95° 44′ E. Depth, 1975 fms. Diatom ooze.
Elpidia willemoesi, n. sp.
Scotoplanes insignis, n. sp.
Benthodytes sordida, n. sp.
Psychropotes longicauda, n. sp.

Station 157.—Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fms. Diatom ooze.
Elpidia purpurea, n. sp.
Elpidia ambigua, n. sp.
Scotoplanes globosa, Théel.
Scotoplanes robusta, n. sp.
Peniagone horrifer, n. sp.
Benthodytes sordida, n. sp.
Psychropotes longicauda, n. sp.
Psychropotes longicauda, var. *monstrosa*, n.
Psychropotes longicauda, var. *fusco-purpurea*, n.
Oneirophanta mutabilis, Théel.

Station 158.—Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fms. Globigerina ooze.
Peniagone naresi, n. sp.
Peniagone challengeri, n. sp.
Benthodytes sordida, n. sp.
Benthodytes sanguinolenta, var. *marginata*, n.
Lætmogone wyville-thomsoni, Théel.

Station 160.—Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fms. Red clay.
Elpidia glacialis, Théel.
Scotoplanes mollis, n. sp.
Peniagone atrox, n. sp.
Scotoanassa diaphana, n. sp.

Benthodytes sanguinolenta, var. *marginata*, n.
Oneirophanta mutabilis, Théel.

AUSTRALIA, NEW ZEALAND, AND THE EASTERN ARCHIPELAGO SOUTH OF THE EQUATOR.

STATION 164.—Lat. 34° 8′, long. 152° 0′ E. Depth, 950 fms. Grey ooze.
Lætmogone violacea, Théel.
Pannychia moseleyi, n. sp.

STATION 168.—Lat. 40° 28′ S., long. 177° 43 E. Depth, 1100 fms. Grey ooze.
Enypniastes eximia, n. sp.

STATION 169.—Lat. 37° 34′ S., long. 179° 22′ E. Depth 700 fms. Grey ooze.
Pannychia moseleyi, n. sp.

STATION 184.—Lat. 12° 8′ S., long. 145° 10′ E. Depth, 1400 fms. Grey ooze.
Benthodytes papillifera, n. sp.

STATION 192.—Lat. 5° 42′ S., long. 132° 25′ E. Depth, 129 fms. Mud.
Ilyodæmon maculatus, Théel.

STATION 219.—Lat. 1° 50′ S., long. 146° 42′ E. Depth, 150 fms. Mud.
Ilyodæmon maculatus, Théel.

SOUTH PACIFIC OCEAN.

STATION 271.—Lat. 0° 33′ S., long. 151° 34′ W. Depth, 2425 fms. Globigerina ooze.
Peniagone wyvillii, n. sp.
Benthodytes papillifera, n. sp.

STATION 274.—Lat. 7° 25′ S., long. 152° 15′ W. Depth, 2750 fms. Radiolarian ooze.
Benthodytes selenkiana, n. sp.
Psycheotrephes exigua, n. sp.

STATION 281.—Lat. 22° 21′ S., long. 150° 17′ W. Depth, 2385 fms. Red clay.
Oneirophanta mutabilis, Théel.

STATION 295.—Lat. 38° 7′ S., long. 94° 4′ W. Depth, 1500 fms. Red clay.
Benthodytes mamillifera, n. sp.
Benthodytes sanguinolenta, n. sp.

Station 298.—Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fms. Grey mud.
Parelpidia cylindrica, n. sp.
Benthodytes mamillifera, n. sp.
Benthodytes sordida, n. sp.
Benthodytes sanguinolenta, n. sp.
Benthodytes abyssicola, n. sp.
Psychropotes longicauda, n. sp.

Station 299.—Lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fms. Grey mud.
Parelpidia elongata, Théel.
Elpidia verrucosa, Théel.
Scotoplanes globosa, Théel.
Benthodytes mamillifera, n. sp.
Oneirophanta mutabilis, Théel.

Station 300.—Lat. 33° 42′ S., long. 78° 18′ W. Depth 1375 fms. Globigerina ooze.
Benthodytes papillifera, n. sp.
Lætmogone wyville-thomsoni, Théel.

Station 302.—Lat. 42° 43′ S., long. 82° 11′ W. Depth, 1450 fms. Globigerina ooze.
Peniagone vitrea, n. sp.

North Pacific Ocean.

Station 241.—Lat. 35° 41′ N., long. 157° 42′ E. Depth, 2300 fms. Red clay.
Elpidia rigida, n. sp.
Achlyonice paradoxa, Théel.
Oneirophanta mutabilis, Théel.

Station 244.—Lat. 35° 22′ N., long. 169° 53′ E. Depth, 2900 fms. Red clay.
Oneirophanta mutabilis, Théel.

Station 246.—Lat. 36° 10′ N., long. 178° 0′ E. Depth, 2050 fms. Grey ooze.
Deima validum, Théel.

Eastern Asia, including China, Japan, and the Eastern Archipelago north of the Equator.

Station 209.—Lat. 10° 10′ N., long. 123° 55′ E. Depth, 95 to 100 fms. Mud.
Ilyodæmon maculatus, Théel.

Station 216.—Lat. 2° 56′ N., long. 134° 11′ E. Depth, 2000 fms. Globigerina ooze.
Deima fastosum, Théel.

Station 232.—Lat. 35° 11′ N., long. 139° 28′ E. Depth, 345 fms. Sandy mud.
Lætmogone wyville-thomsoni, Théel (?).

Station 235.—Lat. 34° 7′ N., long. 138° 0′ E. Depth, 565 fms. Mud.
Lætmogone spongiosa, Théel.

It is evident that some of the Elasipoda, living together in great multitudes, pass along the bottom of the sea; this seems especially to be the case with *Lætmogone wyville-thomsoni* and *L. violacea*, *Oneirophanta mutabilis*, several species of the genus *Benthodytes*, *Kolga nana*, *Scotoplanes globosa*, &c., of which great numbers have sometimes been dredged at the same station. But numerous different species were also found together; thus, no less than ten forms were obtained from Station 157, five from Station 158, six from Station 160, six from Station 298, &c. The nature of the bottom of the sea is doubtless of great importance in regulating the distribution of the abyssal Holothurioidea, and they are found most numerous, and in greatest abundance, on a bottom of red clay, globigerina ooze, or diatom ooze.

DESCRIPTION OF THE SPECIES.

Order ELASIPODA.

Body bilateral, more or less distinctly symmetrical. The lateral ambulacra of the ventral surface, with larger and smaller mostly non-retractile pedicels, disposed in a single row, or rarely in two rows, and sometimes with another series of elongated conical, commonly non-retractile processes placed externally and above the pedicels; pedicels of the lateral ambulacra symmetrically arranged, being more or less distinctly opposed across the ventral surface. The odd ambulacrum naked, or with a few minute pedicels, or with a double row of such. The dorsal surface provided with very long, elongated conical, non-retractile processes, often disposed in one or more rows along each of its ambulacra, or with only a few rudimentary ones in its anterior part; or with a single, very large, broad, and more or less flattened, branched or unbranched appendage, crossing the odd interambulacrum, and some minute processes. Integument with plates, wheels, and branched or simple spicula; ambulacral vessels five; polian vesicle single, rarely two; madreporic canal single, dorsal, either intimately united to the perisoma in

the medio-dorsal line, its extremity being invested by a calcareous network or not, or piercing the body-wall, and communicating with the exterior by one or several pores. The madreporic canal never depends freely into the peritoneal cavity. Ambulacral vesicles often transformed into large branched or unbranched cavities lying within the perisoma. Calcareous ring incompletely developed, either composed of a continuous, very fragile, network, without any distinct radial and inter-radial pieces, or mostly of five radial spicule-shaped pieces. Respiratory trees, ciliated cups, and retractor muscles absent. Sexes distinct.

This order is divided into three families—Elpidiidæ, Deimatidæ, and Psychropotidæ. The latter differs considerably from the two former in the shape of the body, which approximates often in general appearance to that of certain Aspidochirotæ; the presence of a more or less distinct margin round the body gives it a rather depressed aspect, and the head portion of the representatives of this family is generally considerably flattened—almost discoidal. The completely ventral position of the mouth, the arrangement of the comparatively minute pedicels in a single row round the above-mentioned brim, the presence of a double row of pedicels along the odd ambulacrum, &c., may be considered as characters which give the Psychropotidæ the right of being placed side by side with the two other families. Particular attention must be paid to the lateral pedicels, which are more numerous in the Psychropotidæ, and either small and retractile, or resembling more or less prominent protuberances, while those in the Elpidiidæ and Deimatidæ are as a rule large, wide, cylindrical, and non-retractile; besides, in both of these families the tentacles are very seldom capable of being drawn within the body, and their dorsal processes, mostly of considerable length, are often symmetrically arranged in pairs. The Elpidiidæ differ from the others in having the calcareous ring constantly composed of only five radial spicula, while in the other families it seems to be made up of a fragile net-work. The Deimatidæ are distinguished from the Elpidiidæ by their dorsal processes being more numerous, generally longer, densely crowded, and arranged in one or several continuous rows along the dorsal ambulacra; by their generally more elongated body, by the form of the calcareous deposits, by the number of the tentacles, &c. The Elpidiidæ have, with but few exceptions, ten tentacles, and the perisoma is always strengthened by branched or unbranched spicula.

Family I. Elpidiidæ.

Body varying greatly in shape from very long, cylindrical, and Synapta-shaped, to rather short, almost globular, or strongly depressed, nearly flat; tentacles as a rule ten, in a few forms eleven to twelve or twenty; mouth seldom completely ventral, usually almost terminal, though more or less distinctly turned towards the ventral surface; the lateral ambulacra of the ventral surface bearing long and wide, cylindrical or conical,

slightly retractile pedicels, disposed in a single row all along each side of that surface, or round its posterior half, or only on the margin of a brim surrounding the hindmost extremity of the body; the odd ambulacrum naked; the dorsal surface with a smaller number of sometimes very long, sometimes rather short or nearly rudimentary processes commonly disposed on its anterior part, or with a large branched or unbranched lobe-like appendage, situated anteriorly or forming a brim round the foremost extremity of the body; calcareous deposits; straight or slightly curved, C-shaped and horseshoe-shaped spicula, three- or four- armed bodies, more seldom a few minute, net-like plates, minute wheels, rosette-shaped or elliptical bodies; calcareous ring composed of only five spicule-shaped pieces, each consisting of a number of long, slender rods, diverging in opposite directions from a small central part.

This family presents a great number of forms of the most variable appearance. At first sight it seems almost impossible to comprise under the same family two genera so different from one another in their external appearances as, for instance, *Parelpidia* and *Peniagone*, but, after comparing all the thirty-one forms with one another, those scruples vanish totally, and give place, on the contrary, to some difficulty in finding satisfactory generic characters. The interval between those two extreme forms is filled up by such a series of gradations as to make a strict definition of the genera rather troublesome.

In defining the genera of this family, we have in the first place to consider the number of the tentacles, which, as characteristic of the family, may be regarded as being ten, only three forms being exceptions to this rule: *Enypniastes eximia*, *Achlyonice paradoxa*, and *Achlyonice lactea*, the first of which has about twenty tentacles, and the two latter only eleven or twelve. *Enypniastes* being an extremely characteristic form, and greatly different from the other genera of this family, I have felt somewhat doubtful with regard to its place in the system; its unexpectedly great number of tentacles, and several other peculiarities indicate a closer alliance with the family Psychropotidæ, but the individuals which have been at my disposal were in such a lacerated condition as to render it impossible to state anything concerning them. Likewise, on account of the number of its tentacles, I believe the genus *Achlyonice* to be justified. *Achlyonice paradoxa* being the typical form, seems, by its constant twelve tentacles, by the form of its body, and by other distinctions, to be easily distinguished from other genera, while the other species, *Achlyonice lactea*, having either eleven or twelve tentacles, approaches more to the genus *Elpidia*. Besides, the genus in question may easily be discerned by its calcareous bodies. In addition, I have tried to find out suitable generic characters from the shape of the body, as well as from the forms of the dorsal appendages, and, above all, from the construction of the calcareous deposits. *Parelpidia* differs from all other genera by its unusual length; it bears some similitude to the Synaptæ in its narrow cylindrical shape, with the mouth and anus at the opposite ends of the body, this resemblance being the more striking, as the dorsal surface is almost

naked, its few processes being very rudimentary. Consequently, this genus is represented by forms which differ in their external shape most remarkably from the other Elpidiidæ. Notwithstanding this, a conformity not to be neglected really exists between them, in the arrangement of the internal organs, as well as in the position of the pedicels and the form of the calcareous deposits. It is worthy, indeed, of observation that the four-armed deposits of *Parelpidia* always carry but one process, while the other genera, *Elpidia*, *Peniagone*, and *Scotoanassa*, provided with similar calcareous bodies, always seem to bear, besides those deposits with one process, numerous others having two to five processes. It is possible that after the discovery of some new forms this difference may turn out to be of little or no importance, but, in the present state of our knowledge, it deserves to be kept in mind. The genus *Scotoanassa* seems to represent the type of a new genus on account of its singularly depressed body, and the flattened margins surrounding the anterior and posterior extremities.

On the other hand, it might seem that too little attention is given to the shape of the body by including animals of very different appearances in the genus *Elpidia*. The difference between such forms as *Elpidia glacialis* and *Elpidia verrucosa* on the one side, and *Elpidia willemoësi* on the other, is most conspicuous, this latter species being distinguished partly by the flatness of the posterior end of the body, and partly by the pedicels round this posterior end being webbed together by an extension of the integument. If this peculiarity should call for a new genus, *Peniagone vitrea* and *Peniagone affinis*, for instance, though closely related, for the same reason ought to be separated from one another, the consequence of which would be, in our opinion, that generic division was being urged too far; possibly a separation into sub-genera might, on account of what is mentioned, be justified. I have felt somewhat doubtful whether *Elpidia glacialis*, might not keep its place as the sole representative of the original genus, thus necessitating a new genus for the remaining species, and I am of opinion that this separation might be fully justified—particularly as the calcareous deposits and the construction of the calcareous ring give plain evidence—if I were quite persuaded that *Elpidia glacialis* really is the only form in which the madreporic canal does not communicate with the exterior. Failing this I feel obliged to leave the definite decision of this point to further investigations. The dorsal appendages are found to be of two different kinds, one having the form of larger or smaller, more or less elongated conical processes, enclosing a single canal, the other, on the contrary, consisting of a generally very prominent and broad lobe traversed by several canals. *Parelpidia*, *Elpidia*, *Scotoplanes*, *Kolga*, *Irpa*, and *Achlyonice* carry appendages of the former kind, while the three other genera of this family bear a dorsal lobe of greater or smaller dimensions. The conical processes are usually situated on the anterior part of the dorsal surface, though one pair or more are also to be found posteriorly, as, for instance, is the case in *Scotoplanes globosa*, *Scotoplanes murrayi*, and *Elpidia glacialis;* especially in

the latter species they vary in number as well as in position. The dorsal lobe seems to arise exclusively from the anterior part of the back, as in the genus *Peniagone*, or constitutes a rather broad brim round the anterior flat extremity of the body, as is the case in *Scotoanassa* and *Enypniastes*. It might seem as if these two forms of dorsal appendages should offer particularly valuable generic characters by representing the animals in very different aspects, but it must be noted that a series of gradations is to be found between the lobes and the conical processes. I am of opinion that *Kolga hyalina*, &c., is a striking example, in having its processes disposed in a transverse row, and united at their base, thus running out from a low ridge.

The calcareous deposits of the integument represent several types, also suitable for drawing lines of demarcation between the genera. The four-armed deposits, being the most common, are found in *Parelpidia*, *Elpidia*, *Scotoanassa*, and *Peniagone*,—excepting *Peniagone naresi*,—and resemble one another so closely, that no important peculiarities are to be found among them. Besides, these deposits which sometimes, as for instance in *Elpidia glacialis* and *Elpidia ambigua*, are associated with small wheel-shaped bodies, seem to be of little or no value in defining species. With regard to the four-armed deposits of *Elpidia glacialis* they certainly differ very considerably from all others of the same kind, though constructed after the same idea. The three-armed bodies are found in *Achlyonice*, *Scotoplanes insignis*, *Scotoplanes robusta*, and *Peniagone naresi*,—the latter possessing besides those C-curved spicula, otherwise exclusively characteristic of the genus *Scotoplanes*. I do not attach so much importance to the three-armed shape of the deposits as to feel justified in associating the above-mentioned forms with one another. *Kolga* and *Irpa* are very closely allied to one another, and have very small horseshoe-shaped spicula, which are peculiar to them. I do not think it possible to found the determination of genera on the form of the calcareous bodies alone, and I consider the value of the characters which they present to be of necessity subordinate to those depending upon the number of the tentacles, the form of the body, and the conformation of the dorsal appendages; it is of comparatively slight importance if a species is seen to agree as to its deposits more closely with another genus than with the other species of its own genus.

The madreporic canal offers distinctions which seem to be most applicable as generic characters. It is either connected to the inside of the body-wall, as in *Irpa* and *Elpidia glacialis*, or it pierces it, thus communicating with the exterior, as is the case with *Kolga hyalina* and several other species. From want of materials, however, I have not been able to examine the madreporic canal in all the different species, wherefore I am obliged to neglect taking it into account in the classification. I know with certainty no other forms than *Irpa* and *Elpidia glacialis* in which the madreporic canal is connected to the body-wall and does not communicate with the exterior. It is, however, remarkable that these two modes of termination of the madreporic canal, though of the

greatest importance, do not induce any perceivable changes in the conformation or appearance of the body, as is easily seen by comparing with one another *Elpidia glacialis* and *Scotoplanes globosa*. Even if I had been able to study the madreporic canal in all the forms of this family, I should certainly have hesitated to choose as generic characters anatomical peculiarities which in most cases can be distinguished only with the greatest difficulty and by means of particular microscopical research, excepting, of course, where these peculiarities are accompanied by others.

The variability in the position of the pedicels, which are sometimes arranged all along each side of the body, sometimes wanting in the anterior half or third of the ventral surface, and sometimes present only round the posterior extremity of the body, does not give suitable generic characters. I have only once made use of this peculiarity of the pedicels, when establishing the genus *Scotoanassa*, which is most peculiar on account of its pedicels running out from the margin of the considerable brim which surrounds the posterior extremity of the body.

Thus, as stated above, there are great difficulties at present in producing a natural classification of the family Elpidiidæ.

Tabular View of the Genera of the Family Elpidiidæ.

I. Tentacles ten.
  A. Dorsal surface with processes most frequently of considerable size.
    a. Body very long, cylindrical, Synapta-shaped. Processes of the dorsal surface almost inconspicuous. Calcareous deposits four-armed, with a single long central process, directed outwards, ... Gen. I. *Parelpidia*, n. gen.
    b. Body more or less elongated ovate, cylindrical, or depressed posteriorly. Processes of the dorsal surface generally large.
      1. Calcareous deposits : four-armed bodies with large processes, and, besides, sometimes small wheels, . . Gen. II. *Elpidia*, Théel.
      2. Calcareous deposits : unbranched spicula or three-armed bodies ; and, besides, always small C-shaped spicula, ... Gen. III. *Scotoplanes*, n. gen.
      3. Calcareous deposits : simple, irregularly curved, horse-shoe-shaped bodies, scattered straighter spicula, and sometimes a few perforated, net-like plates—
        ×. Madreporic canal opening externally, . Gen. IV. *Kolga*, Dan. & Kor.
        × ×. Madreporic canal not opening externally, . Gen. V. *Irpa*, Dan. & Kor.
  B. Dorsal surface with a large lobe-like appendage anteriorly, and commonly with some minute processes, ... Gen. VI. *Peniagone*, n. gen.
  C. Body very depressed, almost flat, with a large brim round its anterior and posterior ends, ... Gen. VII. *Scotoanassa*, n. gen.
II. Tentacles eleven to twelve, ... Gen. VIII. *Achlyonice*, n. gen.
III. Tentacles twenty, ... Gen. IX. *Enypniastes*, n. gen.

Parelpidia, n. gen.

Body very elongated, cylindrical, Synapta-like, five or six times longer than broad. Tentacles ten. The dorsal surface in its anterior part only provided with a few rudimentary, almost inconspicuous processes. The ventral surface without pedicels in its anterior part. Integument with calcareous deposits, composed of four arcuate arms directed towards the inside of the body, and one central, long and straight process directed outwards.

Parelpidia elongata, Théel (Pl. I. figs. 3, 4).

Elpidia elongata, Théel, Preliminary Report on the Holothuridæ of H.M.S. Challenger, p. 17.

Mouth anterior, subterminal. Anus posterior, dorsal. Tentacles of almost equal size; their terminal part rather large, with numerous small retractile processes, and with an incision in the outer edge. Pedicels, eight along each side of the ventral surface, and behind the anus an azygous one, flat and twice as broad as the others, having the point obtuse and incised in its middle; the two or three posterior pairs flat, broader and longer than the others. The dorsal surface with about three pairs of very small, rudimentary processes on its anterior part.

Colour in alcohol, light grey. Length, about 150 mm. Breadth, about 25 mm.

Habitat.—Station 299. December 14, 1875. Lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms; bottom temperature, 1·1° C.; grey mud. One incomplete specimen.

The body is of almost equal breadth throughout, the posterior end being suddenly rounded. The mouth, the rather large oral disk, and the tentacles are slightly bent towards the ventral surface. The anus is large, perfectly dorsal, and placed near the posterior end of the body. The anterior part of the body is destitute of pedicels, the first pair being situated almost at the middle of the body or somewhat anteriorly. The pedicels, eight along each side, are disposed in pairs; the odd pedicel is situated behind the anus at the posterior end of the body. Three different kinds of pedicels are to be distinguished. The first five or six pairs, 8 or 10 mm. long, are almost cylindrical, with the end a little enlarged. The two or three posterior pairs are considerably longer, almost 13 or 14 mm., flattened, broadest at the middle, and tapering towards the end. The odd pedicel is also flat, and twice as broad as the others; it is not longer than about 7 mm., and its breadth is a little greater than its length. The free obtuse end of this pedicel is distinctly emarginated, and its upper and lower surfaces are concave in the middle. The processes of the dorsal surface are very small, visible only as spots on the anterior part of the back; they are six in number and irregularly disposed, three along each ambulacrum. The perisoma is rather thick, with five longitudinal lines marking

out the five muscular bands. Exteriorly, the integument is provided with very small papillæ, each of them containing a four-armed calcareous deposit (Pl. XXXII. fig. 16), the form of which has been already described in the character of the genus. The four curved arms of that deposit are directed towards the base of each papilla, and the long central process towards the top. The arms as well as the process are more or less spinose, though it is impossible to decide to what degree, several calcareous bodies having been thoroughly dissolved and the rest considerably deformed, the alcohol, in which this animal as well as some others had been preserved, probably having become acid. The length of the arms of those calcareous bodies is about 0·12 mm. The end of the pedicels contains a number of larger and smaller unbranched spicula and four-armed irregular bodies (Pl. XXXII. fig. 17).

As usual in this family the calcareous ring (Pl. XXXVII. fig. 2) is composed of five radial pieces or spicula, as I prefer to call them, which, being separated from one another in this species, do not form a complete ring round the gullet. Each spiculum consists of a short central part, from which radiate on each side ten to fourteen slender rods, 0·8 mm. long, slightly arcuated, and towards the end widened, flattened, and more or less branched. In the layer of connective tissue round the calcareous ring is a quantity of more or less irregular four-armed bodies, resembling those of the pedicels. Two ventral polian vesicles are to be observed, one on each side, and two other rudimentary prolongations are given off from the circular vessel. The madreporic canal seems to be destitute of calcareous deposits, and it has not been possible to determine whether it pierces the wall of the body or not. The reproductive organ, only 25 or 30 mm. long, is composed of two branches, each enlarged posteriorly and divided into a number of small bundles of cæcal branches. The anterior part of the organ also carries at its sides some small, thin bundles of the same shape. On the nerve ring are to be observed small auditory vesicles containing thirty or forty otoliths of the usual ovate form, with one end abruptly broken off, and with three to four concentric layers; the size of these otoliths varies from 0·21 to 0·04 mm. in length.

Parelpidia cylindrica, n. sp. (Pl. I. figs. 1, 2).

Mouth anterior, terminal. Anus posterior, dorsal. Tentacles bearing on their terminal part small retractile processes. Pedicels nine along each side of the ventral surface, of almost equal size, the posterior pairs being a little longer but thinner. The dorsal surface with two pairs of very small rudimentary processes on its anterior part.

Colour in alcohol, light grey. Length, about 185 or 190 mm. Breadth, about 36 or 70 mm.

Habitat.—Station 298. November 17, 1875. Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. One incomplete specimen.

The body is of an almost cylindrical form, but tapers slightly towards each extremity, the thickness being not quite the same throughout. The mouth and tentacles are almost terminal. The anus is large, dorsal, and situated near the posterior end of the body. The tentacles are doubtless ten in number, though in the only specimen existing in the collection only five are left; the rest have apparently been torn off. As their terminal part is more or less contracted, it is impossible to state correctly the form or number of the processes. Like the preceding species, this one is destitute of pedicels on the anterior part of the body, the first pair arising about 70 or 75 mm. behind the tentacles. The first five pairs of pedicels have a cylindrical form with the ends slightly enlarged; the posterior parts are narrower and a little longer. As in *Parelpidia elongata*, the spaces between the different pairs decrease backwards, so that the four hindmost pairs are close together at the posterior extremity of the body. The dorsal surface is furnished with four very small rudimentary processes, arranged in pairs, two on each ambulacrum, the first pair being situated 20 mm. and the posterior pairs about 45 mm. behind the tentacles. The perisoma is quite transparent and very thin, so that the five broad yellowish muscular bands are distinctly visible through it; its surface is scattered over externally with very small papillæ, each containing a calcareous deposit, evidently of almost the same shape as in *Parelpidia elongata*. Unfortunately, those deposits are quite dissolved, and it is only by treating the skin with hæmatoxylin or carmine that their outlines can be distinguished.

The alimentary canal is narrow; it descends to the anal extremity of the body, where it turns upon itself and forms a small circumvolution. Throughout the whole of its course, the alimentary canal is attached to the wall of the body by larger or smaller bands. The cloaca is of inconsiderable dimensions. The polian vesicles, ventral and two in number, are 12 mm. long. The madreporic canal is rather thick and, after penetrating the perisoma, communicates with the exterior by a pore situated not very far behind the tentacles. I have not been able to observe more than a single pore, although possibly there might be several. The reproductive organ is unusually long, nearly the length of the body, consisting of two very slender tubes of almost equal thickness throughout and divided posteriorly into thread-like branches. The tubes carry here and there thin bundles of such branches, and anteriorly, where both of them join and form a wide sack-like extension, there are several other small, very close-set bundles of slightly thicker branches. The whole reproductive organ is therefore very slender, almost filiform. The two species of this genus are evidently nearly allied. The transparency of the integument and its extreme thinness, the length and slenderness of the reproductive organ, the number of the processes, and especially the shape of the pedicels, distinguish this species from the preceding one.

Elpidia, Théel.

Elpidia, Mem. sur l'Elpidia, nouv. genre d'Holothuries; Kongl. Sv. Vet. Akad. Handlingar, Bd. 24, No. 8, 1877.

Body oval, or more or less oblong, about twice or thrice as long as broad; sometimes depressed posteriorly. Tentacles ten. The dorsal surfaces with processes commonly few in number and mostly disposed only on its anterior part. Integument with calcareous deposits composed of four more or less curved arms issuing from a common central point, or from the ends of a more or less elongated central part, or from the sides of a long slender spiculum, and provided with one to five processes directed outwards; besides these bodies there are often small wheels.

Elpidia glacialis, Théel.

Elpidia glacialis, Théel, Note sur l'Elpidia; Bihang till K. Svenska Vet. Akad. Handlingar, Band 4, No. 4, Stockholm, 1876.
„ „ Théel, Memoire sur l'Elpidia; Kongl. Svenska Vetenskaps-Akademiens Handlingar, Band 14, No. 8, Stockholm, 1877.
„ „ Danielssen and Koren, Echinodermer fra den Norske Nordhavsexpeditionen; Nyt Mag. for Naturvidensk. xxiv. 3, Christiania, 1877.
„ „ Danielssen and Koren, Echinodermer fra den Norske Nordhavsexpeditionen, Nyt Mag. for Naturvidensk. xxv. 2, Christiania, 1879.

Body oval, about thrice as long as broad. Mouth anterior, subventral. Anus posterior, slightly dorsal. Tentacles of almost equal size; their terminal part bearing two larger and some smaller retractile processes. Pedicels large, four along each side of the ventral surface. The dorsal surface with rather long processes on each ambulacrum; they vary in number, and are more or less distinctly disposed in pairs. Integument transparent, brittle, and rough, with two sorts of calcareous deposits numerous: slender spicula of different lengths, bearing near their middle and at some distance from each other two pairs of arms, one on each side, and two short conical processes directed outwards; and very small, hat-shaped, scattered wheels.

Colour glassy. Length, about 22 mm. Breadth, about 8 mm.

Habitat.—Station 160. March 13, 1874. Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms; bottom temperature, 0·2° C.; red clay. Only one specimen was brought home by the Challenger Expedition. Besides this, a great many individuals were taken in the Sea of Kara at a depth of 50 to 150 fathoms by the Swedish Arctic Expeditions, 1875 and 1876, and likewise a not insignificant number in the North Atlantic ocean by the Norwegian North Atlantic Expedition.

As has been mentioned, only one individual of this species was brought home by the Challenger Expedition. The discovery of this specimen in a locality so far south as the neighbourhood of the Antarctic sea is of the greatest interest, considering that this species during the last six or seven years has been found living rather commonly in

the North Atlantic Ocean and in the Arctic Ocean (Sea of Kara). *Elpidia glacialis* seems able to exist under very various conditions; the individual brought home by the Challenger Expedition proves that it lives at the greatest depth, up to 2600 fathoms, while those from the Arctic sea are found at depths of only 50 to 150 fathoms. The southern form differs in various points from the northern one, but the difference is of very little importance. The dorsal surface bears only three pairs of processes, the first on the anterior part, the second in the middle and the third on the posterior part of the body. The number and position of these dorsal processes seem to be highly variable. Some of the tentacles do not quite agree with the figure given by me in the above cited memoir on *Elpidia glacialis*, but that dissimilarity is accounted for by the fact that only the two larger processes were extended in the first individuals I saw, the other ones being retracted. The small hat- or wheel-shaped deposits scattered in the integument of the northern form have not been detected, but, from the fact that the comparatively very large spicula are rather deformed, I suppose that these very minute deposits have already been dissolved. It seems that the size of the animal considerably surpasses that stated above, and this is especially the case with the individuals brought home by the Norwegian North Atlantic Expeditions. *Elpidia glacialis* is easily distinguished from all other known forms of the same family by the peculiar shape of its calcareous deposits, and from the other species of the genus *Elpidia* by its singular calcareous ring, of which I have given a detailed account in my above-mentioned memoir. As to the ambulacral system and the wrong opinion expressed by myself and Drs Danielssen and Koren, I refer to the anatomical part of this report.

Elpidia verrucosa, Théel (Pl. III. figs. 1, 2).

Elpidia verrucosa, Théel, Prelim. Report on the Holothuridæ, p. 15.

Body sub-ovate, nearly twice as long as broad. Mouth anterior, terminal. Anus posterior, slightly dorsal. Tentacles of apparently equal size, their terminal part bearing small retractile processes. Pedicels rather large, nine along each side of the ventral surface. The anterior part of the ventral surface destitute of pedicels. The dorsal surface with two pairs of processes in its anterior part. Integument extremely brittle and hard, with numerous, rather large, pyramidal papillæ, crowded especially on the back, each papilla containing a calcareous deposit, composed of four long, spinose, arcuate arms, directed towards the inside of the body, and one or two central large and straight processes, directed outwards from the body.

Colour in alcohol, light violet with some darker spots. Length, about 52 mm. Breadth, about 28 mm.

Habitat.—Station 299. December 14, 1875. Lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms; bottom temperature, 1·1° C.; grey mud. One specimen.

This species, of which only a single individual is preserved in the collection, has the

body ovate, short, and about twice as long as broad. The mouth is terminal, slightly turned towards the ventral surface. The anus is large, of an almost triangular form. Only five tentacles are left, but traces are seen of five others which have been torn off; some of those of the ventral surface seem to be a little smaller. The tentacles are very hard, brittle, and non-retractile; their ends are rather large, bearing round the edge small retractile processes, the form and length of which are unknown. In consequence of their brittleness several pedicels are broken, but from the traces left on the body-wall they seem to be eighteen in number, nine along each side of the ventral surface. As the first pair is situated almost 20 mm. behind the tentacles, the anterior part of the body is destitute of pedicels. This first pair is comparatively the largest, about 9 or 10 mm. in length, and the others diminish gradually backwards, the hindmost ones being very small. The ends of the pedicels are slightly enlarged. As the processes on the dorsal surface are torn off, it is impossible to state their length and appearance, but the large holes in the body-wall indicate clearly that they must have been of great size and four in number. They project from the anterior part of the back and are arranged in pairs of which the first one is a little closer to the middle line of the back than the others. The integument, especially on the back, is of an unusual solidity and brittleness, in consequence of the presence of numerous crowded pyramidal papillæ (Pl. XXXIX. fig. 2), which are larger and visible to the naked eye on the back, but towards the ventral surface are almost indistinguishable. Each papilla contains a calcareous deposit (Pl. XXXIV. fig. 3) composed of four, up to 0·6 mm. long, spinose, arcuate arms, following the four edges of the papilla towards its base, and one or two rather long, straight, spinose processes directed outwards from the body; these processes run out from the centre of the deposit, that is to say, almost from the top of the papilla, where the arms are joined together. The integument is therefore rather rough. As the papillæ are largest and most distinct on the back, so the calcareous deposits also are largest there, their arms being more distinctly curved and directed inwards than is the case with those of the ventral surface. The pedicels as well as the tentacles are furnished with a great number of deposits, resembling those of the ventral surface of the body, but commonly a little smaller and with the arms more irregularly curved. Besides, several other kinds of deposits (Pl. XXXIV. fig. 4) are to be found, especially in the pedicels, viz., four-armed ones with the arms either unusually long and curved or short and straight; and smaller or larger, unbranched, straight or curved, more or less spinose spicula.

The polian vesicle is 4 mm. long. The alimentary canal is of a brownish colour. The cloaca is large and without any cæcal prolongation.

Elpidia rigida, n. sp.

Body subovate, nearly twice as long as broad. Mouth anterior, ventral. Anus posterior, subdorsal. Tentacles of apparently equal size, their terminal part bearing

numerous small retractile processes. Pedicels rather large, ten (?), all along each side of the ventral surface. The dorsal surface with about five (?) short, obtuse, thick processes round its anterior part. Integument thin, brittle, and very rough, with a great number of larger and smaller calcareous deposits, composed of four spinose slightly curved arms of variable length, and five long, straight, spinose processes directed outwards, one running out from the centre of the deposit and the others from the arms.

Colour in alcohol, light grey. Length, about 32 mm. Breadth, about 16 mm.

Habitat.—Station 241. June 23, 1875. Lat. 35° 41′ N., long. 157° 42′ E. Depth, 2300 fathoms ; bottom temperature, 1·1° C ; red clay. One very incomplete individual.

The only specimen I have had at my disposal is so incomplete and contracted as to make it impossible to form a correct idea of the shape and general appearance. The body seems, however, to be more or less ovate, and projects a little further than the mouth, which is thus rendered thoroughly ventral in position. The tentacles seem to be nearly of equal size, and their circular, rather large, terminal part is provided with numerous small retractile processes. It is rather difficult quite correctly to state the number of pedicels, but I believe them to be twenty in all, ten along each side of the ventral surface. They are rather large and brittle, so that they are easily broken off when touched. The integument is thin and very brittle, in consequence of a great number of calcareous deposits being closely crowded one upon another. Those calcareous deposits (Pl. XXXII. fig. 18) have an almost cross-like form, with the arms slightly curved, more or less spinose and very long, sometimes up to 0·48 mm. From the centre of the deposit there rises a long, more or less straight, spinose process, and a similar one proceeds from each arm, at some distance from the centre. As those processes are directed outwards from the body, the integument becomes very rough. The deposits of the pedicels and tentacles (Pl. XXXII. figs. 19, 20) are either of the same shape as those in the integument of the body or consist of unbranched, more or less spinose spicula, or they are, lastly, composed of irregular four-armed bodies, with the arms short, thick, spinose, and with or without any processes.

The polian vesicle is rounded and 5 mm. long. The madreporic canal seems to be destitute of calcareous deposits in its walls ; however, I have not been able to ascertain whether it pierces the body-wall or is only attached to its anterior surface ; I thought I observed the former to be the case.

Elpidia purpurea, n. sp. (Pl. VII. figs. 4–6).

Body nearly oval, or of almost equal breadth throughout, more or less depressed, little more than twice as long as broad. Mouth anterior, ventral. Anus posterior, terminal, subdorsal. Tentacles of almost equal size ; their ends with small, retractile processes, those round the edge being larger than the others. Pedicels, fifteen or eighteen in number, only round the posterior half of the ventral surface. The foremost part of the dorsal surface

with two pairs of rather long slender processes directed forwards, one a little behind the other. Integument thin, transparent, rather rough, with numerous crowded calcareous deposits, composed of four long, spinose, more or less arcuated arms, each bearing a long, spinose process.

Colour in alcohol, violet. Length, about 37 mm. Breadth, about 16 mm.

Habitat.—Station 147. December 30, 1873. Lat. 46° 16′ S., long. 48° 27′ E. Depth, 1600 fms.; bottom temperature, 0·8° C.; globigerina ooze. One specimen. Also a single individual was dredged at Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze.

I intend first to describe a little more in detail the individual from Station 147, and then to point out by what this differs from the one dredged at Station 157. The body is elongated, almost oval, with the posterior end evenly rounded; the anterior, on the contrary, is suddenly truncated. The back is but slightly convex, and the ventral surface almost flat, the body thus looking rather depressed. The mouth is completely ventral and situated a little behind the foremost truncated part of the body. That part which projects in front of the mouth consists of a brim or border-like enlargement of the body-wall, which gives to the foremost end of the body the appearance of being very thin and flattened. This brim carries at its front on each side a pliable non-retractile process, 10 or 11 mm. in length, and a little behind each of those, another one of about the same length or a little shorter. The processes as well as the brim are directed forwards but can probably, at the will of the animal, be bent upwards; they belong to the dorsal ambulacra. The tentacles (Pl. XLIV. fig. 6) are of almost equal size, and their terminal part is provided round the edge with a number of small retractile processes of which two seem to be a little larger than the others; besides, the terminal part carries a great number of papilla-like retractile projections of a dark violet colour. We have not succeeded in observing any tentacle completely extended. Pedicels are wanting on the anterior half of the body; round its posterior half, however, they are arranged to the number of fifteen or sixteen. The calcareous deposits of the integument (Pl. XXXIII. figs. 13, 14), which are numerous and very crowded, are composed of a more or less elongated central part, from each of the ends of which run out two long, spinose, more or less arcuate, arms, with the ends somewhat widened; near its attachment each arm bears a long spinose process. Even the pedicels, tentacles, and dorsal processes are provided with a great number of deposits of the same shape, both the first ones having, besides, at their ends some curved, slightly spinose spicula, and some four-armed bodies without processes, and with the arm considerably spinose and arcuate. The colour of individuals preserved in alcohol is violet, with the back a little darker; the terminal parts of the tentacles are almost black violet.

The calcareous ring does not seem to be continuous, but consists of five pieces separated one from another, each being composed of a number of rods radiating in two

directions from a common centre. The reproductive organs consist of two wide, short tubes bearing small bundles of cæca; they open into a single common duct having its orifice immediately in front of the tentacles in the downwardly directed part of the dorsal surface. Both of the tubes of the organ contain numerous calcareous deposits in the form of spicula. I have not been able to examine the madreporic canal. The alimentary canal is of a violet colour.

The individual obtained from Station 157 shows several peculiarities which I shall now point out. The size itself is considerable in comparison with that of the above-described specimens, the length amounting to 55 or 60 mm. and the breadth to about 25 mm. The body is of almost equal breadth throughout, with its posterior end abruptly rounded, thus differing very considerably from the oval form peculiar to the preceding. The dorsal surface also projects considerably in front of the mouth, which thus becomes thoroughly ventral, and is situated about 10 or 12 mm. behind the transversely truncated anterior end of the body. The processes which constitute the first pairs are 22 mm. long, and the posterior ones a little shorter. The pedicels are eighteen in all, nine arranged along each side of the posterior half of the ventral surface. On comparing the individuals from Station 146 it becomes evident that the anterior half of the body is always wanting in pedicels, while the number of the pedicels on the posterior half may vary a little. The calcareous deposits within the integument are very crowded and rather small, their arms attaining only to about 0·1 mm. in length; for the rest, the size varies a little in the same animal, the deposits being considerably larger in some parts of the body than in others. This variation in size is also accompanied by a rather considerable alteration in the appearance of the calcareous deposits. I have here been able to examine the calcareous ring more closely than in the above described individual; each of its five pieces or spicula, separated one from another, consists of a short central part, which gives off, in opposite directions, about eight long rods, the ends of which seem to be a little flattened, broad, and as if they were dichotomously branched. Supposing the ends of the rods to be united one with another by a line, it seems that such a line should then describe a semi-circle. The madreporic canal pierces the body-wall and thus brings the ambulacral system into connection with the surrounding medium; its pore is situated nearer the tentacles than I have observed in any other form described here. The madreporic canal seems to be destitute of calcareous deposits in its wall, which is most singular, as the reproductive organ, except the narrow efferent duct, is provided with numerous, crowded, rather straight, and slightly spinose spicula. The reproductive organ ought properly to be considered as a single fascicle composed of two bundles; its long common efferent duct bears several small bundles. This duct has the peculiarity of being divided, a little before reaching the body-wall, into two diverging canals, which open far apart from one another, one on each side of the pore of the madreporic canal.

Elpidia willemoësi, n. sp. (Pl. VIII. figs. 2, 3).

Body elongated, of almost equal breadth throughout, about twice and a half as long as broad, considerably depressed backwards, and the posterior very flat extremity with an incision in its middle. Mouth anterior, ventral. Anus posterior, dorsal. Tentacles large, of almost equal size, some of the ventral ones a little smaller than the others; their terminal part with retractile processes. The dorsal surface with three large, rather short, lobe-like processes, arranged in a transverse row at its foremost part, the middle one larger than the others, and with one or two very small, rudimentary processes on each ambulacrum a little behind the former ones. Pedicels ten, all along each side of the ventral surface, rather large, the hindmost pairs a little smaller. Integument thin, transparent, with two sorts of calcareous deposits numerous: large four-armed bodies, each arm slightly curved, and with numerous long spines and spinose processes; smaller ones with the arms less spinose, but more arcuated, and with two to four rather long, spinose processes, directed outwards, or with only one central process.

Colour in alcohol, light grey. Length, about 85 to 90 mm. Breadth, about 35 mm.

Habitat.—Station 156. February 26, 1874. Lat. 62° 25′ S., long. 95° 44′ E. Depth, 1975 fathoms; diatom ooze. One almost complete and three incomplete specimens.

The body is more or less distinctly elongated and the anterior part, in individuals preserved in alcohol, is considerably narrower than the posterior. The ventral surface is almost flat, and the back slightly convex, the height of the body being thus not very considerable; the greatest height is at its middle and anterior part. Posteriorly, the dorsal surface gradually approaches the ventral surface, so that the posterior obtusely rounded, almost truncated, extremity of the body is rather flattened; it is incised in its middle, so that it gives the impression of being bilobed. The anterior part of the body terminates in three short, obtusely triangular processes or lobes, disposed in a transverse row, and having their bases close to each other; the middle process is at its base several times broader than the other two. The body-wall surrounding those processes is thickened and projects from the mouth, which thus acquires a thoroughly ventral position. In the single uninjured specimen we have had at our disposal, not only the tentacles, but also a neck-like portion of the body, supporting them, protrudes below the ventral surface, forming thus a distinct angle with it. In a thoroughly extended state it seems probable that the animal might change, in some degree, the position of this neck-part, so as to stretch it forwards, possibly beyond the three dorsal processes, which, instead of being directed forwards, ought to be turned more upwards. The anus is situated on the dorsal surface immediately in front of the incision in the posterior extremity of the body. The tentacles are of rather inconsiderable size, some ventral ones being a little smaller than the others. Their terminal parts are, as usual, mostly retracted, and bear a number of retractile processes, which, especially towards their extremities, are provided with very small brownish projections,

resembling those I have represented in *Orphnurgus asper*. The pedicels are ten all along each side of the ventral surface, the posterior pairs being somewhat smaller than the others, which are of rather a remarkable size. The first five or six pedicels on either side are distinctly separated from one another by certain distances, while the other ones are close-set side by side; the former are directed downwards and slightly backwards, while the latter or posterior ones are directed outwards and backwards, proceeding from the margin of the very thin posterior end of the body. The wide canals of these posterior pedicels are continued directly inwards and traverse without discernible diminution the brim-like thickened perisoma, which surrounds the hind-part of the body; hence one cannot help thinking that these pedicels are also in reality long, but have their ends alone free, being for the rest of their length webbed together by an extension of the integument. From these close lying canals being visible through the skin, the posterior extremity of the body has almost a fin-like appearance. In addition to the three above-mentioned lobe-like appendages, there are on the dorsal surface some minute processes, one placed on the right ambulacrum and two on the left. The integument is whitish, rather thin and transparent. The larger calcareous deposits (Pl. XXXIII. fig. 10) have their four arms about 0·2 mm. long, almost straight or slightly curved with a number of large spines, each arm sending out one or several spinose processes; they have no central processes, lie in the internal layer of the connective tissue of the body-wall, and are to be found in greatest number on the sides of the body. The other calcareous deposits are far more numerous. Their four arms are only half as long but more curved and covered with considerably smaller spines; the arms either meet in a central point or are united by a shorter or longer rod-like central part. These deposits have either a single slightly spinose, straight process proceeding from the centre, or two to four similar ones, situated more or less distant from the centre; those with two to four processes predominate on the ventral surface, while those with only one process are to be found on the back and in the pedicels, where the process attains a considerable length.

I have occasionally seen some C-shaped bodies, but their rarity has made me fear that they do not belong to the animal, but have happened to stick to the skin.

The oral disk contains, besides the four-armed deposits with four processes, unbranched spicula as well as three-, four-, and many-armed, irregular, finely spinose bodies. The ends of the tentacles and pedicels are provided with numerous larger or smaller, straight or slightly curved, spinose spicula (Pl. XXXIII. figs. 11, 12); besides, the ends of the pedicels contain some four-armed slightly spinose deposits.

Each of the five separated pieces of the calcareous ring (Pl. XXXVII. fig. 1) is composed of a small oblong central part, each end of which sends out a radiating bundle of ten to fifteen rods, which have their extremities more or less ramified and flattened. These five pieces constitute the radial parts of the ring, while every trace of inter-radial pieces

between them is totally wanting. There are two polian vesicles, one on each side of the ventral surface; their length is rather inconsiderable, only 7 or 8 mm. The madreporic canal penetrates the body-wall and opens externally by a pore, situated a little in front of the genital aperture; its parietes contain only a few scattered spicula, but the body-wall round its aperture is provided with large close-set, four-armed, more or less irregular calcareous deposits. The cloaca is small and insignificant. The reproductive organ consists of two large, wide tubes, which communicate anteriorly with a narrow efferent duct which opens at the top of a very small papilla placed immediately above the downwardly directed neck-part of the body. The said tubes bear scattered thin bundles of rather large, elongated cæcal sacs.

Elpidia incerta, n. sp. (Pl. VIII. fig. 1).

Body elongated, about twice and a half as long as broad, considerably depressed posteriorly. Mouth anterior, ventral. Anus posterior, dorsal. Tentacles large, of almost equal size, some of the dorsal ones a little smaller; their terminal part very large, circular and discoidal, with numerous small retractile processes. The dorsal surface with a pair of indistinct, tuberous processes at its foremost part. Pedicels ten, all along each side of the ventral surface, rather large, the posterior pair a little smaller. Integument thin, slightly rough and transparent, containing calcareous deposits, composed of four arms and two to four processes, resembling those of the preceding species.

Colour in alcohol, white. Length, about 90 mm. Breadth, about 27 mm.

Habitat.—Station 152. February 11, 1874. Lat. 60° 52′ S., long. 80° 20′ E. Depth, 1260 fathoms; diatom ooze. Four incomplete specimens.

This species seems to be most closely allied to *Elpidia willemoësi;* the four individuals brought home by the Challenger expedition differ indeed so slightly from it, that I have long been in doubt whether it is justifiable to refer them to a new species or not. The body has its greatest height, about 20 mm., anteriorly and thence it diminishes gradually backwards, the hindmost extremity becoming thus very thin. Anteriorly, where the body attains its greatest height, the dorsal surface bends rather abruptly downwards, forming a kind of rounded hump, whereby the neck-like narrow portion of the body, which supports the mouth and the tentacles, seems to have an almost perpendicular direction; thus the mouth has a thoroughly ventral position. The tentacles—only six are left in one specimen, and they are altogether torn off from the other three individuals—do not seem to be of quite equal size, a couple of the dorsal ones being a little smaller. Their terminal part is uncommonly large, circular, flat, and discoidal. The pedicels resemble in size and position those of the preceding species, excepting that here the first pair is placed a little further from the tentacles. The back bears only two tuberous indistinct projections, lying side by side, and situated just on the above-mentioned hump; they are so

contracted and indistinguishable that their existence can be ascertained only by opening the animal and looking for their ambulacral cavities. The integument is rather thin and transparent, so that the thick yellowish muscular bands are obvious through it. The calcareous deposits (Pl. XXXIII. fig. 3) are represented by a great number of close-set small four-armed bodies with a long rod-like central part; each arm, only about 0·064 mm. in length, is spinose, enlarged towards the end, a little curved, and provided with a shorter, extremely spinose, outwardly directed process; occasionally one or two arms are destitute of those processes. There is also another kind of deposit, with the four arms only slighly spinose, about 0·16 mm. long and bent towards one another, and with the two to three 0·14 mm. long processes straight and very little spinose. The terminal part of the pedicles bears a number of larger or smaller, more or less branched and curved spinose spicula (Pl. XXXIII. fig. 4). The terminal parts of the tentacles enclose an infinite number of larger or smaller, commonly extremely arcuated spinose spicula. The calcareous ring resembles that of *Elpidia willemoësi*. In the surrounding connective tissue there are numbers of simple and ramified, more or less curved, and towards the ends very spinose spicula, of about the same shape as those encountered in the muscular layer of the integument. The madreporic canal has a number of straight or curved, simple or three- or four-branched spinose spicula. The alimentary canal forms a great circumvolution, and is all along its length attached to the inside of the body-wall by means of numerous strong muscular bands and threads; there are no mesenteric membranes; its colour is white, excepting the cloaca and the part that lies nearest to the circular water-vessel, which are violet. The cloaca is rather considerable, but has no cæcal prolongation. The two polian vesicles are 20 or 25 mm. in length. The reproductive organ is composed of two, 20 or 25 mm. long, very thick dichotomously ramified bundles of small elongated cæcal sacs; the single efferent duct bears also some very small bundles. All along the two lateral ambulacra of the ventral surface, I have observed a great number, thirty to forty, of small auditory vesicles, containing numerous otoliths; some vesicles are situated more or less distant from the ambulacral nerves and communicate with them by a branch. The number and position of the dorsal processes, the size of the terminal parts of the tentacles, the fine ramification of the reproductive organ, and the want of the internally placed calcareous deposits of the integument, constitute the characters which distinguish this species from the preceding one.

Elpidia ambigua, n. sp.

Body elongated; about twice as long as broad, slightly depressed. Mouth anterior, ventral. Anus posterior, subdorsal. Tentacles of almost equal size; their terminal part large, discoidal, provided with small retractile processes. The dorsal surface with a pair of long slender processes at its foremost part, and immediately behind those, two or three very small ones. Pedicels only on the posterior half of the ventral surface,

about seven along each side. Integument with two sorts of calcareous deposits; four armed bodies with four processes resembling those of *Elpidia purpurea*; and small wheels with eight or ten spokes.

Colour in alcohol, light violet. Length, about 35 mm. Breadth, about 15 mm.

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. Two incomplete specimens.

The two individuals obtained from the above station are in such an incomplete state, that the description of them cannot be otherwise than very unsatisfactory. The form of the body it is almost impossible to state. All along each side of the body the perisoma forms a distinct list or brim, which may, however, depend on the contraction in alcohol. The terminal part of the tentacles bears a number of small retractile processes, of which two on its outer margin are largest; all these processes are, in their turn, provided with a number of very small retractile papilliform projections. Among the dorsal processes the first pair, situated on the anterior extremity of the body, is of considerable length, about 17 mm.; the pair placed immediately behind is very inconsiderable, and the processes arising close behind this second pair, one or two on each ambulacrum, are completely rudimentary, almost invisible. Pedicels are only to be observed round the posterior half of the ventral surface, and most of them being torn off it is impossible to state correctly their number; they seem to have been about fourteen, seven along each side, and of a rather considerable size. The calcareous deposits (Pl. XXXIII. fig. 6) in the integument are, as above remarked, of two sorts: four-armed bodies with four outwardly directed processes; and very scattered small wheels, 0·048 mm. in diameter, with eight to ten spokes, and with four curved minute rods, proceeding from the inner margin of the nave and united together in the centre. The four-armed deposits closely resemble those of *Elpidia purpurea*; their size, however, as well as the proportions between the arms and the processes is rather variable. The wheels are only to be found on the dorsal surface. The calcareous deposits being scattered, the surface of the skin does not feel very rough.

As may be seen, this species has a great resemblance to *Elpidia purpurea*, which, however, differs by its darker colour, by the greater number of calcareous deposits, and by its want of wheel-shaped bodies.

Tabular View of the Species of the Genus Elpidia.

I. Pedicels all along each side of the ventral surface.
  A. Body elongated, posteriorly depressed and flattened.
    a. Calcareous deposits: large four-armed bodies with numerous long spines and spinose processes; and smaller ones provided with two to four outwardly directed processes, . *Elpidia willemoësi.*
    b. Calcareous deposits: only small four-armed bodies with two to four outwardly directed processes, . . . *Elpidia incerta.*

B. Body ovate or oval.
  a. Calcareous deposits: four-armed, almost cruciform bodies, with five outwardly directed processes, ... *Elpidia rigida.*
  b. Calcareous deposits: four-armed bodies with the arms running out two from each opposite side of a long spicule, and provided with two outwardly directed processes; and small scattered hat-shaped wheels, ... *Elpidia glacialis.*

II. Pedicels only around the posterior half of the ventral surface.
  a. Calcareous deposits: four-armed bodies with one or two outwardly directed processes, ... *Elpidia verrucosa.*
  b. Calcareous deposits: four-armed bodies with four outwardly directed processes, ... *Elpidia purpurea.*
  c. Calcareous deposits: four-armed bodies with four outwardly directed processes; and small wheels with eight to ten spokes, ... *Elpidia ambigua.*

Scotoplanes,[1] n. gen.

Body varying from more or less elongated to ovate, almost globular, from once and a half to thrice as long as broad, sometimes depressed posteriorly. Tentacles ten. The dorsal surface with a small number of processes, often of remarkable length and size. The ventral surface with pedicels all along each side or only round its posterior half. Integument with two sorts of calcareous deposits: small spicula, curved in the form of a C; and either large, straight, unbranched spicula, or three-armed bodies.

Scotoplanes globosa, Théel (Pl. IV. and Pl. V. fig. 3).

Elpidia globosa, Théel, Preliminary Report on the Holothuridæ, p. 14.

Body ovate, more or less globular, from once and a half to twice as long as broad. Mouth anterior, terminal, slightly ventral. Anus posterior, subventral. Tentacles of equal size, their terminal parts bearing numerous, small, digitate, retractile processes. Pedicels seven along each side of the ventral surface, rather large. The dorsal surface, with three processes, disposed on each side of its ambulacra; the first pair in the anterior, and the second in the posterior part of the back, both of them very large elongated and conical; the third pair immediately behind the second, small and rudimentary. Integument very thin and transparent, with two sorts of calcareous deposits: small spicula, curved in the form of a C; and large straight spinose ones.

Colour in alcohol, light grey. Length, about 130 mm. Breadth, about 70 mm.

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth 1950 fathoms; diatom ooze. One specimen. Station 299. December 14, 1875. Lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms; bottom temperature, 1·1° C.; Grey mud. Twenty-five to thirty specimens.

[1] Σκότος = darkness.

This specimen is distinguished by its obviously globular form, the dorsal surface being extremely convex, the ventral, on the contrary, almost flat. In size it surpasses all hitherto known forms of this family. The tentacles (Pl. XLIV. fig. 12) are wide, and their flat terminal part is large, about 9 mm. in diameter, discoidal and provided with a number of unbranched, digitiform, retractile processes, of which those round the edge, and especially two on the outside, are large. The pedicels are very large, of great circuit, and constantly consisting of seven pairs, of which the posterior ones are slightly smaller; the last pair, being generally very small, is not placed on the hindmost part of the ventral surface, but on the inside of and a little in front of the next pair, which consequently is the most posterior. The number of the processes and their arrangement seem always to be constant, but their size changes, though not greatly; in most cases they are of great size, equalling in length almost the breadth of the body; the hindmost pair is always rudimentary. The body-wall of the thinness of paper is soft and transparent, the radial nerve-cords, the ambulacral vessels and cavities being visible through it. The calcareous deposits consist of small spicula curved in the form of a C (Pl. XXXIV. fig. 8), which are more numerous than the comparatively larger spinose spicula (Pl. XXXIV. fig. 9), which, thinly scattered, are visible to the naked eye. Those first mentioned are frequently provided with an obvious enlargement in the middle, and taper towards both of their equally curved ends; the largest ones measure about 0·16 mm. in length, but most of them are considerably smaller; their form varies too, as to the degree of curvature. Those C-shaped deposits, which sometimes give off a third arcuated arm issuing from their middle, in which case the C-shaped form evidently vanishes, seem to be most numerous on the ventral surface. The straight spinose spicula vary in size, the largest measuring in length about 0·92 mm., or sometimes more; some individuals have those spicula more numerous than others, especially on the dorsal surface; they are not quite straight always, one or another being more or less arcuated.

The integument possesses besides those calcareous deposits, masses of small cell-like corpuscles containing a brown pigment. Calcareous deposits of almost the same form as those above described are found in the pedicels, tentacles, and processes, the C-curved ones in the pedicels being a little shorter and thicker; the large spicula are often apparently arcuated, sometimes even provided with one or several branches. The ends of the pedicels as well as those of the tentacles contain a number of larger or smaller, thicker, straight, more or less arcuated spicula, which are almost smooth, excepting their obtuse ends, which are rough and spinose; sometimes those spicula bear a larger branch. The transverse muscular layer of the body-wall and the five longitudinal muscular bands are very thin.

The five pieces of the calcareous ring are very small and far separated one from another; each piece consists of a short central part, from which run out towards each opposite side

four thick and short diverging rods with rough outlines. The polian vesicle is single, measuring only 15 to 20 mm. in length. The thick cord-like madreporic canal pierces the body-wall, thus connecting the ambulacral system with the surrounding sea water; as usual, its aperture is situated in the medio-dorsal line, about 15 mm. behind the tentacles. The wall of the madreporic canal is particularly firm and thick, containing only a small number of calcareous deposits of the same C-curved shape as those in the integument of the body. In regard to the ambulacral system, I refer to the anatomical part of my report.

The alimentary canal is rather wide. It decreases at first slightly backwards, and dilates again gradually, so as to form a large, thick-walled cloaca, from the left side of which projects forwards a considerable cæcal prolongation. The alimentary canal is attached to the inside of the body-wall not by mesenteric membranes but by a number of longer or shorter elastic bands. The madreporic canal and the efferent duct of the reproductive organ are connected with each other as well as with the adjacent portion of the alimentary canal by a mesentery. The five vessels, which the water-vascular ring emits, are united with one another by a very thin transparent membrane, thus forming a cavity or sinus around the foremost part of the alimentary canal. The reproductive organ consists of a single fascicle made up of bundles of small oval cæca, and is situated on the left side of the medio-dorsal line. The organ opens immediately behind the pore of the madreporic canal. The walls of the alimentary canal, the blood-vessels, and the reproductive organ, as well as the elastic bands, which retain the alimentary canal in a proper position, contain C-curved calcareous deposits; sometimes I have observed in the respiratory organ some scattered, spinose spicula of about the same shape as those of the integument. The individual from Station 157 differs from the others by its gigantic size, 180 mm. by 110; besides, its dorsal processes seem to be comparatively smaller. The discovery of this characteristic species in two such far distant localities, as in the South Indian Ocean, not very far from the Antarctic Sea, and in the South Pacific Ocean, near Valparaiso, is in the highest degree interesting, and justifies the supposition that its distribution must be very extensive.

Scotoplanes mollis, Théel (Pl. II. figs. 1, 2).

Elpidia mollis, Théel, Preliminary Report on the Holothuridæ, p. 14.

Body ovate, about twice as long as broad. Mouth terminal, subventral. Anus posterior, terminal. Tentacles of almost equal size; their terminal part provided with two large retractile digitiform processes, and with several small ones. Pedicels six along each side of the ventral surface, rather large. Processes of the dorsal surface two, rather large, elongated and conical, flexible, placed side by side a little in front of the middle of the body, and two smaller ones issuing from each outer side of the former near their

base. Integument very thin and soft, with small papillæ; calcareous deposits of two sorts: large, straight, spinose spicula, much scattered; and small ones more close set, in the form of a C.

Colour in alcohol, light grey, inclining to violet. Length, about 70 mm. Breadth, about 33 mm.

Habitat.—Station 160. March 13, 1874. Lat. 42° 42′ S., long 134° 10′ E. Depth, 2600 fathoms; bottom temperature, 0·2° C.; red clay. One specimen.

Only a single specimen having been obtained, it has been impossible to examine it more in detail. The terminal part of the tentacles is rather large, about 6 mm. in diameter, discoidal, and deeply incised in its outer margin, thus giving rise to two rather large processes; the whole terminal part, consequently also those two processes, are provided with a great number of very small, retractile, unbranched projections. At the first sight the processes of the dorsal surface (Pl. XLIV. fig. 2) seem only to be two, measuring in length about 20 mm., but by more careful examination, one finds that each of those consists of two, that is to say, that another process, considerably smaller, exists on the outer side of each of those first mentioned, and is united with them by a web, only the top being visible. The integument is very thin, soft, and transparent, and is covered all over with small papillæ, which are most numerous and conspicuous on the pedicels and the tentacles as well as at the top of the processes. In each papilla are to be found minute fibres, which are probably nerves. The calcareous deposits (Pl. XXXIII. fig. 17) resemble perfectly those in *Scotoplanes globosa*, the large straight spicula being very rare, but the C-shaped ones more numerous and close set. The last mentioned deposits are in this species usually slightly longer, more arcuated, and almost thread-like. The polian vesicle is small. The madreporic canal seems to open externally by a rounded pore; however, I have not been able to prove this.

Scotoplanes papillosa, Théel (Pl. II. figs. 5, 6).

Elpidia papillosa, Preliminary Report on the Holothuridæ, pp. 16, 17.

Body ovate, about once and a half as long as broad. Mouth anterior, terminal. Anus posterior, slightly dorsal. Tentacles of almost equal size, bearing at their terminal part numerous small digitiform processes. Pedicels eight along each side of the ventral surface. The dorsal surface with four small processes disposed in a transverse row a little in front of the middle of the back and united by their bases, forming a low ridge between the two ambulacra; and immediately behind this ridge another pair of small processes. Integument very thin, soft, and transparent, with small light papillæ, scattered on the back; calcareous deposits of two sorts: large straight spinose spicula, and small ones, more numerous and curved like a C.

Colour in alcohol, light grey. Length, 56 mm. Breadth, 34 mm.

Habitat.—Station 325. March 2, 1876. Lat. 36° 44′ S., long. 46° 16′ W. Depth, 2650 fathoms; bottom temperature, 0·4° C.; grey mud. One specimen.

The mouth is almost terminal, slightly bent towards the ventral surface, and is surrounded by tentacles of almost equal size; their terminal part, a little smaller than that of *Scotoplanes mollis*, is furnished with numerous retractile processes, and with a slight incision in its outer margin. Of the pedicels six pairs are of a conical form with a rather large base; whether the others, which are very small and insignificant, form two pairs or one only is difficult to decide, but I have thought the former to be the case. The transverse ridge on the dorsal surface is very low, crossing the odd interambulacrum from one radius to the other, and bears four small processes, of which the two in the middle are larger than the others, which are almost inconspicuous. Close behind this ridge each ambulacrum is provided with a minute process. The integument, very thin and transparent, is covered with papillæ of a more considerable size than those of *Scotoplanes mollis*. The ventral surface seems to be almost destitute of such papillæ. The calcareous deposits resemble those of the above-mentioned species; however, the C-curved ones seem frequently to be provided either with a small straight spine issuing from the middle or with a long curved arm, constituting thus a three-armed figure. The straight spicula are generally smaller on the ventral surface than on the dorsum, some of them being comparatively small and without spines.

From want of material, I have not been able to study more in detail the calcareous ring; it is only possible to state that it is composed, as usual, of five pieces (Pl. XXXVII. fig. 12), each consisting of a central part, from which radiate eight rather straight rods. But I have not been able to decide positively whether those pieces are separated from each other, or whether they are united by the ends of the rods, thus forming a perfect ring; I suppose the former to be the case. The polian vesicle is minute. The madreporic canal opens externally, 9 mm. behind the crown of tentacles. The reproductive organ consists of a single, rather large fascicle made up of a great many small close-set cæca.

It is obvious that the three forms *Scotoplanes globosa*, *S. mollis*, and *S. papillosa* are closely allied, and one is scarcely able to detect in the forms of the calcareous deposits any character to distinguish them from one another. On the contrary, the size, the position, and the form of the dorsal processes present, I believe, very good and constant specific characters. *Scotoplanes globosa* differs greatly from the two others in the form of the body, which, in consequence of the unusual convexity of the dorsal surface is more or less distinctly globular, while the body of the other two species is considerably more elongated.

Scotoplanes murrayi, Théel (Pl. III. figs. 3, 4).

Elpidia murrayi, Théel, Preliminary Report on the Holothuridæ, p. 16.

Body ovate, about twice as long as broad. Mouth anterior, subventral. Anus posterior, terminal. Tentacles of nearly equal size; the middle ventral one a little smaller than the others; their terminal part provided with small, digitiform, retractile processes. Pedicels short, five along each side of the ventral surface. The dorsal surface with three small processes, as long as half the breadth of the body or shorter, disposed on each of its ambulacra; the posterior pair rudimentary. Integument brittle and glassy from numerous crowded spicula, covering one another, some small and in the form of a C, others large, unbranched, straight, and very spinose.

Colour in alcohol glassy. Length, about 20 mm. Breadth, about 10 mm.

Habitat.—Station 152. February 11, 1874. Lat. 60° 52′ S., long. 80° 20′ E. Depth, 1260 fathoms; diatom ooze. One specimen.

I regret that but one specimen of this very pretty little species should have been obtained. It closely resembles, in general form, the typical *Elpidia glacialis*. The back is extremely convex. Some of the tentacles (Pl. XLIV. fig. 4) are evidently smaller than the others, which is especially the case with the middle one on the ventral surface, and the second one counting from that to the right. The processes on the dorsal surface are arranged so that the first pair is situated on the anterior part of the body, the second one on its posterior part, and the third rudimentary one immediately behind the second. The processes of the two first pairs measure about 3 mm. in length. The pedicels, as well as the tentacles and processes, are brittle and fragile on account of the large, slightly curved, generally spinose and transversely placed spicula. As in *Elpidia glacialis*, the ends of the pedicels as well as the minute processes of the tentacles are completely retractile and, as it seems, destitute of deposits. The integument is brittle, rough, and glassy; it contains quantities of close-set, straight, or curved spicula (Pl. XXXIV. fig. 2), measuring in length about 0·8 mm., and provided with large spines. Between those large spicula are to be distinguished small C-curved bodies, measuring about 0·13 mm. in length or sometimes less. Those last-mentioned deposits change considerably in size, but principally in form, some being extremely and equally arcuated, others being very slightly curved, while others, lastly, are almost perfectly straight, excepting their two nearly evenly arcuated ends. A series of dark spots appears on the dorsal surface, which, however, does not seem derived from pigment in the integument, but from some internal objects. Only a single specimen having been at my disposal, and that a very small one, it has not been possible to study any of the internal organs.

Scotoplanes albida, n. sp.

Body elongated, about twice as long as broad. Mouth anterior, terminal. Anus posterior, dorsal. The terminal part of the tentacles circular discoidal, unusually large, provided with small retractile processes. The dorsal surface with some small processes on its anterior part. Pedicels very long, ten or eleven (?) along each side of the ventral surface. Integument thin and soft, with two sorts of numerous calcareous deposits: small spicula, curved in the form of a C; and large, straight, spinose ones.

Colour in alcohol, white. Length, about 75 mm. Breadth, about 35 mm.

Habitat.—Station 143. December 19, 1873. Lat. 36° 48′ S., long. 19° 24′ E. Depth, 1900 fathoms; bottom temperature, 1·4° C.; globigerina ooze. One incomplete specimen.

Only a single specimen having been brought home by the Challenger Expedition, and that such an incomplete one as to render a detailed examination impossible, the description must necessarily be rather imperfect. The ventral surface is flat, the dorsal on the contrary convex. The anus is situated near the posterior end of the body, and is completely dorsal. The tentacles, of which only seven are left, have the terminal part very large, measuring about 10 mm. in diameter, and are furnished with a number of small-branched processes round the edge; besides those processes there are numerous very small papilla-like projections. Only some small processes have been discovered anteriorly on the dorsal surface, but how these are arranged I have not been able to observe. The pedicels are very large, measuring in length about 14 mm.; the posterior pairs are much smaller. The integument is thin and destitute of papillæ; the calcareous deposits in the form of a C (Pl. XXXII. fig. 14) are numerous, varying in length from 0·056 mm. to 0·1 mm.; the straight spinose spicula are very thinly scattered, and about 0·57 mm. in length. The pedicels and tentacles contain C-curved bodies, as well as larger or smaller more or less arcuated spicula (Pl. XXXII. fig. 15) which are beset with spines towards the ends. Only a single polian vesicle is to be observed. The cloaca is very large, with a cæcal prolongation. The madreporic canal seems to be without deposits. The reproductive organ consists of a single, 15 to 20 mm. long, fascicle of numerous small cæca.

This species bears a strong resemblance to *Scotoplanes mollis* and *Scotoplanes papillosa*, but it differs from these especially by the number and size of the pedicels, as well as by the large end of the tentacles, which greatly exceeds in dimensions the largest known of these two species mentioned.

Scotoplanes robusta, n. sp. (Pl. VI.).

Body elongated, widest a little in front of its middle, about twice and a half as long as broad. Mouth anterior, subventral. Anus posterior, dorsal. Tentacles of almost equal size; their large, thick, and sole-like terminal part contracted, only two processes being visible in its outer margin. Pedicels, eleven along each side of the posterior half of the

ventral surface; the anterior part of that surface destitute of pedicels. The dorsal surface with three pairs of processes anteriorly; two larger, close-set, arranged in a transverse row, and the third pair small, placed a little behind those. Integument thin, with two sorts of calcareous deposits: large bodies composed of three long, straight spinose arms; and smaller ones, in the form of a C.

Colour in alcohol, light violet. Length, about 133 mm. Breadth, about 53 mm.

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. One specimen.

The dorsal surface is extremely convex. The ventral surface is almost flat or slightly convex, and its anterior half is totally destitute of pedicels. The posterior pairs of pedicels are comparatively small. Four of the dorsal processes, being of a comparatively large size, are arranged in a transverse, slightly arcuated row between the two ambulacra, and situated 30 to 40 mm. behind the anterior extremity of the body; united together at their large base, they give the impression of running out from a low ridge; those in the middle are largest, measuring in length about 10 mm. The third pair of processes is placed a little behind the former ones, one on each ambulacrum. The calcareous deposits (Pl. XXXIV. fig. 6) are rather scattered in the integument, in consequence of which this becomes rather soft and pliable. The C-shaped bodies, measuring in length about 0·1 mm., are more crowded together than the three-armed ones, which are comparatively larger, each arm having a length of about 0·24 mm. The arms being more or less spinose and bearing in the middle some small spinose, outwardly directed processes, run out from a central point, thus forming with one another angles of equal size. The tentacles and processes (Pl. XXXIV. fig. 7) bear besides those C-curved deposits, straight or arcuated, branched or unbranched spinose spicula. The five pieces (Pl. XXXVII. fig. 9) constituting the calcareous ring, are separated from one another, and consist of eight rods, which, having their ends more or less branched, diverge from a common centre. The polian vesicle measures in length about 15 to 20 mm. The madreporic-canal opens exteriorly about 20 mm. behind the crown of the tentacles—that is to say, on the back almost in the middle between the tentacles and the transverse row of processes; its wall contains only a few C-shaped bodies. The alimentary canal is very thick and connected to the body-wall by elastic bands and threads; the cloaca fills up the whole posterior peritoneal cavity. The reproductive organ consists of a single considerable wide tube, narrowing anteriorly into an efferent duct, which opens at the top of a small papilla, situated immediately behind the pore of the madreporic canal. The tube bears numerous bundles of cæca, and its length is about three-fourths of the body.

Scotoplanes insignis, n. sp. (Pl. VII. figs. 1–3).

Body elongated, of almost equal breadth, about twice and a half as long as broad, considerably depressed posteriorly; its posterior flat end deeply incised in its middle.

Mouth anterior, ventral. Anus posterior, dorsal. Tentacles of almost equal size, some of the ventral ones a little smaller; their terminal part large, brown, contracted. The dorsal surface with three small processes in a transverse row anteriorly, and a little behind those are two other ones, smaller, placed one on each ambulacrum. Pedicels, eleven along each side of the ventral surface. Integument thin, soft, transparent; calcareous deposits of two sorts: large three-armed spinose bodies; and small ones, in the form of a C.

Colour in alcohol, white. Length, about 50 to 60 mm. Breadth, about 24 mm.

Habitat.—Station 156. February 26, 1874. Lat. 62° 26′ S., long. 95° 44′ E. Depth, 1975 fathoms; diatom ooze. One specimen.

The only specimen I have had at my disposal is, as the figures show, considerably contracted, wherefore the form of the body evidently must have been different in the living state of the animal. The dorsal surface is extremely convex anteriorly, and posteriorly approaches gradually to the ventral, almost flat surface, so that the hindmost part of the body becomes strongly depressed. The greatest height of the body is immediately behind the crown of tentacles. For the rest, the body is of almost equal breadth, rounded anteriorly, but having its posterior extremity truncated and deeply incised in the middle. The species evidently bears a certain resemblance to *Elpidia willemoësi* as regards the external form of the body. The mouth is completely ventral, but there is no doubt that its position must change when the body is extended to its natural form. The anus is large and dorsal in aspect, situated immediately behind the above-mentioned incision. The six anterior pairs of pedicels on each side of the ventral surface are distinctly separated from each other, the first being situated at some distance behind the crown of tentacles. The others, which are directed backwards and closely crowded side by side, are webbed together by an extension of the integument, only their tops being free; these five united pedicels form a thin fin-like lobe on each side of the above-mentioned incision. In fact, the arrangement of the pedicels resembles considerably that of *Elpidia willemoësi*.

In consequence of the strong convexity, which is probably derived from the contraction, to which I have alluded above, the foremost part of the dorsal surface is turned downwards, and this very part bears the five small processes, of which three are situated in a transverse row a little before or rather below the other two. The ends of the tentacles are large, of a brownish colour, and so strongly contracted that no processes are visible; only on the outer margin is it possible to observe traces of two such. The calcareous deposits (Pl. XXXIII. fig. 7) resemble most strikingly those of *Scotoplanes robusta*. The three-armed bodies consist, as in that species, of three straight, spinose, long arms, measuring about 0·2 mm. in length, which run out from a common centre, and form with each other three angles of equal size; those deposits are very thinly scattered in the integument, while the more or less strongly C-shaped ones are much

more numerous, but measuring in length only about 0·12 mm. The ends of the pedicels and tentacles have a number of straight or slightly curved, more or less spinose spicula.

Tabular View of Species of the Genus Scotoplanes.

I. Pedicels all along each side of the ventral surface.
  A. Body elongated, posteriorly extremely depressed with the flat truncated posterior end deeply incised in its middle. Calcareous deposits: C-shaped spicula and three-armed bodies, ... *Scotoplanes insignis.*
  B. Body more or less elongatedly ovate or almost globular. Calcareous deposits: C-shaped spicula, and large, straight, unbranched ones.
    a. Perisoma brittle and glassy, ... *Scotoplanes murrayi.*
    b. Perisoma thin, soft, and pliable.
      1. Pedicels seven along each side of the ventral surface. Dorsal surface, with three pairs of processes, the two first pairs being very large and elongatedly conical, ... *Scotoplanes globosa.*
      2. Pedicels six along each side of the dorsal surface. Dorsal surface, with two very large elongatedly conical processes side by side near its middle, and with two smaller ones issuing one from the outer side of each of the former, ... *Scotoplanes mollis.*
      3. Pedicels eight along each side of the ventral surface. Dorsal surface, with a low transverse ridge near the middle, bearing four very small processes, and with two rudimentary processes behind this ridge, . *Scotoplanes papillosa.*
      4. Pedicels ten or eleven along each side of the ventral surface. Dorsal surface, with some small processes anteriorly, . . *Scotoplanes albida.*
II. Pedicels only around the posterior half of the ventral surface. Calcareous deposits: C-shaped spicula and three-armed bodies, ... *Scotoplanes robusta.*

Irpa, Danielssen and Koren.

Irpa, Dan. and Kor., Nyt Magazin for Naturvidenskaberne, xxiv. 3, 1877.

Irpa abyssicola, Danielssen and Koren.

Body elongated, nearly cylindrical, about thrice and a half as long as broad. Mouth anterior, almost terminal. Anus posterior, terminal subdorsal. Tentacles of almost equal size; their terminal part, with small digitate processes. Pedicels cylindrical, twelve along each side of the ventral surface. The dorsal surface, only in its anterior third, with two anteriorly diverging rows of processes, four in each, and with two slightly larger processes between the two rows. Integument leathery, with two sorts of calcareous deposits: scattered small, straight or curved horseshoe-shaped spinose spicula, rarely provided with some branches; and numerous very small elliptical bodies.

Length, about 21 mm. Breadth, about 6 mm.

Habitat.—Station 35. Lat. 63° 22′ N., long. 1° 20′ W. Depth, 1050 fathoms; bottom temperature, 1·3° C.; grey-brown mud. One specimen dredged by the Norwegian North Atlantic Expedition.

Kolga, Danielssen and Koren.

Kolga, Dan. and Kor., Nyt Magazin for Naturvidenskaberne, xxv. 2, 1879.

Kolga hyalina, Danielssen and Koren.

Body elongatedly oval, thrice to thrice and a half as long as broad. Mouth anterior, ventral. Anus posterior, dorsal. Tentacles of almost equal size; their terminal part with small digitate processes. Pedicels large, seven to nine along each side of the ventral surface. The foremost part of the dorsal surface, with six small processes close-set in a row on a low, slightly curved transverse ridge; the two middle ones a little larger. Integument very thin and transparent, with several sorts of calcareous deposits: minute unbranched, more or less spinose and irregularly curved, often horseshoe-shaped spicula; larger ones more or less curved, spinose, and not very seldom with longer and shorter branches; bodies having the form of network and of small rosettes.

Length, about 50 mm. Breadth, about 12 to 15 mm.

Habitat.—Station 295. Lat. 71° 59′ N., long. 11° 40′ E. Depth, 1110 fathoms; bottom temperature, 1·3° C. Biloculina mud. Station 303. Lat. 75° 12′ N., long. 3° 2′ E. Depth, 1200 fathoms; bottom temperature, 1·6° C.; brown mud.

This form differs, however, in several other characters of more or less importance from the preceding one, as, for instance, in the construction of the calcareous ring, &c.; but the greatest difference is in regard to the madreporic canal, which communicates with the exterior in *Kolga*, while its extremity is united with the inside of the body-wall in *Irpa*.

Kolga nana, Théel (Pl. II. figs. 3, 4).

Elpidia nana, Théel, Preliminary Report on the Holothuridæ, pp. 15, 16.

Body elongatedly ovate, from twice and a half to thrice as long as broad. Mouth anterior, terminal, slightly ventral. Anus posterior, subdorsal. Tentacles of equal size; their terminal part bearing several small, digitate, retractile processes. Pedicels eight or nine along each side of the ventral surface. The dorsal surface with three pairs of small processes anteriorly, close-set in two rows, converging forwards. Integument thin and transparent, with two sorts of calcareous deposits: numerous minute, unbranched, more or less irregularly curved, frequently horseshoe-shaped spicula, provided with some small spines; and very few bodies in the form of a network.

Colour in alcohol, light grey or white. Length, about 16 mm. Breadth, about 5 mm.

Habitat.—Station 50. May 21, 1873. Lat. 42° 8′ N., long. 63° 39′ W. Depth, 1250 fathoms; bottom temperature, 2·8°; grey ooze. Several specimens.

Station 152. February 11, 1874. Lat. 60° 52′ S., long. 80° 20′ E. Depth, 1260 fathoms; diatom ooze. One incomplete individual.

The above specific characteristics chiefly refer to the individuals from Station 50 ; the only specimen obtained from Station 150, which I have had at my disposal, was most incomplete; it differs in some ways from those of the first-mentioned station, and will, when compared with individuals in a more complete state, possibly prove to belong to another species differing from this one. The want of necessary materials, and the strong general resemblance it bears to this species, induce me to leave it here provisionally ; but I intend, after having first given a more detailed account of the typical form, to point out by what this one is distinguished. A short time after my Preliminary Report on the Holothuridæ of H.M.S. Challenger had been communicated to the Royal Swedish Academy of Science, and before it was printed, I received from Drs Danielssen and Koren their report upon the Echinoderms of the Norwegian North Atlantic Expedition, in which a new Holothurian, *Kolga hyalina*, is described most carefully ; this species bears a strong resemblance to *Kolga nana*, described by me, and at first I considered the two forms to be identical. From want of material I have not had the opportunity of making comparisons,and, as several differences exist, I have preferred to keep *Kolga nana* in the meantime as a separate species.

All the specimens which have been brought home by the Challenger expedition are more or less injured, the most of them being torn in pieces, consequently they are neither suitable for determining the outer form, nor for rendering an examination of the inner organs possible. The body is elongated, ovate, and reaches its greatest breadth at the middle or a little behind it ; its posterior extremity is evenly rounded, while the anterior one is almost truncated ; the mouth and tentacles are terminal, indistinctly bent towards the almost flat ventral surface. The dorsal surface is not very strongly convex, the breadth of the body being always greater than the height. The ends of the tentacles are divided by some small incisions round the edge into four or five small processes or lobes, each carrying some smaller retractile branches ; in most cases, the terminal part being retracted, only one or two processes are to be seen. The processes of the dorsal surface are small, decreasing in size backwards, so that the last pair is minute ; sometimes four pairs of processes are to be observed instead of three, which seems to be the ordinary number. As they are usually crowded in each row, and webbed together at the base, they appear to project from a low ridge, caused by the contraction of the animal ; some fully extended specimens seem, however, to have the processes at some distance from each other and projecting directly from the body-wall. The pedicels are eight or in most cases nine in number along each side of the ventral surface ; the posterior pairs are always considerably smaller. Among the calcareous deposits of the integument, the extremely arcuated spicula (Pl. XXXIV. fig. 5), often almost curved in the form of a ring, are especially numerous, but very small and insignificant, and slightly enlarged in their middle ; they are partly scattered, partly aggregated, and generally provided with spines. The plates, on the contrary, are perforated so as to

resemble a network, and comparatively large, about 0·14 mm. in diameter; they are very scattered, and consequently difficult to detect; every here and there in the integument of the body some larger, straight and more spinose spicula are to be observed. The processes, the pedicels, and the tentacles contain a number of smooth, spinose, rather large, more or less fusiform, or slightly curved spicula.

According to my observations, each of the five pieces of the calcareous ring consists of a central part, from which issue in opposite directions ten rods, five towards each side; their terminal part is flattened and expanded. From want of material I have not been able to give any figure of the ring. The polian vesicle seems to be inconsiderable. The madreporic canal appears to be destitute of deposits and opens externally a little in front of the dorsal processes. The posterior part of the alimentary canal dilates into a large cloaca, which runs out from the left side into a considerable prolongation, directed forwards. In regard to the number of the ambulacral canals of the water-vascular system, which I have found to be five in all forms of the order Elasipoda, but which Danielssen and Koren state in the species *Kolga hyalina* to be only two, I refer to the anatomical part of my report. All along each side of the ventral surface are to be seen some small globular vesicles attached to the nerve-cords; these measure about 0·14 mm. in diameter and are disposed one at each nerve-branch which is given off to the pedicels, two a little before the first pair of pedicels, and two between the first and the second pair of pedicels. Several such auditory vesicles are doubtless to be found on the nerve-ring, though from want of material they have escaped me; as in *Elpidia glacialis* and several other species, their position seems to vary a little. They are lined internally by a layer of large cells, and contain up to twenty minute, oblong otoliths (Pl. XXXVI. fig. 25), measuring about 0·028 mm. in length, their wider end being rounded and the opposite one truncated. The reproductive organ consists of a fascicle composed of two bundles of small cæca; the organ opens immediately behind the pore of the madreporic canal.

When comparing the above-described species and that of Danielssen and Koren with one another, one finds that the latter is distinguished by the following characters:—The processes of the dorsal surface, six in number, project from a continuous, transverse, slightly curved ridge; the mouth is ventral and the number of pedicels varies from fourteen to eighteen; besides smaller and larger, unbranched and arcuated spicula, resembling those of *Kolga nana*, there are also to be discovered rather large and branched ones, and, though exclusively in the oral disk, some small rosette-shaped bodies together with some net-like perforated plates; each of the five pieces constituting the calcareous ring gives off fourteen rods, seven towards each opposite side, four of which are always longitudinally split; the auditory vesicles are twenty-six in number, and the otoliths of each auditory vesicle vary from about twenty to one hundred and thirty.

I shall now give an account of the characters which distinguish the individual dredged at Station 152 from the typical *Kolga nana*. The form of the body of this animal, as well as the position of the mouth, agree in most part with those of *Elpidia glacialis*. The length is about 28 mm. and the breadth about 14 mm. The pedicels are nine along each side of the ventral surface. From the incomplete state in which this individual was found, it is not possible to give a more detailed description of the dorsal processes; they seem, however, to be very insignificant, four in number, and evidently arranged in a transverse row, those in the middle being largest. The calcareous deposits (Pl. XXXIII. figs. 1, 2) of the integument consist exclusively of numerous, minute spicula provided with some small spines and with an enlargement in the middle; they are either almost straight, or extremely arcuated, horseshoe-shaped, or curved so as to form an angle. The perisoma seems to be destitute of net-like perforated plates, but, as they are much scattered in the typical form, they may have possibly escaped my observation.

The typical form is found in the North Atlantic Ocean near Halifax, while the other lives not very far from the Antarctic circle; whether these two forms prove to belong to the same species, or, though very closely allied, are distinct, the great distance of those localities are always interesting. This is not the only example among the Holothurids from the great depths of the sea, where representatives of the same species or at least of the most nearly allied forms are found in or near the Arctic Sea and also in the neighbourhood of the Antarctic Ocean.

Peniagone,[1] n. gen.

Body more or less elongated, sometimes depressed posteriorly or with a narrow neck-like part anteriorly. Tentacles ten. The dorsal surface with a larger or smaller, branched or unbranched lobe-like appendage anteriorly, and commonly with some more or less minute processes. The ventral surface with pedicels all along each side, or only round its posterior half or third. Integument with several sorts of calcareous deposits: four-armed bodies with one to four processes; and three-armed ones together with branched or unbranched spicula and small bodies curved in the form of a C.

Peniagone wyvillii, n. sp. (Pl. X. figs. 3, 4).

Body slightly depressed, about twice as long as broad, broadest in its anterior part. Mouth anterior, ventral. Anus posterior, terminal. The terminal part of the tentacles large, provided with small, branched, retractile processes. Pedicels about eight (?) along each side of the ventral surface; the anterior part of the ventral surface destitute of

[1] Πενία = poverty.

pedicels. The dorsal surface with an extension of the skin anteriorly constituting a large, very broad, transverse lobe, bearing four rather large branches or processes in its upper margin; and having immediately behind that lobe two small, rudimentary processes on each ambulacrum. Integument very thin and transparent, with calcareous deposits, composed of a long, thin central part and two slightly arcuated arms, diverging from each of its ends; each arm with a large process, directed outwards.

Colour in alcohol, light grey, inclining to violet, here and there a little darker; tentacles, the oral disk and the nerve cords almost black violet. Length, about 60 or 70 mm. Breadth, about 35 mm.

Habitat.—Station 271. September 6, 1875. Lat. 0° 33′ S., long. 151° 34′ W. Depth, 2425 fathoms; bottom temperature, 1·0° C.; globigerina ooze. One very incomplete specimen.

The only individual of this species, which has been obtained by the Challenger expedition, is extremely incomplete; it wants some of the pedicels, parts of the body-wall, the madreporic-canal, and the water-vascular ring; consequently my description must be very unsatisfactory. To give an idea of the form of this species, it has been necessary to draw the figures in accordance with my opinion of its probable appearance, hence it is possible that I may have made some mistakes. Only five rather large pedicels are left along each side of the body-wall, and two extremely minute ones at the posterior end of the body; the rest are torn off, and eight, the number mentioned above, may be wrong. All the tentacles (Pl. XLIV. fig. 5) are broken, except a single one, which has the terminal part beset with a number of small rather branched, and retractile processes, two of which are largest; those processes are provided with a number of retractile, branched or unbranched, cylindrical papillæ (Pl. XLIV. fig. 7) the extremely thin walls of which seem to be destitute of deposits. The large, and broad four-branched appendage on the anterior part of the back is made up of four large and long processes, which are arranged in a transverse row, and are webbed together by an extension of the integument leaving only their upper half free. These free ends, of which the two middle ones are largest, appear to be of an elongated conical form though rather flattened. These processes are in connection with large, elongated ambulacral cavities, of which those communicating with the largest middle processes are situated a little in front of the other ones. The appendage is very flexible and seems capable of being directed upwards, as well as of being bent downwards and forwards, thus covering the tentacles. The thin and transparent integument is covered with small papillæ, each containing a calcareous deposit of the above-mentioned shape. The four processes, running out one from each arm, are situated close to the elongated central part of the deposits. As the calcareous deposits are mostly dissolved and only the surrounding membranes are left, it is impossible to decide whether the arms and the processes are spinose or not.

The madreporic canal communicates with the exterior by a pore, situated a little above the crown of tentacles; it is invested by a thick sheath of connective tissue, which increases gradually towards the body-wall. The individual which has been at my disposal has lost the reproductive organ, except the efferent duct, which is surrounded by the same sheath which encloses the madreporic canal. This common efferent duct (Pl. XXXVII. fig. 6) is very remarkable from its dividing into two short and wide canals, which diverge towards the body-wall, where each divides into about eight divergent long and very narrow canals; those canals make some coils in the layer of connective tissue of the body-wall before they reach the apertures by which they open externally and which are placed far apart. Those secondary canals, carrying sometimes one or two branches, diverge greatly from each other, and some of them extend beyond the two dorsal ambulacra, consequently several of their openings lie in the lateral interambulacra.

Peniagone lugubris, n. sp. (Pl. X. fig. 1).

Body elongated, three or four times as long as broad. Mouth anterior, ventral. Anus posterior, subdorsal. The terminal part of the tentacles large, provided with small retractile processes. Pedicels about five along each side of the ventral surface; the anterior third of the ventral surface destitute of pedicels. The dorsal surface with an extension of the skin anteriorly constituting a very large, broad, transverse lobe, bearing four rather small processes on its upper margin. Integument rather hard, with a great number of crowded calcareous deposits, composed of a slightly elongated central part, and two arcuated arms, diverging from each of its ends; each arm with a large process, directed outwards.

Colour in alcohol, black-violet; the ends of the tentacles almost black. Length, about 70 or 75 mm. Breadth, about 15 or 20 mm.

Habitat.—Station 104. August 23, 1873. Lat. 2° 25′ N., long. 20° 1′ W. Depth, 2500 fathoms; bottom temperature, 1·7° C.; grey ooze. One incomplete specimen.

The dorsal surface is convex, the ventral, on the contrary, almost flat. Anteriorly, above the tentacles, where the body attains its greatest height, the dorsal surface is provided with a very large, comparatively flat appendage, which measures in length about 40 mm. The free end of this appendage is broad and slightly rounded, and its base seems to be considerably broader than the body itself. This lobe, which has a transverse position, crossing from one side of the body to the other, divides the dorsal surface into a more or less horizontal, posterior part, and an anterior almost vertical part. The appendage carrying four small, obtuse projections or processes on its upper rounded margin, is traversed by four long and very wide canals tapering upwards, and each of them entering one of the above-mentioned projections. As those canals are visible to the naked eye through the walls of the lobe, the whole dorsal appendage gives the

impression of being constituted by four long, conical processes, webbed together by an extension of the skin. The lobe seems to possess a high degree of flexibility, and doubtless it can be thrown upwards and backwards as well as turned over the mouth and the tentacles. The skin of this specimen being very contracted and wrinkled, it is not possible to decide with certainty whether or not the dorsal surface is provided with some other minute processes. The mouth is perfectly ventral and surrounded by ten tentacles, of which only a few are left; they seem mostly to resemble those of *Peniagone wyvillii*. The pedicels appear to be five or six in number on each side, of which as usual the anterior ones are slightly larger and further apart from each other than the posterior ones. The calcareous deposits have the aspect of being very closely crowded together within the integument, and bear a strong resemblance to those of the above-mentioned species; their arms, measuring in length from 0·06 to 0·08 mm., are slightly curved and, as is the case with the four processes, minutely spinose.

The characters which distinguish this species from the preceding one are the following:—The almost black colour, the large rounded dorsal appendage, the more cylindrical form of the body, the number of pedicels, and lastly the abundance of calcareous deposits.

Peniagone horrifer, n. sp. (Pl. X. fig. 2).

Body elongated, about thrice as long as broad. Mouth anterior, ventral. Anus posterior, terminal; tentacles very long, their large terminal part with small, branched, retractile processes. Pedicels about eight along each side of the ventral surface; the anterior half of the ventral surface destitute of pedicels. The dorsal surface having an extension of the skin anteriorly, constituting a very large, flattened, almost triangular lobe, with its base in the direction of the medio-dorsal line, and with four rather large, flat, obtuse projections along the right side of its upper or rather posterior dilated concave margin; and bearing near the base of that lobe some other small papilla-like processes. Integument thin, with a great number of crowded calcareous deposits, composed of four arcuated, slightly spinose arms, diverging from the ends of a more or less elongated central part, and two to four rather long, straight spinose processes, directed outwards.

Colour in alcohol, light violet. Length about 85 to 90 mm. Breadth about 30 to 35 mm.

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. One very incomplete specimen.

It is a great pity that I have had the opportunity of examining only a single individual of this very interesting species, and that this like the preceding forms has changed so considerably during the preservation in spirit, that it has been almost impossible to form any correct idea of its true aspect. The dorsal surface is strongly convex, the ventral surface being on the contrary flat. The large characteristic appendage of the

dorsal surface has a more or less marked triangular shape, and is compressed from the sides as to form a more or less flattened lobe; its broad base is in the direction of the medio-dorsal line of the body, while the contrary takes place in *Peniagone lugubris* and *Peniagone wyvillii*. A glance at the figure will give an idea of its form and position, as I have thought them to be. The anterior side of the lobe is more or less curved, and almost vertical, and passes immediately into the anterior downwardly directed part of the dorsal surface. Its posterior side, on the contrary, which inclines obliquely downwards and backwards, is significantly dilated and considerably depressed along its middle so as to form two margins, of which the right one sends out four flat, obtuse projections, the uppermost of these forms the top of the lobe. The height of the appendage is about 35 mm. Posteriorly, almost at the base of the lobe are to be observed one or several very small processes, the correct number of which it is difficult to determine. The tentacles, of which but few remain, seem to be almost equally large; when extended, they are very long, measuring about 22 mm. Their large terminal part recalls the preceding species by having, especially round the edge, some branched retractile processes, of which two on the outer margin are largest. The inner side of the processes, as well as a great part of the ends of the tentacles, carry a number of small, retractile, papilla-like projections. Only the posterior half of the ventral surface is provided with eight or nine pairs of pedicels, the posterior ones attaining a comparatively inconsiderable size. The calcareous deposits (Pl. XXXIII. fig. 9), which are visible in great abundance within the perisoma, seem to resemble in form those of *Peniagone lugubris*, though varying generally more than those in shape as well as in size. The largest deposits have the arms measuring about 0·1 mm. in length and often considerably arcuated; sometimes the arms seem to exceed four in number. The processes are generally very long, and vary between two and four; in the former case the deposits seem to be slightly smaller, and their processes issue from the ends of their more or less elongated central part; in the latter case one process proceeds from each of the four arms, near their attachment to the central part. The ends of the pedicels as well as of the tentacles contain partly simple or branched more or less arcuated spicula, partly four-armed deposits without processes, and with the arms often unequal and more or less irregularly curved (Pl. XXXIII. fig. 8). It has been impossible to subject the calcareous ring to a closer examination, but, judging from what I have seen, it does not differ in any striking manner from the ordinary form in this family. Two polian vesicles, measuring from 10 to 15 mm. are present. The reproductive organ consists of a number of large, thick bundles of cæca, which open into two particularly wide tubes, which communicate with a single, very wide efferent duct narrowing anteriorly. The alimentary canal is retained in its proper position by elastic bands or threads; a mesenteric membrane only occurs anteriorly, uniting the foremost part of the alimentary canal and the duct of the reproductive organ with the medio-dorsal line of the body-wall.

Peniagone atrox, n. sp. (Pl. X. fig. 5).

Body elongated, about thrice as long as broad. Mouth anterior, ventral. Anus posterior, dorsal. The terminal part of the tentacles large, discoidal, with small, branched, retractile processes. Pedicels about 5 (?) along each side of the ventral surface. The anterior half of the ventral surface destitute of pedicels. The dorsal surface having an extension of the skin anteriorly, constituting a long, but not very broad, flattened, transverse lobe, with the free end rounded and the posterior surface concave. Integument with a great number of crowded calcareous deposits, composed of a slightly elongated central part, and two more or less curved arms, diverging from each of its ends; each arm with a process, directed outwards; the length of the arms and processes extremely variable.

Colour in alcohol, light grey. Length about 100 mm. Breadth about 33 mm.

Habitat.—Station 160. March 13, 1874. Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms; bottom temperature, 0·2° C.; red clay. One incomplete specimen.

The dorsal surface is extremely convex, and its odd interambulacrum is divided by a long and transverse appendage into a posterior, nearly horizontal part, and an anterior part sloping downwards. The ventral surface is more or less evidently flat. The anus is situated upon the dorsal surface. The dorsal appendage attains a length of 35 or 40 mm. and is flattened, its anterior surface being convex, the posterior one, on the contrary, almost concave; its upper part is evenly rounded without any distinguishable processes. The integument seems to form a thin, rather broad fold or brim, along the left dorsal ambulacrum, but I dare not say with certainty whether the animal really possesses it when living, or whether it has originated from an accidental contraction. Only two of the tentacles remain. The calcareous deposits (Pl. XXXIII. fig. 5) of the integument vary greatly as well in form as in size; some of them have their comparatively slender arms very long, measuring about 0·12 mm., spinose, more or less curved, and provided with a short spinose process; others resemble those, though their arms are considerably thicker, and measure only 0·04 mm. in length. Most of the deposits are very small, with their spinose arms extremely short and obtuse, measuring about 0·016 mm., and with their processes of almost the same length and form as the arms, consequently it is almost impossible to distinguish them from each other. The deposits in the ends of the pedicels as well in the tentacles resemble those of the preceding species.

Peniagone naresi, n. sp. (Pl. IX. figs. 1, 2).

Body more or less elongated. Mouth anterior, subventral. Tentacles of almost equal size; their terminal part with a number of small, retractile processes. The dorsal surface having a large extension of the skin anteriorly, constituting a high, flattened, flexible, transverse lobe with four distinct projections on its upper margin, and with two

very small ones posteriorly at its base. Integument very thin, transparent, with three sorts of calcareous deposits numerous: large and small, spinose, three-armed bodies; unbranched or irregularly branched, spinose spicula; and small spicula, curved in the form of a C.

Colour in alcohol, light violet. Breadth about 15 to 17 mm.

Habitat.—Station 158. March 7, 1874. Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fathoms; bottom temperature, 0·3 C.; globigerina ooze. One incomplete specimen.

As the posterior part of the body is torn off in this very interesting and characteristic species, it is quite impossible to determine the length of the body, the position of the anus, or the number of the pedicels. The remaining part of the body measures about 35 mm. in length. Anteriorly, where the large dorsal appendage arises, the body reaches its greatest height, and from that point the dorsal surface is almost vertically bent down towards the tentacles. The dorsal surface is extremely convex, the ventral, on the contrary, is almost flat or slightly convex, the breadth of the body seems to be almost equal throughout. The circular ends of the tentacles are large and sole-like. Only six pairs of pedicels remain, the first one arising close to the tentacles; their form is conical, strongly tapering towards the ends, which present a small sole-like enlargement. The dorsal appendage is of considerable size, measuring about 25 to 30 mm. in length, broad superiorly, and almost flat; its inferior part, on the contrary, is a little narrower, and has the posterior surface grooved in the form of a gutter. Of the four projections in the upper free margin of the lobe the two in the middle are largest. The whole lobe of this specimen is constituted, like that of the preceding species provided with such appendages, by four long processes which, communicating with the dorsal ambulacra, are webbed together by an extension of the integument, leaving only their tops free. The integument is very transparent, and the strongly pigmented ambulacra, as well as the nerve-cords and the ambulacral cavities are plainly visible through it. The form and the size of the calcareous deposits (Pl. XXXIII. fig. 15) vary greatly. The large three-armed bodies are more scattered in the integument, and have their arms straight, spinose, and measuring about 0·22 mm. The small three-armed deposits, on the contrary, are very crowded, and their arms, measuring only about 0·06 mm. in length, are provided with conspicuously large spines; the difference between these two deposits is thus striking. The arms are generally straight and, arising from a common centre, form with each other angles of almost equal size; but it is necessary to add that many exceptions are found, some arms being more or less irregularly curved, and consequently the angles being of unequal size. The spicula unbranched, or sometimes which are provided with one or several branches, are very scattered and strongly spinose. The small C-shaped spicula, attaining a length of about 0·068 mm., present an enlargement in the middle, the existence of which seems to be common to all deposits of this kind. Their

degree of curvature is rather variable; sometimes, though rarely, an arcuated arm projects from the middle of the convex side, sometimes its C-shape is changed into the form of an S.

Peniagone challengeri, n. sp. (Pl. IX. figs. 6–8).

Body elongated, of almost equal breadth throughout, about five times as long as broad, depressed posteriorly; its posterior flat extremity with an incision in its middle. Mouth anterior, ventral. Anus posterior, dorsal. Tentacles of almost equal size; their discoidal, terminal part with small retractile processes. Pedicels eight or nine along each side of the ventral surface; the anterior half of that surface destitute of pedicels. The dorsal surface having anteriorly an extension of the skin, constituting a long, broad, flattened, obliquely transverse lobe, with two rather considerable projections in its upper margin. Integument rather hard and rough, with numerous, crowded calcareous deposits, composed of a slightly elongated central part, and two more or less curved spinose arms diverging from each of its ends; each arm with a spinose process, directed outwards; the length of the arms and processes extremely variable.

Colour in alcohol, light grey, inclining to violet. Length, about 65 mm. Breadth about 13 mm.

Habitat.—Station 158. March 7, 1874. Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fathoms; bottom temperature, 0·3° C.; globigerina ooze. Two specimens.

As the above dimensions indicate, the body, being of equal breadth throughout, seems very narrow in comparison to its length. It attains its greatest height a little behind the tentacles and immediately in front of the large appendage, which divides the dorsal surface into a posterior part, which is slightly convex and gradually approaches the ventral surface posteriorly, and into an anterior, extremely convex part. The large anus is situated on the dorsal surface a little in front of the incision. The dorsal appendage, measuring about 22 mm. in length and about 12 mm. in breadth at the base, crosses obliquely from one side of the dorsal surface to the other, so that while the base at the right side is found at a distance of about 20 mm. from the anterior extremity of the body, this distance at the left side, on the contrary, amounts only to about 11 mm. The upper edge of the lobe is deeply emarginated so as to form two rather slender processes, 8 to 10 mm. long, the right one being a little the larger. The tentacles, of which four are torn off, appear to be of almost equal size; their terminal part is large and discoidal, and of the small retractile processes the two on the outer edge have the appearance of being the largest. The five anterior pairs of pedicels are large in comparison to the posterior ones and separated from each other at certain distances; the seven remaining pedicels, which run out from the flat, truncated posterior end of the body are small and directed backwards, very closely crowded, and disposed four on the right side of the above-mentioned incision, and three on the left. The calcareous deposits (Pl. XXXIII. fig. 16) vary

greatly in size. The arms of the largest scattered ones measure about 0·12 mm.; the small ones, on the contrary, are considerably more numerous, and have the arms about 0·036 mm. in length. There are many forms between those two extremes. In the small deposits, the processes run out from the very base of the arms, whereby those calcareous bodies have the appearance of consisting of four arms diverging from each end of the more or less elongated central part. Here and there some very small bodies have been found destitute of spines and processes.

Peniagone vitrea, n. sp. (Pl. VII. figs. 7–9).

Body elongated, of almost equal breadth throughout, about thrice as long as broad; its foremost neck-like part narrow and bent downwards, forming almost an acute angle with the ventral surface. Mouth anterior, directed downwards. Anus posterior, dorsal. Tentacles of almost equal size; their terminal part with small, retractile processes. Pedicels eight pairs, disposed round the posterior third of the ventral surface; the anterior two-thirds of that surface destitute of pedicels. The dorsal surface with a broad, not very high, flat, transverse lobe anteriorly, with four projections in its upper margin, the middle ones being considerably the larger; behind that lobe are two very small processes on each ambulacrum. Integument extremely hard, brittle, and very rough, with numerous calcareous deposits, composed of four long, more or less curved, slightly spinose arms, and one to four straight, spinose, rather long processes, directed outwards.

Colour in alcohol, white and glassy. Length, about 60 mm. Breadth, about 20 mm.

Habitat.—Station 302. December 28, 1875. Lat. 42° 43′ S., long. 82° 11′ W. Depth, 1450 fathoms; bottom temperature, 1·5° C.; globigerina ooze. Several specimens.

The shape of the body seems to be very peculiar, and at first sight one is almost tempted to consider the dorsal surface to be the under side of the body and contrariwise. It is possible that the individuals of this species may in their living state differ in shape from that described above, but of course one cannot be quite sure of their true aspect from the examination of specimens much deformed by preservation in spirit. That which seems most doubtful is whether the narrow neck-like part of the body is really bent downwards as much as my figures show. Anyhow, I am obliged to take the above description of the form of the body for granted, especially as it accords with the figures which were drawn from fresh materials during the voyage of H.M.S. Challenger. The breadth of the body, almost equal to the height, has the appearance of being equal or slightly greater anteriorly. The broad dorsal appendage divides the odd interambulacrum into two parts: a posterior, almost horizontal and slightly convex one, which extends almost the whole length of the animal; and an anterior shorter and curved one, which is turned downwards and slightly backwards so as to form an almost obvious angle with the former one. Both of the interambulacra of the ventral surface may

also be divided into a posterior rather convex portion and an anterior shorter, narrower one, which makes an acute angle with the former. The neck-like part, measuring from 8 to 10 mm., is several times narrower than the rest of the body, and extends considerably below the ventral surface. On account of that neck-portion being bent downwards and backwards, the anterior and posterior contours of the body form almost a semicircle. The posterior third of the ventral surface is extremely convex, and approaches the upper surface. If the neck-like part of the animal, when living, is really as strongly bent downwards as I have thought, the mouth, being situated at its extremity, must also be directed downwards. If, however, the bend of the neck-like part depends only upon an accidental contraction, so that the neck in its normal condition is extended forwards, then the mouth will attain a terminal position in the anteriorly narrowing extremity of the body. The tentacles (Pl. XLIV. fig. 10) are cylindrical, equally large, measuring from 5 to 7 mm. in length; their terminal part is not remarkably enlarged, and is provided with retractile processes round the edge. The pedicels are sixteen in number, but are only found on the posterior third of the ventral surface, where that is more obviously convex; the foremost pairs are cylindrical in form, and are of almost the same size as the tentacles; they thus exceed the posterior ones greatly in size, and are evidently situated nearer the medio-ventral line. The transverse dorsal appendage does not reach a greater height; its breadth on the contrary is considerable, approaching that of the body. It seems to be produced by four processes, disposed in a transverse row, which are webbed together by an extension of the skin, leaving only their tops free; the two middle processes are considerably larger than the others. Behind that lobe the dorsal surface carries two pairs of extremely minute, almost invisible, processes. The glassy body-wall is transparent and very hard and brittle, by reason of which the pedicels and processes fall off on being slightly touched. The calcareous deposits (Pl. XXXIV. fig. 17) are very numerous and close-set; their four arms, attaining the length of about 0·16 mm. or sometimes more, and having the aspect of being minutely spinose, are sometimes almost straight and directed towards the inside of the body, sometimes on the contrary extremely arcuated, especially at the ends. The processes are straight, finely spinose, and very long, their number varying from two to four; now and then only a single process is to be observed. It seems as if a small pyramidal papilla encloses each deposit. The oral disk contains deposits (Pl. XXXIV. fig. 18) of more or less irregular shape, their arms being almost straight or slightly curved; besides these are found some more or less straight, long spicula, which are either simple or irregularly branched. The ends of the tentacles contain unbranched spicula, and irregular three- or four-armed bodies with or without processes. The ends of the pedicels are provided with only a few unbranched spicula.

The five separated pieces of the calcareous ring bear a great resemblance to those of

Elpidia willemoësi, but their number of rods amounts only to sixteen, eight towards each opposite side. Two small ventral polian vesicles are found, they are of a sack-shaped form, and measure about 5 mm. in length. The madreporic canal, which seems to be destitute of deposits, pierces the dorsal perisoma and opens externally; that part of it which penetrates the body-wall is extremely fine. It is possible that traces of calcareous deposits may be found where the canal enters the integument, though I have not been able to detect them. In the individuals, examined by me, the alimentary canal forms a small convolution posteriorly, and it does not seem impossible that, when the body is extended to its full length, this may vanish so that the digestive tract may have an almost straight antero-posterior course. The cloaca is inconsiderable. All along both of the lateral nerve-cords are to be observed a number of auditory vesicles, containing a varying number of otoliths. The reproductive organ consists of two minute, thick fascicles of small cæca of the usual shape; the common efferent duct divides, when piercing the body-wall, into two narrow canals, which diverging towards each opposite side within the perisoma, reach the dorsal ambulacra, where they communicate with the exterior, each by a pore.

Peniagone affinis, n. sp. (Pl. VIII. figs. 4, 5).

Body elongated, of almost equal breadth throughout, three or four times as long as broad, depressed posteriorly. Mouth anterior, ventral. Anus posterior, subdorsal. Tentacles of almost equal size; two ventral ones a little smaller than the others; their discoidal, terminal part with small, retractile processes. Pedicels about eleven all along each side of the ventral surface. The dorsal surface with a broad, not very high, flat, transverse lobe anteriorly with four projections on its upper margin, the middle ones being considerably larger; behind that lobe are two very small processes on each ambulacrum. Integument rather thin and rough, with numerous crowded calcareous deposits, composed of four more or less arcuated, slightly spinose, arms, and one to four straight spinose processes, directed outwards; the length of the arms and processes extremely variable.

Colour in alcohol, light grey, glassy. Length, about 100 mm. Breadth, about 27 mm.

Habitat.—Station 147. December 30, 1873. Lat. 46° 16′ S., long. 48° 27′ E. Depth, 1600 fathoms; bottom temperature, 0·8° C.; globigerina ooze. Numerous specimens.

In spite of the great number of specimens which has been dredged from the above-mentioned locality, only a few are in a tolerably uninjured state. The size is most variable; the largest individual attains the above indicated dimensions, while the smallest has a length of only 20 to 25 mm. and a breadth of about 7 mm. The body is almost equally broad throughout or slightly widened posteriorly, its anterior and posterior ends being

evenly rounded. The height decreases gradually backwards, consequently the posterior extremity of the body has a rather flat aspect. The ventral surface is flat or slightly convex, the dorsal, on the contrary, is extremely convex, especially anteriorly. The ends of the tentacles are a little dilated, and are provided with processes of which those round the edge appear to be largest. The pedicels are arranged all along each side of the ventral surface, the first pair arising a little behind the tentacles. The first five pairs are separated from each other by certain distances and disposed along the anterior four-fifths of the body; the distance between the different pairs decreases gradually backwards. The posterior six pairs of pedicels are, on the contrary, closely crowded side by side around the posterior fifth part of the ventral surface, several of the middle ones being very small; they are webbed together by an extension of the skin, leaving only their ends free. The dorsal appendages are exactly like those of the preceding species. The broad, transverse and almost flat lobe, situated about 10 mm. behind the tentacles, reaches an unimportant height, only about 10 mm., the projections included; its two middle projections present a conical form and attain a considerable size in comparison with the other two, which are almost imperceptible. Immediately behind this lobe two very small papilla-like eminences are to be observed, one on each ambulacrum, and behind those arises another pair; sometimes both of the pairs seem to be wanting. The perisoma is glassy, thin, and transparent, that of the ventral surface possessing a higher degree of pliability and less roughness than that of the dorsal, which to the naked eye appears to be closely covered with minute spines. There exists a remarkable difference between the calcareous deposits of the upper and under surfaces of the body; those in the dorsal perisoma (Pl. XXXIV. fig. 13), are very closely crowded, and consist of four strongly arcuated and finely spinose arms, directed inwards and measuring about 0·28 mm. in length or more, and of one, two, or three straight, slightly spinose processes, which being directed outwards, cause the great roughness of the integument. The arms either run out from a common central point or from the ends of a more or less elongated, rod-like central part. These calcareous deposits bear the strongest resemblance to those of *Peniagone vitrea*. The deposits of the ventral perisoma (Pl. XXXIV. fig. 12) are slightly smaller and more thinly scattered, and resemble the former ones, but differ by having their arms not so obviously curved and only measuring about 0·14 mm. in length or less, each arm carrying close to the elongated central part a short spinose process. The deposits of the oral disk resemble those of the preceding species. The tentacles contain a number of larger or smaller, often strongly arcuated, spicula, with the ends more or less spinose, and among those are to be found three- or four-armed irregular bodies. The ends of the pedicels are provided with a smaller number of arcuated, unbranched spicula, mingled with some four-armed bodies without processes. The five pieces of the calcareous ring are separated from each other as is the case in the preceding species; it is possible that they might meet each other,

when the surrounding tissues are in the state of contraction. Each piece is composed of about twenty-four (?) rods, twelve radiating towards each opposite side. Only a single polian vesicle is present. The madreporic canal opens externally by a pore, near the orifice of the reproductive organ. A great number of auditory vesicles is found along both of the lateral nerve-cords of the ventral surface; the number of otoliths varies from one to a multitude. The digestive tract makes a small convolution. The cloaca is not very important. The reproductive organ consists of two fascicles, each composed of a comparatively wide tube, into which opens a number of bundles of very small cæca; the organ of the largest individual reaches the length of 15 to 20 mm.

When comparing *Peniagone vitrea* and the above described species, one finds several striking points of resemblance; the position and aspect of the appendages of the dorsal surface, as well as the roughness of the integument and the shape of the calcareous bodies, have a great deal of similarity. They differ, on the contrary, much from each other in several extremely obvious characters. First we have to observe the form of the body, which is more depressed in *Peniagone affinis*, and wants the narrow, downwardly directed neck-like part; besides, the pedicels of this species are arranged all along the sides of the ventral surface, not only around its posterior part, and the five or six posterior pairs are webbed together, consequently only their ends are free, while all the pedicels of *Peniagone vitrea* are free.

Tabular View of the Species of the Genus *Peniagone*.

I. Calcareous deposits: four-armed bodies with one to four processes directed outwards.

- A. Body anteriorly with a narrow neck-like part directed downwards. Pedicels sixteen, disposed round the posterior third of the ventral surface, . . . *Peniagone vitrea.*
- B. Body destitute of a narrow neck-like part.
  - *a.* Pedicels twenty two, eleven all along each side of the ventral surface, . *Peniagone affinis.*
  - *b.* Pedicels only round the posterior half or two-thirds of the ventral surface.
    - × Body posteriorly almost flat, and with an incision in its middle. Pedicels seventeen, ... *Peniagone challengeri.*
    - × × Body posteriorly not flattened, and without incision.
      1. Dorsal appendage in direction of the medio-dorsal line. Pedicels sixteen or eighteen, ... *Peniagone horrifer.*
      2. Dorsal appendage in a transverse position, not very broad and without visible processes. Pedicels about ten, . . *Peniagone atrox.*
      3. Dorsal appendage in a transverse position, broad and with four small processes. Pedicels about ten, . . . *Peniagone lugubris.*
      4. Dorsal appendage in a transverse position, broad and with four long processes. Pedicels about sixteen, . . *Peniagone wyvillii.*

II. Calcareous deposits: three-armed bodies; branched or unbranched spicula; and small C-shaped ones, ... *Peniagone naresi.*

Scotoanassa,[1] n. gen.

Body very depressed, almost flat, with an extension of the body-wall constituting a broad rather flat brim round its anterior and posterior ends. Tentacles ten. The dorsal surface with processes only on the margin of the anterior brim. The ventral surface with pedicels only round the margin of the posterior brim. Integument with calcareous deposits, composed of four arms and four outwardly directed processes.

Scotoanassa diaphana, n. sp. (Pl. IX. figs. 3–5).

Body about thrice as long as broad. Mouth ventral, behind the anterior brim. Anus dorsal, immediately in front of the posterior brim. Tentacles of almost equal size; their terminal part with two rather long, digitiform processes and with a number of small, branched, retractile projections. Processes of the dorsal surface very small, four on the margin of the anterior brim. Pedicels of the ventral surface ten, round the margin of the posterior brim; the two middle ones very small. Integument thin and transparent; calcareous deposits slightly scattered, composed of four spinose, slightly curved arms, diverging two from each end of a long rod-like central part; each arm with a spinose process directed outwards.

Colour in alcohol, white and glassy. Length, about 50 to 55 mm. Breadth, about 18 to 20 mm.

Habitat.—Station 160. March 13, 1874. Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms; bottom temperature, 0·2 C.; red clay. One specimen.

The body is distinguished by its slight height, the dorsal and ventral surfaces possessing about the same degree of convexity. Four elongated conical canals pass through the brim round the anterior part of the body, each running out into a corresponding almost imperceptible process on the margin of the brim. By closer examination it is easy to discover that the two left hand canals communicate with the left dorsal ambulacrum and the two others with the right. The brim has the appearance of being constituted by four dorsal processes, which are intimately united with each other by an extension of the connective tissue layer of the body-wall, leaving only their tops free. The brim, which thus belongs to the dorsal surface, reaches its greatest breadth, about 8 mm., anteriorly, and decreases regularly towards each side. The posterior brim, which is thin, flat, and almost equally broad, about 7 mm., belongs for a similar reason to the ventral surface, its pedicels, which project around its margin, being in connection with long canals which penetrate the brim and communicate with the ventral lateral ambulacra. The two middle pedicels are quite unimportant and almost imperceptible. On account of this arrangement of the two brims the mouth has a more distinct ventral position, and the anus is more perfectly dorsal than is usually the case. The tentacles (Pl. XLIV. fig. 9) are rather large, and end in two long digitiform

[1] Σκότος = darkness.

processes; these as well as the rest of the terminal part of the tentacles are provided with a number of small, branched, retractile projections devoid of deposits. The calcareous deposits (Pl. XXXV. fig. 18) do not lie very close together, and vary generally in size, the largest ones having their arms measuring about 0·16 mm. and their elongated rod-like central part of about the same length. The ends of the tentacles as well as of the pedicels contain spicula.

Only a single polian vesicle is present, attaining the length of about 4 to 5 mm. From want of material for examination, I am somewhat undecided with regard to the madreporic canal, whether it communicates with the exterior or not. The alimentary canal has no cloaca. The reproductive organ, consisting of a very small fascicle of cæca, attains a length of about 7 or 10 mm.; its duct opens a little above the crown of the tentacles where the brim projects.

Enypniastes,[1] n. gen.

Body very depressed, with an extension of the body-wall round its anterior extremity, constituting a very large, broad, rather flat brim. Tentacles twenty (?). The dorsal surface with small projections round the margin of the brim and with some other very small processes on its ambulacra. Pedicels along the sides (?) and round the posterior extremity of the body.

Enypniastes eximia, n. sp. (Pl. VIII. figs. 6, 7).

Body about twice as long as broad. Mouth ventral, behind the very broad brim. Anus dorsal. The dorsal surface with numerous small processes round the margin of the brim, and with some other very small ones, disposed in pairs on the ambulacra.

Colour in alcohol, light grey. Tentacles and processes brown, inclining to violet. Length, about 72 mm. Breadth, about 32 mm.

Habitat.—Station 168. July 8, 1874. Lat. 40° 28′ S., long. 177° 43′ E. Depth, 1100 fathoms; bottom temperature, 2·0° C.; grey ooze. Four very incomplete specimens.

The four specimens brought home are unfortunately so lacerated and in such a state of maceration as to render any closer examination impossible. It is not possible to form any correct idea of these very interesting forms, on account of which I have not been able to give any complete drawings but only some simple outline figures, and I even feel very considerable uncertainty as to the correctness of those. The dorsal surface is slightly convex and the ventral one almost flat, the body thus becoming very depressed. The animal attains its greatest breadth a little in front of the mouth. With regard to the broad brim, formed anteriorly by the body-wall and pierced by a number of wide close-

[1] Ἐνυπνιάστης = dreamer.

lying canals, the mouth has the aspect of being situated unusually far, about 30 mm., from the anterior extremity of the body. At first sight one is almost tempted to think that the mouth is situated near the middle of the ventral surface, but on making a closer examination of that part of the body which lies in front of the mouth, one becomes convinced that the whole of this part is constituted by an extension of the dorsal perisoma forming the above-mentioned brim, and that, consequently, the mouth is really placed on the anterior part of the ventral surface. The peritoneal cavity is thus not prolonged much in front of the mouth. The large, wide canals, penetrating the brim side by side, are in connection with the dorsal ambulacra; some of them on each side communicate possibly with the ventral lateral ambulacra, but I am not certain as to this. The canals taper towards their cæcal ends, and the rather large spaces between them are occupied by the connective tissue of the brim. Each of the canals enters one of the more or less considerable processes which are to be observed round the margin of the brim. Almost at the middle of the dorsal surface two pairs of small papilla-like projections can be distinguished; possibly there may have been several others. The tentacles are torn off except in one individual, where I found them to amount to twenty; they seem to be of unequal size; on account of their macerated condition it is not possible to give a description of their true aspect. As the pedicels are mostly torn off their number is unknown. I feel certain that they are present on the posterior end of the body, but must leave it undecided whether they are also to be found along the sides of the ventral surface, though I have thought I could detect some traces of them there. The integument being very flexible is in an extreme degree of dissolution, so that no calcareous bodies can be distinguished.

Achlyonice, Théel.

Achlyonice, Théel, Preliminary Report on the Holothuridæ of H.M.S. Challenger, p. 13.

Body oval or ovate, about twice as long as broad. Tentacles eleven or twelve. The dorsal surface with some processes anteriorly. The ventral surface with pedicels all round its sides. Integument with calcareous deposits composed of three-armed bodies, sometimes along with unbranched spicula and small wheels.

Achlyonice paradoxa, Théel (Pl. V. figs. 1–2).

Achlyonice ecalcarea, Théel, Preliminary Report on the Holothuridæ, p. 13.

Body ovate, widening behind, about twice as long as broad. Mouth anterior, subventral. Anus posterior, dorsal. Tentacles twelve, of equal size; their terminal part very large, discoidal, with small retractile processes. Pedicels twenty-seven, disposed along the sides and round the posterior part of the ventral surface. The dorsal surface with about

six very soft and flexible processes disposed in an almost transverse row on its anterior part. Integument very thick, soft, spongy, and apparently porous; calcareous deposits composed of three more or less spinose arms, each arm with a process near the common central point.

Colour in alcohol light grey, inclining to green. Length, about 100 mm. Breadth, about 50 mm.

Habitat.—Station 241. June 23, 1875. Lat. 35° 41′ N., long. 157° 42′ E. Depth, 2300 fathoms; bottom temperature, 1·1° C.; red clay. Two specimens.

When preparing the Preliminary Report on the Holothuridæ of H.M.S. Challenger, I had not an opportunity of making a detailed examination of the perisoma of this species, and as it was quite impossible to detect any traces of calcareous deposits either by a microscopic examination of small pieces of the integument or by treating them with a solution of potass, I took for granted that there were none. By using such colouring matters as hæmatoxylin, however, I have been persuaded that I made a mistake in stating that the perisoma was destitute of deposits. This reagent brings out with such distinctness the extremely thin sheaths or membranes which surround the calcareous deposits, that one gets a fairly true idea of their forms, though the calcareous matter has been dissolved for a considerable time. On account of this I have thought it necessary to change the name of the species so as to avoid the chance of misapprehension.

The dorsal surface is extremely convex, the ventral, on the contrary, is almost flat or slightly concave. An obvious edge marks the transition between these surfaces. The body is especially broad posteriorly and rounded in the form of a semicircle, and decreases anteriorly towards the crown of tentacles where it is almost truncated. The mouth, the surrounding oral disk, as well as the tentacles, are almost terminal, being slightly inclined towards the ventral surface. The anus is of considerable size, and is situated on the dorsal surface, about 17 mm. from the sharp edge which separates the ventral and dorsal surfaces posteriorly. The left side of the extremely convex dorsal surface is divided into large rhomboidal or quadrangular prominent areas, separated from each other by furrows; these have been caused by abnormal contraction, though it may appear very peculiar that both of the specimens should possess them. The tentacles seem to be of almost equal size, some of the ventral or dorsal ones being slightly smaller. Their large, discoidal ends, projecting beyond the supporting stems, are provided with a number of very small, retractile processes, especially round their margin. The ventral surface bears thirteen pedicels all along its sides and an odd one posteriorly, in the middle, the first pair projecting near the tentacles. Most of them are retracted, but a few which are in a state of extension indicate that they are rather short, with their terminal part large, flat, and slightly convex. About 35 or 40 mm. behind the crown of tentacles the dorsal surface supports about six conical processes, which are arranged in an almost transverse row, and attain the length of about

5 to 6 mm.; in their fully extended state they appear to have a greater length. Those processess communicate with both of the dorsal ambulacra, three with each. On examining the inside of the body-wall one discovers three pairs of ambulacral cavities (Pl. XLI. fig. 5) disposed one a little in front of the other; the first pair of these cavities is in connection with the two middle processes, the posterior pair with both of the outermost processes, and the middle ones with each of the others. In one individual I observed in front of those processes eight papillæ far separated from each other, and so small that they were scarcely distinguishable to the naked eye; their nature will be discussed further on. The perisoma, being particularly thick, soft, and spongy, seems to be in a very macerated condition; on its surface it is easy to distinguish by the naked eye a number of small holes (Pl. XXXIX. fig. 3) which give the integument a porous aspect; they enter small cæcal cavities, the function of which I have not been able to understand. As stated above the calcareous substances are quite dissolved, but the membranes which have surrounded the deposits are, on the contrary, easy to discover; by staining them in hæmatoxylin, one is able to form a correct idea of their former aspect (Pl. XXXIX. fig. 7). From a common centre three straight, slightly spinose arms, about 0·2 mm. long, run out, forming angles of equal size with each other; each arm gives off, close to the centre, a process directed obliquely outwards. Whether some deposits of another shape occur or not, it is difficult to decide, though I have thought I could detect traces of curved, spinose and unbranched spicula. It is also impossible to tell either the shape of the calcareous ring, or whether the madreporic canal has deposits or not.

The polian vesicle measures about 30 or 35 mm. in length. Though I have not been able to discover any pore of the madreporic canal I have succeeded in following the canal itself in its passage through the thick perisoma, and am thus persuaded that it really communicates with the exterior. The narrow alimentary canal terminates posteriorly in a very large and wide cloaca, which towards the left side has a remarkably large cæcal prolongation which ascends towards the middle of the peritoneal cavity; the breadth of the prolongation is about half that of the body or sometimes more. The reproductive organ is elongated and almost as long as the body itself, it is constituted by a single fascicle of numerous small cæca. The common efferent duct divides, where it penetrates the perisoma, into a number of larger and smaller narrow canals, which pass through the integument and end in the tops of the above-mentioned very small papilla-like dorsal processes. The organ is situated on the left side of the peritoneal cavity.

Achlyonice lactea, n. sp.

Body oval, about twice as long as broad. Mouth anterior, subventral. Anus posterior, dorsal. Tentacles eleven or twelve, of nearly equal size; their terminal part

rather large, discoidal, with retractile processes. Pedicels about twenty-six, thirteen along each side of the ventral surface. The anterior part of the dorsal surface bearing some small processes. Integument thin, soft, and transparent, with three sorts of calcareous deposits: numerous three-armed, spinose bodies, each arm with two opposite, very spinose processes; a few spinose unbranched spicula, and small scattered wheels, with twelve spokes.

Colour in alcohol, white. Length, about 40 mm. Breadth, about 20 to 25 mm.

Habitat.—Station 147. December 30, 1873. Lat. 46° 16′ S., long. 48° 27′ E. Depth, 1600 fathoms; bottom temperature, 0·8° C., globigerina ooze. Four specimens.

All the four specimens being very contracted, it is difficult to determine their size or true shape, which however seem to agree with those usual in the genus *Elpidia*. The ventral surface is more or less flat, the dorsal, on the contrary, is extremely convex. The body is nearly evenly rounded towards its extremities. The number of tentacles varies from eleven to twelve, and their size does not seem to be constantly equal, two of the dorsal ones being rather rudimentary in one individual. Their terminal part bears processes, those round the edge being largest. Two of the animals carry twenty-six closely crowded pedicels, and probably the number on the other two is the same, though I have not been able to determine it. From the state of contraction of the body, it is impossible to form any correct idea of the dorsal processes; it seems, however, that some small ones project anteriorly, close to the tentacles. The three-armed deposits (Pl. XXXII. figs. 21–23) vary greatly in size, the arms of the largest ones measuring about 0·22 mm. in length; each arm carries at some distance from the common centre two very spinose processes. The deposits of the ventral surface are smaller and more scattered, have a more irregular shape, and give off considerably smaller processes; besides those, a few spinose unbranched spicula are to be found. The wheels, which are scattered over the dorsal as well as the ventral surface, measure about 0·06 mm .in diameter, and are provided with twelve spokes; between each of those the felly gives off a rounded process or lobe, directed obliquely outwards. The nave is large, and sends out from its middle a small irregular crown, consisting of four slightly curved rods united with each other. The pedicels contain some straight and curved, spinose or smooth, spicula of greater or smaller size. The tentacles have also some spicula, which seem to bear one or several branches. The calcareous ring seems to resemble that of *Parelpidia elongata;* each of its five pieces gives off about twenty-four diverging rods, their ends being flattened and dilated. Only a single polian vesicle is present, measuring about 8 mm. in length.

Family II. Deimatidæ.

Body usually rather long, cylindrical or fusiform, seldom shorter and of an elliptical form. Tentacles fifteen or twenty. Mouth almost terminal, though more or less

distinctly turned towards the ventral surface. The lateral ambulacra of the ventral surface bearing very long and wide, cylindrical or conical, slightly retractile pedicels, disposed either in a single or a double row along each side of that surface, and sometimes provided with another series of extremely elongated, conical, non-retractile processes placed externally and above the pedicels. The odd ambulacrum generally naked, seldom with a few rudimentary pedicels or with a double row of rather large ones. The dorsal surface with very long, elongated, conical, mostly non-retractile processes, disposed in one or more rows all along each of its ambulacra. Calcareous deposits: perforated plates, spicula, wheels, cruciform and dichotomously branched bodies. Calcareous ring composed of a rather fragile and imperfect net-work; no distinct radial or interradial pieces.

The genera which are included under the head of this family seem in general to be well defined. *Deima* differs from the others not only in having its calcareous skeleton more fully developed and in the minute size of its tentacles and their capability of being drawn within the body, but by the presence of a highly characteristic system of canals, which is in communication with the water-vascular system, and is more fully described in the anatomical part of this report. *Oneirophanta* bears the nearest resemblance to this genus from the shape of its calcareous bodies, but it differs from it not only in the above noted peculiarities, but also in the number and position of its processes and their degree of flexibility, and above all by the pedicels of its ventral lateral ambulacra being arranged in a double row.

As *Orphnurgus* is distinguished by its characteristic calcareous bodies, it keeps its place as an independent genus. *Lætmogone*, *Ilyodæmon*, and *Pannychia* constitute a group by themselves, which is characterised by the perisoma containing wheels of diverse dimensions. *Lætmogone* carries only a single row of processes along each of the dorsal ambulacra, and a single row of pedicels along each side of the ventral surface; while the two other genera are provided with numerous dorsal processes which are either arranged in several more or less distinct rows along each ambulacrum or are scattered irregularly over the lateral interambulacra. Like *Lætmogone*, *Ilyodæmon* possesses fifteen tentacles, and has its odd ambulacrum naked, but its lateral pedicels are disposed in double rows. *Pannychia*, on the other hand, is provided with twenty tentacles, and carries a single row of pedicels along each side and a double row of smaller ones along the odd ambulacrum. There can be no doubt that these three genera are closely allied, and this affinity is most striking between *Ilyodæmon* and *Pannychia*. As three species of *Lætmogone* have been discovered which have all the above-mentioned generic characters in common, I feel convinced that this genus is well defined; with regard to the two others I take it for granted that the difference in the number of tentacles, and above all in the arrangement of the pedicels, will justify their being placed as different genera.

Tabular View of the genera of the Family Deimatidæ.

I. Integument mostly rather hard, strengthened by numerous perforated calcareous plates, often crowded and forming a skeleton; tentacles twenty.
  A. Tentacles small, retractile. Pedicels of the ventral lateral ambulacra in a single row, ... Gen. I. *Deima*.
  B. Tentacles large, not retractile. Pedicels of the ventral lateral ambulacra in a double row, ... Gen. II. *Oneirophanta*.
II. Integument pliable, strengthened by scattered spinose spicula; tentacles twenty, . Gen. III. *Orphnurgus*.
III. Integument very pliable, containing wheels along with spicula, cruciform bodies, or dichotomously branched deposits.
  A. Tentacles twenty; odd ambulacrum with a double row of pedicels, . Gen. IV. *Pannychia*.
  B. Tentacles fifteen; odd ambulacrum naked.
    a. Dorsal processes very long, disposed in a single row along each ambulacrum, ... Gen. V. *Lætmogone*.
    b. Dorsal processes shorter, disposed in several rows along each ambulacrum, ... Gen. VI. *Ilyodæmon*.

Oneirophanta, Théel.

Oneirophanta, Théel, Preliminary Report on the Holothuridæ, p. 6.

Tentacles twenty, large, and not capable of being retracted within the mouth. The lateral ambulacra of the ventral surface with large pedicels disposed in a double row all along each side of that surface, and with another series of very elongated, conical, more or less flexible, non-retractile processes, placed externally and above the pedicels all along each side of the body. The odd ambulacrum with a few more or less rudimentary pedicels. The dorsal surface with processes, resembling those of the ventral lateral ambulacra, disposed in a single row all along each of its ambulacra. Integument with more or less crowded, irregularly rounded, perforated plates, sometimes forming a rather hard skeleton.

Oneirophanta mutabilis, Théel (Pl. XXI. fig. 2; and Pl. XXII.).

Oneirophanta mutabilis, Théel, Preliminary Report on the Holothuridæ, pp. 6, 7.

Body elongated, of almost equal breadth throughout, more than twice as long as broad. Mouth anterior, subventral. Anus posterior, ventral. Tentacles of equal or unequal size; their terminal part with six to eight small unbranched processes. Pedicels varying greatly in number from about fifty-four in all—twenty-eight along the left side and twenty-six along the right—to only eleven along each side or even less. The odd ambulacrum with two to nine small pedicels. Processes of each of the lateral ambulacra of the ventral surface varying in number from about seventeen to seven or less. Processes of each of the dorsal ambulacra varying from seventeen or nineteen to seven or less. The length of the processes varying greatly, some being almost rudimentary, others as long as the breadth

of the body or more. Integument thin, but rather hard and brittle, with larger and smaller, irregularly rounded, perforated plates, either scattered or crowded, and then covering one another with their edges; each plate bearing near its centre one or more small spines or processes.

Colour in alcohol, light grey, glassy or violet. Length of the largest specimen, 204 mm. Breadth, 86 mm.

Habitat.—Station 146. December 29, 1873. Lat. 46° 46′ S., long. 45° 31′ E. Depth, 1375 fathoms; bottom temperature, 1·5° C.; globigerina ooze. Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. Station 160. March 13, 1874. Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms; bottom temperature, 0·2° C.; red clay. Station 241. June 23, 1875. Lat. 35° 41′ N., long. 157° 42′ E. Depth, 2300 fathoms; bottom temperature, 1·1° C.; red clay. Station 244. June 28, 1875. Lat. 35° 22′ N., long. 169° 53′ E. Depth, 2900 fathoms; bottom temperature, 1·2° C.; red clay. Station 281. October 6, 1875. Lat. 22° 21′ S., long. 150° 17′ W. Depth, 2385 fathoms; bottom temperature, 0·8° C.; red clay. Station 299. December 14, 1875. Lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms; bottom temperature, 1·1° C.; grey mud. Station 325. March 2, 1876. Lat. 36° 44′ S., long. 46° 16′ W. Depth, 2650 fathoms; bottom temperature, 0·4° C., grey mud.

Having obtained a smaller or greater number of individuals from each of the above localities, a great abundance of material has been at my disposal. As the name indicates, this species is represented in many varying forms, individuals not only from different localities but even from the same station presenting considerable diversities. If I had only had the opportunity of examining a few forms I should doubtless have made the mistake of referring them to several different species, but on account of the abundance of material, I have been able to observe a series of gradations filling up the intervals between the extreme forms. All the specimens evidently belong to the same species, though they may possess one or more differences which at first may appear to be of such importance that they could not be classed under the head of variations. The size varies extremely, the smallest individuals reaching only a length of 35 mm. and a breadth of 10 mm., while the largest ones attain gigantic dimensions. The difference in the general appearance of the body depends upon the number of pedicels and processes, which in its turn would seem to depend upon the size of the animal, so that the larger individuals would be provided with a greater number than the smaller ones. However, this is not always the case. The largest specimen, for instance, dredged at Station 146, and reaching a length of about 204 mm., has only fifty-six processes, while another individual from Station 241, having only a length of 170 mm., possesses about seventy; another animal dredged at Station 160, about 46 mm. long, carries only nineteen pedicels and nineteen processes, while a considerably

smaller specimen, obtained at Station 146 and measuring about 35 mm. in length, gives off about twenty-nine pedicels and thirty-five processes. These statements prove that the number of processes and pedicels is pretty much independent of the size of the animal. The ventral surface is flat or slightly concave, while the dorsal, on the contrary, is extremely convex. Both extremities of the body are evenly rounded. The mouth and anus are ventral, the former having a more terminal position. The colour varies considerably, most of the individuals having a light grey or glassy colour, while those found at Station 157 are of a darker or lighter violet. Before continuing the description, it seems proper to give the following table, exhibiting in what degree variation occurs with regard to the pedicels and processes:—

Station.	Length of the Body.[1]	Breadth of the Body.	Pedicels distinctly disposed in two rows along each side of the Ventral Surface.				Pedicels indistinctly disposed in two rows along each side of the Ventral Surface.		Pedicels of the odd Ambulacrum.	Processes of the Lateral Ambulacra of the Ventral Surface.		Processes of the Dorsal Ambulacra.		Tentacles.	Colour.
			Left Side.		Right Side.										
			Outer Row.	Inner Row.	Outer Row.	Inner Row.	Left Side.	Right Side.		Left Side.	Right Side.	Left Sides.	Right Side.		
244	137	48	11	10	12	10	...	...	6	9	11	13	14	of equal size.	light grey.
244	104	37	...	...	...	...	11	12	4	10	10	12	10	of unequal size.	glassy.
244	92	44	9	5	8	6	...	...	4	10	9	11	10	of unequal size.	glassy.
244	78	31	...	...	...	...	13	12	3	8	7	9	10	of unequal size.	glassy.
244	83	32	...	...	...	...	12	11	3	9	8	10	9	of unequal size.	glassy.
244	135	37	16	11	15	11	...	...	9	10	9	12	13	of equal size.	yellowish-white.
244	130	50	...	...	...	...	11	12	3	11	11	11	12	of unequal size.	glassy.
325	102	34	...	...	...	...	14	13	3	7	6	9	9	of equal size.	glassy.
325	109	36	10	4	10	4	...	...	3	9	9	5	7	of equal size.	glassy.
325	109	36	...	...	...	...	11	12	4	12	11	8	10	of equal size.	glassy.
325	106	40	...	...	...	...	15	14	3	10	11	12	11	of equal size.	white, glassy.
325	120	36	...	...	...	...	14	14	4	7	7	7	7	of equal size.	white, glassy.
325	120	51	...	...	...	...	14	14	4	11	10	10	9	of equal size.	white.
325	122	44	...	...	...	...	13	15	4	11	12	11	12	of equal size.	yellowish-white
160	123	50	...	...	...	...	14	13	3	11	11	5	6	of equal size.	white.
160	120	38	...	...	...	...	11	11	3	12	12	7	8	of equal size.	white.
160	103	34	...	...	...	...	14	14	4	14	14	8	7	of equal size.	yellowish-white
160	120	42	...	...	...	...	12	13	3	11	11	10	8	of equal size.	white.
160	133	40	...	...	...	...	11	11	4	12	12	7	7	of equal size.	white.
160	83	31	...	...	...	...	10	10	4	11	10	8	9	of equal size.	white, glassy.
160	46	15	...	...	...	...	8	8	3	5	6	4	4	of equal size.	glassy.
241	170	60	13	8	11	9	...	...	7	17	17	17	19	of equal size.	glassy.
146	204	82	13	10	13	10	...	...	4	16	15	13	12	of equal size.	white.
146	53	20	10	8	11	6	...	...	6	8	9	9	9	of equal size.	glassy.
146	35	10	...	...	...	...	14	13	2	8	9	9	9	of unequal size.	glassy.
299	134	41	11	10	10	9	...	...	2	6	5	7	7	of equal size.	whitish.
299	126	43	10	7	10	6	...	...	2	10	11	10	11	of equal size.	whitish.
281	90	34	...	...	...	...	15	13	3	11	11	9	10	of unequal size.	glassy.
157	180	58	14	14	14	12	...	...	2	12	12	8	8	of equal size.	dark violet.
157	135	41	...	...	...	...	22	20	4	7	7	4	4	of equal size.	violet.
157	83	25	11	11	11	11	...	...	4	7	7	4	4	of unequal size.	light violet.
157	49	15	10	8	10	8	...	...	2	7	7	9	9	of unequal size.	light violet.

[1] All measurements are given in millimetres.

The tentacles are generally equally large, though not rarely individuals occur in which they are unequal, one or several being considerably smaller. It is necessary to observe, that those smaller tentacles, which have often the same shape as the fully developed ones, but which are sometimes much reduced and destitute of processes on their usually somewhat swollen ends, frequently though not always belong to the ventral surface; the smaller individuals bear tentacles generally of unequal size. The normal tentacle is dilated towards its end, which is discoidal or hand-like, and commonly provided with six simple digitiform processes round its margin; sometimes the processes are seven or eight in number, as is the case with the individuals from Stations 157 and 299. The tentacle itself is not capable of being retracted, while its processes on the contrary are retractile.

As is above noted, the number of pedicels varies extremely, as does also their position. In the large typical forms they are disposed in two distinct rows along each side of the ventral surface, while this arrangement in double rows is scarcely discernible in other individuals, the pedicels being arranged in a single but irregular row along each side. The pedicels of the inner row constantly alternate with those of the outer, so that if we could imagine them united by a line, it would run in a zigzag course. The inner pedicels, being always smaller than the outer ones, seem to be developed later, which may be fully proved by the fact that they are generally rudimentary in young animals, while those of the outer row are well developed. The pedicels are supported by numerous calcareous deposits, are non-retractile, and reach a considerable size, those of the largest individuals attaining a length of 16 mm. and measuring in diameter at their base about 6·5 mm. The odd ambulacrum bears some pedicels, commonly three to four, but sometimes nine, which, in most cases are rudimentary, and rarely acquire a more considerable size; they always remain, however, much smaller than the pedicels of the lateral ambulacra; two of them are generally situated side by side immediately in front of the anal aperture. As is shown in the above table, the processes vary greatly in number and dimensions. They are disposed in four single rows, two running along the dorsal ambulacra, and the others placed along the sides of the body a little above the ventral lateral ambulacra with which they are in connection. Thus the dorsal ambulacra as well as the lateral ambulacra of the ventral surface are furnished with processes, the lateral ones proceeding from the lateral interambulacra. At the posterior and especially at the anterior extremity of the body, where the ambulacra approach one another, it is difficult to decide from the position of the processes which of the ambulacra they belong to, the processes being so closely crowded at these places that it is only by means of injection or a close anatomical examination, that certainty can be obtained. The size varies very greatly even in the same animal, some of the processes being rudimentary while others attain a considerable length almost equal to the breadth of the body. They are usually of a very

elongated conical form, and are capable of being retracted. In some of the specimens they seem to be rather inflexible, though they mostly possess a high degree of pliability, this is especially the case in the individuals from Station 299. The animals from that station are also distinguished by the enormous length of their processes, which being about 125 mm. are nearly of the same length as the body. The processes, often brittle and easily broken off, have sometimes the tops bipartite. The specimens from Stations 146 and 157 are provided with processes of comparatively small size.

The perisoma is more or less strongly developed, and is sometimes pliable, sometimes very hard, brittle, transparent, and clear like glass. It is strengthened by numerous calcareous deposits which have the form of larger or smaller, more or less distinctly circular plates (Pl. XXXI. fig. 1), and are in some individuals closely crowded and overlap one another, the perisoma becoming thus more solid and brittle than in other specimens, where the plates lie side by side at greater or smaller distances from one another. The position of the calcareous deposits doubtless greatly depends upon the extent to which the perisoma is contracted; they seem usually to be more closely crowded on the dorsal than on the ventral surface, though sometimes the contrary is the case. The plates do not lie closer than to form two layers, of which the exterior one is distinguished by the smallness of its deposits. It is a remarkable fact that while some of the individuals possess two layers of deposits, others have only one. The plates, varying greatly in size, sometimes measuring about 2·2 mm. or more in diameter, are flat, discoidal, slightly convex outwards and perforated by a great number of usually somewhat circular holes, of which those at the middle are of a considerable size, attaining about 0·32 mm. in diameter; the size of the holes diminishes towards the circumference of the plates, and are consequently only visible as small points round the periphery. The convex side of the plates carries one or more small processes or spines situated close to or at some distance from the the centre; those spines are partly simple, partly give off small branches at their top, which running parallel with the plate itself are in connection with similar branches from other spines, thus forming a network upon the original plate. Here and there plates are found without any projections; several of the individuals obtained at Station 157 are remarkable from having all their plates quite smooth and destitute of spines. Besides the fully developed plates I have found a multitude of others in stages of development. The individuals dredged at Station 157 have the plates extremely firmly constructed and with comparatively small holes.

The pedicels contain a great number of calcareous deposits (Pl. XXXI. fig. 3), of almost the same shape as the above-described plates, though usually smaller; towards the ends the deposits become more simple in form, consisting of longer or shorter rather straight spicula or rods, the ends of which are branched or dilated and perforated. Those spicula have a transverse position. The large circular sole-like end of the pedicels has, besides those more important deposits, a greater number of small almost unbranched spicula, but is

destitute of any supporting calcareous plate, though sometimes traces of an undeveloped one are distinguishable. The individuals from Station 241, which differ from the others by their very thin body-wall, have the deposits of the pedicels very much scattered and rod-like up to their base, which is not generally the case. The pedicels, as well as the processes and tentacles, are very brittle and easily broken off. The tentacles are provided with a number of larger or smaller, comparatively short and thick spicula, with their ends slightly or not at all branched. The processes also are supported by a great number of smaller, more or less rounded or elongated perforated plates, and besides these by long more or less straight rods (Pl. XXXI. fig. 2), the ends of which are rather dilated, thin, and perforated; these rods, as well as the elongated plates, have not a transverse position, but lie in the direction of the processes, whereby the flexibility is considerably limited. The oral disk is strengthened by plates and by short, straight rods with their ends either unbranched or having short branches. The calcareous ring (Pl. XXXVII. fig. 4) consists of radial and interradial pieces or ossicles, which are extremely friable, and present the structure of a very fine network, and are united with one another by connective tissue. In consequence of their extreme friability, it is rather difficult to isolate them from one another; they break off even on the most careful treatment with solution of potass. The five radial pieces, being of a more solid structure, are however comparatively easily distinguishable; they measure about 3·4 mm. in breadth, and each has a deep furrow for the passage of the nerve-cord, which proceeds from the circumœsophageal nerve to the parietes of the body. The interradial parts of the calcareous ring are more irregular, very thin, and deeply concave anteriorly; it is impossible to determine whether they are simple or compound, but on treating them with solution of potass, I thought I could observe that they were divided each into three pieces. The polian vesicle arises from the left ventral portion of the circular vessel, and is of a cylindrical or extremely elongated conical form; its size varies greatly, and in one individual from Station 244 it reaches the enormous length of 134 mm., thus attaining almost the length of the animal itself. The madreporic canal (Pl. XXXVIII. fig. 11) contains calcareous deposits of varying appearance, partly small perforated plates, partly spicula, which are also to be found in the adjacent mesenteric membrane. The madreporic canal springs from the dorsal part of the circular vessel and, taking a curved course, passes upwards and forwards to the dorsal body-wall, where it terminates in the porous madreporic tubercle (Pl. XXXVIII. fig. 12), which is closely united with the inside of the perisoma in the medio-dorsal line a little behind the crown of tentacles. Through the openings in the madreporic tubercle, the interior of the ambulacral system communicates with the peritoneal cavity. The large ambulacral cavities (Pl. XLI. figs. 1, 2, and 4), which lie within the perisoma and communicate with the pedicels and processes, are very peculiar, and deserve the greatest attention. In the anatomical part of the report they will be described in more detail. Those ambulacral cavities are distinguished by their size, as

well as by giving off a number of cæcal prolongations, which run into the connective tissue of the perisoma; those cavities which belong to the pedicels and processes of the ventral lateral ambulacra lie, of course, very close side by side, and mostly overlap one another. In order to get a correct idea of their position and general appearance it is very advantageous to inject into the pedicels and processes.

The digestive tract is throughout the whole of its long course attached to the inside of the dorsal perisoma by a fenestrated continuous mesenteric membrane. The cloaca is of little importance. The reproductive organ (Pl. XLVI. figs. 6 and 7) is made up of two fascicles of unbranched, elongated, cæcal sacks, communicating anteriorly, where they are attached, one fascicle on each side of the dorsal mesentery, with a single efferent duct. In some individuals each fascicle consists of only three to four or usually eight to nine cæca, which in comparison with the length of the body are short; in other specimens they are made up of a great number of very small cæca. Before finishing the description of this species it may not be out of place to point out the differences which distinguish the forms dredged at Station 157 from the others, and which possibly may appear to be of such a nature as to justify their separation as at least a variety. We have then to note the violet colour, which is peculiar to those specimens, the comparatively minute length of the processes, and, finally, the firm construction of the calcareous plates and their want of spines or other projections, this latter peculiarity being however common to several individuals from other stations.

Deima, Théel.

Deima, Théel, Preliminary Report on the Holothuridæ, pp. 4, 5.

Tentacles twenty (?), small and capable of being retracted within the mouth. The lateral ambulacra of the ventral surface with large pedicels, disposed in a single row all along each side of that surface, and with another series of very elongated, conical, rigid, non-retractile processes, placed externally and above the pedicels all along each side of the body and directed straight outwards. The odd ambulacrum naked. The dorsal surface with processes, resembling those of the ventral lateral ambulacra, disposed in a single row all along each of its ambulacra. Integument with crowded, irregularly rounded, perforated plates, forming a rather hard skeleton.

Deima validum, Théel (Pl. XVIII. and Pl. XIX.).

Deima validum, Théel, Preliminary Report on the Holothuridæ, p. 5.

Body of an almost elliptical form, about once and a half as long as its greatest breadth. Mouth anterior, ventral. Anus posterior, ventral. Tentacles very small, perfectly retractile; their terminal part with five to six small retractile processes. Pedicels eleven along each side of the ventral surface; the posterior pair, behind the

anus, minute. Processes of the lateral ambulacra of the ventral surface seven, almost inflexible, and nearly as long as the greatest breadth of the body; behind the anus a rudimentary one. Processes of each of the dorsal ambulacra six to eight, resembling the preceding in size and shape. Integument very thick and hard, with two kinds of calcareous deposits: small branched spicula of various shape; and larger and smaller, irregularly rounded, perforated crowded plates, covering one another completely or with their edges alone.

Colour in alcohol, light grey. Length, about 165 mm. Breadth, about 95 mm.

Habitat.—Station 246. July 2, 1875. Lat. 36° 10′ N., long. 178° 0′ E. Depth, 2050 fathoms; bottom temperature, 1·3° C.; grey ooze. Two specimens.

The ventral surface is perfectly flat, while the dorsal one, on the contrary, is extremely convex; the anterior and posterior extremities of the body are almost evenly rounded. The mouth and anus are situated quite on the ventral surface, the latter a little in front of the hindmost pair of pedicels. The bilateral symmetry is particularly strongly marked in this form, especially in regard to the external organs. The pedicels along one side of the ventral surface correspond in number as well as in position and size with those of the other side. The same seems to be the case with the processes, excepting those along the dorsal ambulacra which are slightly variable, though the bilateral symmetry is still traceable even there. The normal number of the dorsal processes seems to be eight along each ambulacrum, though through deformity one or several processes may be wanting; thus one individual possesses six processes along the left ambulacrum and eight along the right, while another specimen has eight along the left ambulacrum and seven along the right. The place where the absent process ought to have been is always plainly indicated by the larger size of the interspace between the processes which lie in front and behind. The pedicels in the middle of the body are larger than the others, about 10 mm. in diameter at the base; their top only is retractile. The processes vary greatly in size, and attain sometimes a length approaching almost the greatest breadth of the body; their form is elongated conical and their base measures about 17 mm. in diameter. The tentacles (Pl. XLIII. fig. 3) of this species as well as those of *Deima fastosum* are very small in comparison with those of the other known forms, and capable of being completely retracted, at the same time the whole crown may be withdrawn, which is not the case in any other forms of the families Deimatidæ and Elpidiidæ. The individuals of the genus *Deima* which I have been able to examine, all have the tentacles drawn into the body, and are thus no longer visible externally. They are quite enclosed in an oral cavity which communicates with the exterior by a small rounded aperture, placed in the centre of a more or less circular disk, round the circumference of which are to be found numerous minute papillæ, the importance of which I have pointed out in the anatomical part of the report. On account of the retracted state of the tentacles it is impossible to determine whether

they are disposed in a simple row or in a double crown, though I believe the former to be the case. The end of the tentacles carries five or six processes, of which a couple appear to be larger than the others.

The perisoma is hard, unpliable, and particularly thick, the latter is especially the case with the body-wall along both sides on the transition between the ventral and dorsal surface where the layer of connective tissue is greatly developed. Three different layers of calcareous deposits are distinguishable. The outermost layer consists of scattered, very small, more or less curved, and branched spicula (Pl. XXXI. fig. 8) of various shapes. The intermediate layer is composed of closely placed plates (Pl. XXXI. figs. 4, 5, and 6), which cover one another completely or with their edges alone, and give the perisoma its firmness. These plates are partly large, about 7 mm. in diameter, and of a more circular form, partly smaller arranged round the former and of a more variable shape. Each plate presents the appearance of a flat network with the upper surface convex, its greatest thickness being at its centre; its under surface is perforated by numerous more regularly rounded holes, while the upper one presents an irregular network provided with some small scattered spines. The innermost layer is made up partly of more or less branched spicula and partly of larger net-like bodies (Pl. XXXI. fig. 9) with wide meshes. Besides those deposits I have found some minute bodies in the form of grains, which are sometimes joined together in bands within the connective tissue, but those are probably a chemical product formed during preservation in alcohol. The tentacles contain a minute number of deposits in the form of small scattered spicula. The deposits of the pedicels and processes strongly resemble the above-described plates, though smaller; the ends of the pedicels have no supporting terminal plate, but are instead provided with small generally more or less branched spicula (Pl. XXXI. fig. 7).

From want of material I have not been able to closely examine the calcareous ring, but it appears to resemble in form as well as in structure that of *Deima fastosum*; it is extremely fragile, and becomes separated into small pieces on being treated with solution of potass. The polian vesicle reaches a length of 30 mm. The water-vascular system corresponds with that in *Oneirophanta*, and in regard to its details I refer to the anatomical part of the report. The cloaca is insignificant. The digestive tract is attached to the inside of the dorsal perisoma by a mesenteric membrane. The reproductive organ (Pl. XLVI. fig. 5) consists of two fascicles, one on each side of the mediodorsal mesentery, each fascicle composed of from five to six long, narrow cylindrical tubes, which carry a number of larger or smaller globular cæcal sacks. A great part of the internal organs such as the water-vascular system, the pseudhæmal vessels, the alimentary canal and the genital organs, contain a great abundance of calcareous deposits in their walls, which generally have the form of branched or simple more or less curved spicula, of net-like bodies and of perforated plates. The mesentery also contains numerous small spicula.

Deima fastosum, Théel (Pl. XX. and Pl. XXI. fig. 1).

Deima fastosum, Théel, Preliminary Report on the Holothuridæ, pp. 5, 6.

Body elongated, of almost equal breadth throughout, more than twice as long as broad, largest a little behind its middle. Tentacles very small, perfectly retractile; their terminal part with about eight small retractile processes. Pedicels eleven or thirteen along each side of the ventral surface; the posterior pairs small. Processes of each of the lateral ambulacra of the ventral surface four, inflexible and much longer than half the breadth of the body. Processes of each of the dorsal ambulacra four, resembling the preceding in size and shape. Integument hard and brittle, with crowded, larger and smaller, irregularly rounded, perforated plates, covering one another completely or with their edges only; every plate rising towards its middle into a large, conical knob.

Colour in alcohol, light grey. Length, 130 mm. Breadth, 58 mm.

Habitat.—Station 216. February 16, 1875. Lat. 2° 56′ N., long. 134° 11′ E. Depth, 2000 fathoms; bottom temperature, 0·9° C.; globigerina ooze. Two specimens.

The body is almost perfectly symmetrically bilateral in having the pedicels and processes of the one side exactly corresponding in size as well as in position with those of the other side; the only asymmetry which may be observed concerns the third pair of dorsal processes, the left one of which is situated a little more posteriorly than the right one. Besides, the processes of the dorsal as well as of the ventral lateral ambulacra form not only four longitudinal rows, but also distinct transverse rows. In the above diagnosis I have stated that the lateral ambulacra of the ventral surface give off four pairs of processes, counting the two hindmost processes of the body as belonging to those ambulacra, though to judge from their position they may belong to the dorsal ambulacra, which is the case with the two foremost processes; from want of material I have not been able to make a more detailed examination. If the hindmost processes, contrary to my opinion, should really belong to the dorsum, its ambulacra possess of course five pairs of processes, while the lateral ambulacra of the ventral surface are only supplied with three. The ventral surface is flat or slightly concave, while the dorsal one is extremely convex, the body attaining its greatest width in the posterior half. The mouth and anus are on the ventral surface, and the latter is situated a little in front of the hindmost pedicels. The number of pedicels appears to vary in different individuals, the largest specimens which I have had at my disposal having only eleven pairs, while the other individual which is several times smaller carries about thirteen pairs. Thus, as in *Oncirophanta*, the number of pedicels is not in proportion to the size of the body. The anterior and posterior pairs are small in comparison with the interjacent ones. The pedicels have a conical form, with their base considerably wider than their top, which is capable of being retracted. Those of the processes which are arranged along the sides of the body lie in the same plane with the ventral surface as in *Deima validum*, while the others project from the dorsal surface;

they are of an elongated conical form, and some of them are almost as long as the greatest breadth of the body. The body-wall passes imperceptibly into the processes, consequently it is rather difficult to state their exact size at the base. The processes are straight, brittle, and easily broken off, and appear to possess an extremely slight degree of flexibility. The tentacles (Pl. XLIII. fig. 3), the discoidal ends of which carry about eight minute retractile processes, are, as in *Deima validum*, small and capable of being withdrawn, thus rendering it impossible to discover any traces of them externally. The anterior circular aperture, which opens into the oral cavity in which the tentacles are enclosed, is surrounded in this species also by a circular disk encircled by a single crown of minute papillæ (Pl. XLIII. fig. 2). The integument, which is extremely brittle and hard, is supported by larger or smaller plates (Pl. XXXI. figs. 10, 11), which are crowded together and cover one another entirely or with their edges alone, so as to form a kind of external skeleton of remarkable firmness. Now and then some very large plates measuring up to 5 mm. are found, especially on the dorsal surface, round which are arranged some small plates, which mostly overlap the former ones. The inner surface of each plate is almost flat, while the outer is more or less convex and rises towards its middle into a large conical knob, which is most distinct and most prominent on the plates which belong to the back and to the processes. The inner surface of the plates is perforated by more regularly circular holes, and upon this inner surface, which doubtless is first formed, a very fine irregular network has arisen, thus giving the plates the form described. The tentacles contain only a small quantity of deposits (Pl. XXXI. fig. 13) in the shape of small oblong perforated spinose plates and spinose irregular spicula. The deposits of the dorsal processes resemble the plates in the integument, though they are smaller and of a more irregular form; I have not been able to distinguish any spicula, though they may possibly be present in the tops of the processes which, in consequence of their brittleness, have always been broken off. The plates on the pedicels seem to be destitute of the characteristic knob, or sometimes possess a slight one; transversely disposed spicula (Pl. XXXI. fig. 12) support the ends of the pedicels, which show no traces of a terminal plate.

The calcareous ring (Pl. XXXVII. fig. 3) resembles in structure that of *Oneirophanta;* five rather large radial pieces are distinguishable, each supplied with a furrow for the passage of the ambulacral nerves and canals. From want of materials I have not been able to make a more detailed examination concerning the number of the interradial pieces. The sutures are not visible between the different pieces, and the entire ring seems to form a continuous whole of an extremely spongy structure. The polian vesicle is short and widens behind. The water-vascular system seems to bear the most striking resemblance to that of *Deima validum* and *Oneirophanta*. The cloaca is insignificant. The reproductive organ (Pl. XLVI. fig. 8) consists of two fascicles, each composed of six or seven elongated cylindrical unbranched cæca. These cæca are very hard

and brittle in consequence of a great number of crowded spinose perforated plates overlapping one another (Pl. XXXV. fig. 9); these plates reach the enormous size of 0·88 mm. or more. The five longitudinal muscular bands, as well as the digestive tract and the pseudhæmal vessels, contain a number of deposits in the form of spicula or of perforated irregular plates (Pl. XXXV. figs. 7, 8, and 10).

Lætmogone, Théel.

Lætmogone, Théel, Preliminary Report on the Holothuridæ, pp. 9–10.

Tentacles fifteen, rather large, not retractile. The lateral ambulacra of the ventral surface with very large pedicels, disposed in a single row all along each side of that surface. The odd ambulacrum naked. The dorsal surface with extremely elongated, flexible, cylindrical, non-retractile processes, disposed in a single row all along each of its ambulacra. Integument with numerous wheels, and besides those deposits spicula or cruciform bodies.

Lætmogone wyville-thomsoni, Théel (Pl. XI. and Pl. XII.).

Lætmogone wyville-thomsoni, Théel, Preliminary Report on the Holothuridæ, p. 10.

Body very elongated, cylindrical or fusiform, several times longer than broad. Mouth anterior, subventral. Anus posterior, terminal, slightly dorsal. Tentacles of almost equal size; their terminal part large, thick, and sole-like, destitute of visible processes. Pedicels varying greatly in number from about fifty-six in all—twenty-nine along the left side and twenty-seven along the right—to only fifteen along each side of the ventral surface or less. Processes of each of the dorsal ambulacra rather slender, very flexible, and varying from sixteen or seventeen to about five; their length varying greatly, some being very short, others as long as the length of the body; a rather short genital process placed in the medio-dorsal line, a little behind the tentacles. Integument very thin and soft, with three kinds of calcareous deposits: scattered spicula, very large, frequently rather straight and unbranched; large wheels with about ten spokes; and smaller wheels with ten to thirteen spokes, both sorts of wheels concave, the felly being directed outwards, not on the same plane as the nave; the wheels have somewhat the form of a crown. Between the large and small wheels there are many forms, varying much in size and shape.

Colour in alcohol, lighter and darker violet, often inclining to dirty brown; ends of the tentacles leather-coloured. Length of the largest specimen, 240 mm. Breadth, about 50 or 60 mm.

Habitat.—Station 147. December 30, 1873. Lat. 46° 16′ S., long. 48° 27′ E. Depth, 1600 fathoms; bottom temperature, 0·8° C.; globigerina ooze. Three specimens. Station 158. March 7, 1874. Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fathoms;

bottom temperature, 0·3° C.; globigerina ooze. One specimen. Station 232. May 12, 1875. Lat. 35° 11′ N., long. 139° 28′ E. Depth, 345 fathoms; bottom temperature, 5·0° C.; sandy mud. One incomplete specimen. Station 300. December 17, 1875. Lat. 33° 42′ S., long 78° 18′ W. Depth, 1375 fathoms; bottom temperature, 1·5° C.; globigerina ooze. A great number of specimens.

The individuals belonging to this species vary greatly in size as well as in the number of pedicels and processes, and in order to give an idea of this variation I have composed the following table:—

Station.	Length of the Body.[1]	Breadth of the Body.[2]	Pedicels along the left side of the Ventral Surface.	Pedicels along the right side of the Ventral Surface.	Processes of the left Dorsal Ambulacrum.	Processes of the right Dorsal Ambulacrum.
147	145	45	22	22	7	8
147	95	...	23	22	8	9
158	20	6	15	15	5	5
300	155	50	29	27	12	9
300	150	...	17	18	11	10
300	160	...	19	22	8	11
300	160	...	20	21	9	11
300	165	...	23	19	11	11
300	185	...	23	21	17	16
300	195	60	19	19	10	8
300	200	...	19	17	7	9
300	200	...	20	22	7	6
300	200	...	17	20	11	12
300	210	...	22	21	11	11
300	210	...	18	21	11	10
300	210	55	19	20	11	12
300	220	55	21	22	8	9
300	225	...	19	19	8	8
300	230	...	18	21	11	9
300	235	...	21	22	10	9
300	240	...	24	24	12	12

Contrary to the condition in *Deima* and *Oneirophanta* the body-wall is here very thin, soft, and pliable; hence the body of this species has lost its original form greatly during preservation in alcohol. The body must have been more or less fusiform, equally tapering towards each extremity; this is best proved by filling the peritoneal cavity with alcohol or air, and thus extending the perisoma. The dorsal surface is extremely convex, while the ventral one is but slightly so. The mouth is more or less strongly inclined towards the ventral surface, and the anus, which is strikingly large, is almost terminal or indistinctly turned upwards. As the above table indicates, the number of pedicels and processes does

[1] All measurements are given in millimetres.

[2] As the individuals are rather contracted, it is impossible to tell the breadth of the body exactly, wherefore I have generally omitted it.

not depend upon the size of the body; the smaller individuals are frequently provided with more numerous pedicels and processes than the larger ones. The largest specimen, about 240 mm. long, which was dredged at Station 300, has only twenty-four pedicels along each side of the ventral surface, while another individual from the same locality, which attains only the size of 155 mm., possesses twenty-nine along the left side and twenty-seven along the right one; and another form dredged at the same station, and attaining a length of 235 mm., carries ten processes along the left dorsal ambulacrum and nine along the right, while a considerably smaller specimen, only 165 mm. long, gives off eleven processes along each ambulacrum. In spite of the fact that the pedicels and processes of one side of the body generally differ in number from those of the other side, a bilateral symmetry is still traceable in their arrangement; this is especially the case with the pedicels, which in consequence of their width and great number are crowded close together side by side; while the processes, which are considerably fewer in number, are scattered irregularly along the dorsal ambulacra and only at the posterior and anterior extremities of the body show a more marked tendency to arrange themselves in pairs.

Only a few individuals have their pedicels fully extended, and these may then attain a length of 30 mm.; they are in most cases very much contracted. The form of the pedicels is almost cylindrical, slightly wider at the base than at the free end, which terminates with a small circular disk of a lighter colour and about 1 mm. in diameter. In the same individual the processes also attain extremely various sizes, some being very short, while others on the contrary measure as much as 150 mm. in length or more. They are very elongated conical, or of an almost cylindrical form, and possess a high degree of flexibility; some of them are considerably wider than others. All of the fifteen tentacles are of an equal size, and reach in their fully extended state a length of 20 mm.; their base is slightly wider, and measures about 6 mm. in diameter. The end of the tentacles is dilated into a thick leathery disk of a light brown colour, on which no processes are distinguishable, unless the insignificant prominences round its edge are to be regarded as such; its surface is uneven and as if wrinkled. It is probable that when the tentacles are fully extended those prominences may be larger, but in all the thirty to forty individuals which I examined, the ends of the tentacles were destitute of true processes as is described above (Pl. XXXIX. fig. 4).

The calcareous deposits (Pl. XXXI. fig. 14–16) present two forms: spicula and wheels. The former have a length of 0·38 mm., are usually simple, straight, or slightly curved, and give off sometimes one or several branches; towards each end they carry some minute spines, which are sometimes found scattered over the whole of the spicula. Excepting in the ends of the pedicels, processes, and tentacles, the spicula are only present on the ventral surface. The wheels offer a great many variations, the largest measuring about 0·14 mm. in diameter, while the smallest only reach a size of 0·04 mm.;

and between these two an immense series of gradations exists. The short and arcuate spokes—in the large wheels from eight to ten in number, or sometimes less, while the smaller wheels have twelve or thirteen—support a large, discoidal nave with a large hole in its middle, from the edge of which proceed five, sometimes four or six, small slightly arcuate rods, which converge to form a conical figure, the top of which is directed towards the inside of the body-wall. The wheels are concave, more or less like a crown, and have their felly directed outwards from the body. The ventral perisoma is almost exclusively strengthened by small wheels which are usually rather scattered, whereas wheels of all dimensions are to be seen on the dorsal surface; nowhere are these deposits so crowded as in the tentacles and processes. The wheels lie in the outer layer of the connective tissue, while the spicula are placed close to the layer of circular muscular fibres. Besides those above-mentioned deposits I have found here and there, though especially in the processes, some minute, round bright particles, and numerous slightly larger bodies of a discoidal form; these are doubtless chemical products which have originated by preservation in alcohol. The layer of connective tissue of the integument contains an immense quantity of violet pigment which is partly scattered, partly crowded in masses, and partly disposed in lines which cross one another in all directions, thus forming an obvious network; the large nerve-cords as well as their ramifications contain pigment, and the pigmented network just mentioned is constituted by them.

The sole-like terminal part of the pedicels is strengthened either by a single, large, more or less circular perforated plate (Pl. XXXIV. fig 1), with the holes in the centre considerably larger than at the circumference, or by some smaller ones; round these plates lie partly some short, thick spicula of a variable shape, which are often provided with branches, and have their slightly enlarged ends spinose, and partly longer arcuated unbranched ones. The processes contain, besides a multitude of wheels of various dimensions, some scattered spicula. The ends of the tentacles are supported by a great number of unbranched spicula of diverse forms and dimensions resembling those of the pedicels; the stem of the tentacles, however, contains only a few scattered spicula but a greater number of wheels.

The calcareous ring (Pl. XXXVII. fig. 11) seems to be made up of a continuous spongy, extremely fragile and thin network, no radial and interradial pieces being distinguishable. By treating it with a solution of potass it separates into small pieces or fragments. The very pliable ring is capable of being considerably contracted, thus forming numerous larger or smaller wrinkles. The polian vesicle, 20 mm. long, has a considerable width. The ambulacral cavities (Pl. XLII. fig. 7) are small, and do not give off any branches; their form is more or less evidently triangular, or approaches almost the shape of a semicircle. The madreporic canal (Pl. XLIII. fig. 4*a*) presents the greatest difference when compared with that of *Oneirophanta;* it runs out, as usual, from the

dorsal portion of the circular vessel, and passes upwards and backwards to the body-wall, where, surrounded by a thick layer of connective tissue, it joins the medio-dorsal line about 30 mm. behind the tentacles. When the tube reaches the perisoma it gives off four to five, sometimes even as many as nine (Pl. XXXVIII. fig. 9), very narrow branches, which pierce the body-wall and open externally each at the top of a minute papilla. These papillæ, measuring from 2 to 3 mm. in length, are closely crowded together at the base of the genital process, which is situated anteriorly in the medio-dorsal line, and which is in connection with the efferent duct of the reproductive organ. The position of those papillæ is various; sometimes they are placed immediately in front of the genital process, sometimes they form a semicircle along one side of it. Through the openings in the free ends of the papillæ the ambulacral system communicates with the surrounding medium. The deposits of the madreporic canal consist partly of scattered more or less aggregated, minute, slender, straight or curved, branched or unbranched irregular rods, partly of a few irregular wheels differing more or less from those in the integument, and finally of a few irregular perforated plates in the form of a network.

The posterior portion of the digestive tract is generally slightly enlarged, excepting in some individuals dredged at Station 147; two of these possess a large cloaca, which in one of them gives off a cæcal prolongation on the left side; in two other specimens from the same locality the cloaca is almost imperceptible. The parietes of the alimentary canal as well as the walls of the pseudhæmal vessels contain calcareous deposits in the form of spicula (Pl. XXXVI. fig. 3). The reproductive organ (Pl. XLIII. fig. 4, *g*) consists of two large fascicles made up of bundles of small oval cæca (Pl. XLVI. figs. 2 and 3), one fascicle on each side of the dorsal mesentery; its efferent duct opens externally by a pore situated on the top of the aforesaid process which has its place in the medio-dorsal line and reaches a length of 11 mm., and a diameter, at the base, of 2·5 mm. This genital process has sometimes a branch projecting from its side, the efferent duct thus having two apertures (Pl. XXXVIII. fig. 9); sometimes the top of the process is divided into four small branches, only two of which seem to communicate with the efferent duct (Pl. XXXVII. fig. 5). I have only once met with an individual provided with two equally large processes side by side, and in which consequently the common duct must have divided while piercing the perisoma. Thus it is of importance to remember that both the reproductive organ and the madreporic canal are subject to considerable variations in their manner of terminating.

As the above description is taken from the individuals which were obtained at Station 300, it is necessary to point out the more or less important characters which distinguish the specimens brought home from other stations. The individual from Station 232 was in such an incomplete state that no close examination is possible; it is only 25 mm. long, and has thirteen developed tentacles and rudiments of a fourteenth; it is most probable that this form is a distinct species from *Lætmogone*

wyville-thomsoni, and this seems still more likely on considering the nature of the sea-bottom and the comparatively inconsiderable depth where the animal was found living.

The single specimen, obtained from Station 158, is distinguished by the strong convexity of the dorsal surface, the height of the body being considerably greater than the breadth, which may possibly be the result of contraction.

The four individuals brought home by the Challenger expedition from Station 147 may possibly be regarded as "varieties." Their colour is darker than in the typical form, and their tentacles are almost black. In one specimen the odd ambulacrum carries posteriorly a couple of small pedicels. The genital process is inconsiderable. One individual possesses a large cloaca which gives off a cæcal prolongation towards the left side, while another specimen has likewise a large cloaca but without any cæcal prolongation. In the two remaining individuals the posterior portion of the alimentary canal resembles that of the typical form. The calcareous deposits of the ventral perisoma, especially the spicula, are much more numerous, and the ends of the dorsal processes are strengthened by a greater number of straight or arcuated spinose spicula, than is the case in the typical form.

Lætmogone violacea, Théel (Pl. XIII.).

Lætmogone violacea, Théel, Preliminary Report on the Holothuridæ, p. 11.

Body elongated, about twice and a half as long as the greatest breadth. Mouth anterior, subventral. Anus posterior, terminal, slightly dorsal. Tentacles of almost equal size; their terminal part rather large, almost discoidal, destitute of visible processes. Pedicels eleven along the left side of the ventral surface, and twelve along the right, rather long and large; the posterior pairs small. Processes of the dorsal surface very slender and flexible, in one individual twenty, in another twenty-three along each of the ambulacra; the largest process about as long as the greatest breadth of the body; a rather short genital process placed in the medio-dorsal line, a little behind the tentacles. Integument very thin and rough, with four sorts of numerous calcareous deposits: scattered spicula; spinose bodies, cruciform or in the form of an X, with the four arms curved; large wheels frequently with eight spokes; and small wheels, sometimes with thirteen spokes. Both sorts of wheels resembling those of the preceding species; between the large and small wheels there are many forms, varying much in size and shape.

Colour in alcohol, grey violet. Ends of the tentacles light yellowish-brown. Length, about 90 mm. Breadth, about 35 mm.

Habitat.—Station 164. June 12, 1874. Lat. 34° 8′ S., long. 152° 0′ E. Depth, 950 fathoms; bottom temperature, 2·2° C.; grey ooze. Two specimens.

During the cruise of the "Knight Errant" between the Faröe Islands and the coast of

Scotland, in the summer of 1880, Mr Murray brought home a rich collection of very interesting abyssal forms, among which I was much surprised to find a great abundance of *Lætmogone violacea*. More than a hundred specimens were obtained at Station 4, August 10, at a depth of 555 fathoms.

This species differs externally from the preceding one by the considerably smaller dimensions of its body and by the greater number of its dorsal processes, which in general do not attain a great length. As the Holothurids dredged by Mr Murray during the cruise of the "Knight Errant" have been placed at my disposal, I have had an opportunity of noticing that the number of processes and pedicels even in these specimens is rather variable, though it seems generally to approach that stated in the diagnosis. The discoidal ends of the tentacles, about 4·5 mm. in diameter, present in resemblance to those of the preceding species no other traces of processes than a few minute protuberances round their edges. The pedicels are very large, and measure at their base about 8·5 mm. in diameter. The dorsal processes, on the contrary, are very slender and of an elongated conical shape, measuring at the base about 3 mm. in diameter; they vary greatly in size, and sometimes attain a length of 30 mm. or more. Like the pedicels, they are highly flexible, but want the power of retraction; however, they are able to be more or less contracted. The processes are arranged in a single row along each ambulacrum except anteriorly, where the two or three first of each side frequently—though not always—are disposed in a transverse row, the two next following being also placed side by side. The animals are in such a state of contraction that I am somewhat uncertain as to the arrangement of those anterior processes. The perisoma is thinner and more transparent than in *Lætmogone wyville-thomsoni*, and is not so abundantly pigmented. The spicula (Pl. XXXVI. fig. 24), which apparently only exist on the ventral surface, are scattered, simple, spinose, and reach a length of about 0·16 mm. The wheels are found of all dimensions everywhere in the integument, and resemble perfectly those of the above-mentioned species; the smaller ones have as many as thirteen spokes and a diameter of about 0·036 mm.; the larger ones (Pl. XXXVI. fig. 20), on the contrary, attain to about 0·2 mm. in diameter, and possess usually eight to nine spokes; the spokes being strongly arcuated, the nave does not lie on the same plane as the felly but inside it. From the edge of the considerable hole in the centre of the nave, proceed commonly four minute rods running together to a point. The wheels have the appearance of a crown with the concave side turned outwards. The largest wheels are found in the parietes of the processes and in the dorsal perisoma, though they are more thinly scattered in the latter. The cruciform spinose bodies (Pl. XXXVI. fig. 21) in their most developed state reach about 0·2 mm. in diameter, while the smallest ones measure only about 0·072 mm., and they are very numerous on the dorsal surface, whereas they are found more scattered and commonly smaller on the ventral one; the arms of those deposits are more or less strongly arcuated and extremely spinose,

and their slightly enlarged ends are directed outwards from the body, thus making the integument very rough. Here and there such bodies composed of three or five arms are to be distinguished. There is no difference in the individuals brought home by the "Knight Errant" with regard to the size and number of the cruciform bodies of the dorsal and ventral surfaces, but it is worthy of note that those deposits are more irregular and differ more frequently from the typical four-armed form, a greater number of them being formed by three, five, or six arms than is the case in the examples dredged at Station 164. In the pedicels, processes, and tentacles a smaller or greater number of wheels and X-shaped bodies are distinguishable. The ends of the pedicels are provided with a perforated terminal plate—sometimes only fragments of the plate are visible—which gives the impression of being hollowed and concave outwards with its edge thick and of a more irregular net-like structure; round this plate a number of straight or slightly curved unbranched spicula is crowded, most of which are rather large and thick and towards the spinose ends either acute or obtuse (Pl. XXXVI. fig. 22). The walls of the dorsal processes contain scattered spicula, and the terminal discoidal part of the tentacles is strengthened by a great number of extremely arcuated ones (Pl. XXXVI. fig. 23).

The water-vascular system resembles that of the preceding species; however, the ambulacral cavities of the pedicels are in this form narrower and more elongated (Pl. XLII. fig. 2). The madreporic canal is supported by calcareous deposits of irregular shape, which constitute a particularly strong network where the tube clings to the body-wall. The madreporic tube terminates in several minute canals, which pierce the perisoma and open externally close to the base of the genital process.

The calcareous ring forms as in *Lætmogone wyville-thomsoni* a continuous whole round the gullet, and does not appear to be composed of separate ossicles; only a more solid structure marks the position of the radial pieces.

Lætmogone spongiosa, Théel (Pl. XIV.).

Cryodora spongiosa, Théel, Preliminary Report on the Holothuridæ, p. 9.

Body elongated, almost cylindrical, and of equal breadth throughout, about four times as long as broad. Mouth anterior, subventral. Anus posterior, subdorsal. Tentacles of almost equal size, their terminal part large and discoidal, destitute of visible processes. Pedicels fourteen along the left side of the ventral surface, and fifteen along the right, the posterior ones very small and indistinct. Processes of the dorsal surface eighteen along the right and seventeen along the left ambulacrum, rather long, very soft and flexible; the four anterior on each side not in a row after one another, but two and two, side by side. Integument very thick, soft and spongy with three sorts of calcareous deposits: wheels, spicula, and four- or five-armed spinous, starlike or cruciform bodies.

Colour in alcohol, light sea-green; top of the tentacles light brown. Length, 135 mm. Breadth, 35 mm.

Habitat.—Station 235. June 4, 1875. Lat. 34° 7′ N., long. 138° 0′ E. Depth, 565 fathoms; bottom temperature, 3·3° C.; mud. One specimen.

On first examining this form, I was surprised to find neither calcareous deposits in the body-wall nor any calcareous ring surrounding the gullet; besides, the thickness of the perisoma as well as its spongy structure were very striking indeed, and on account of this I at first thought myself justified in founding a new genus. After a renewed examination, however, I was convinced that calcareous deposits as well as the calcareous ring are really present, though the calcareous substance for some reason or other had been dissolved, most probably by some impurity in the alcohol. By making horizontal sections of the perisoma, and treating them with hæmatoxylin, the extremely thin sheaths which envelope the deposits become visible; and by studying the integument most carefully in this manner I have been able to distinguish three forms of deposits closely resembling those in *Lætmogone violacea*, which species bears the strongest resemblance to the present one. The genus *Cryodora* must accordingly be annulled.

Some of the tentacles are considerably smaller than others. The dorsal processes vary in size, sometimes attaining a length of 25 to 30 mm. and a diameter at the base of about 5 mm. Wherever a process protrudes from the body the perisoma rises, and thus the processes appear as if they ran out from low ridges. The pedicels are especially wide and long. It is impossible to make a detailed examination of the form and the number of the calcareous bodies. The cruciform or star-like deposits (Pl. XXXIX. fig. 6) which seem to be the most numerous, present a rather irregular form and measure about 0·22 mm. in diameter; their arms are rather arcuated and provided with large spines. I have not been able to distinguish any small wheels, though they may probably be present; the wheels which I made out measure about 0·24 mm. in diameter (Pl. XXXIX. fig. 5).

Traces of a calcareous ring are found in the form of an extremely fine network of minute tubes, the calcareous substance ensheathed by the tubes being now dissolved. The madreporic canal opens externally by ten minute pores, which lie close together in the medio-dorsal line immediately in front of the inconsiderable genital process about 20 or 23 mm. behind the anterior extremity of the body. The polian vesicle is short, and measures only 15 to 20 mm. The anal termination of the alimentary canal presents only a slight cloacal dilatation.

The resemblance between this species and the preceding one is most striking, and the only more important character which distinguishes them from one another seems to be the thickness of the perisoma in *Lætmogone spongiosa;* it is, however, not impossible that the thickness of the integument may depend upon its maceration in impure alcohol, in which case this characteristic peculiarity would also vanish. My opinion is, that until we obtain better material, and are enabled to determine with certainty the form and

number of the calcareous bodies, it is safest to regard these two forms as belonging to different species.

Orphnurgus, Théel.

Orphnurgus, Théel, Preliminary Report on the Holothuridæ, p. 8.

Tentacles twenty, rather large, non-retractile. The lateral ambulacra of the ventral surface with very large pedicels, disposed in a single row all along each side of that surface, and with another series of slender, flexible processes, placed above the pedicels, all along each side of the body. The odd ambulacrum naked. The dorsal surface with a crowded series of numerous processes, resembling those of the ventral lateral ambulacra, apparently disposed in two rows all along each of its ambulacra. Integument with spicula of various forms.

Orphnurgus asper, Théel (Pl. XV.).

Orphnurgus asper, Théel, Preliminary Report on the Holothuridæ, p. 8.

Body very elongated, of almost equal breadth throughout, several times longer than broad. Mouth anterior, terminal, slightly ventral. Anus posterior, slightly dorsal. Tentacles of almost equal size; one smaller than the others, with its terminal part torn off; ends of the tentacles with several retractile branched processes. Pedicels twenty-three along each side of the ventral surface, very large and long; the posterior ones smaller. Number of processes along the lateral ambulacra of the ventral surface almost the same as that of the pedicels. Processes of the dorsal ambulacra very numerous, in all about one hundred and fifty. The length of the slender and flexible processes variable, the largest ones nearly as long as the breadth of the body. Integument hard and rough, with numerous small, short spicula of various shapes, some smooth, others provided with numerous large spines or processes.

Colour in alcohol, light grey. Length, about 170 mm. Breadth, about 35 mm.

Habitat.—Station 23. March 15, 1873. Off Sombrero Island. Depth, 450 fathoms; globigerina ooze. One specimen.

The only specimen which I have had at my disposal was extremely incomplete and much contracted and wrinkled, so that it was rather difficult to ascertain exactly its true aspect, but I believe that my figures present a pretty correct idea of its shape. The body is very elongated and of almost equal width throughout. The ventral surface is almost flat, while the dorsal one, on the contrary, is convex. The anal aperture is very large.

On account of the contraction of the dorsal perisoma it is impossible to state exactly the position of the processes in correspondence with one another as well as with the pedicels. The processes, about two hundred in number, including those of the ventral lateral ambulacra, are of an elongated conical form, and the largest measure about 25 to 30 mm.

in length. The almost cylindrical pedicels, 18 to 20 mm. long, measure at their base 6 mm. in diameter; their ends are truncated, slightly rounded, and measure about 4 mm. in diameter. The tentacles (Pl. XLIV. fig. 3), of which a dorsal one on the right side is rudimentary, terminate in several, commonly four, large, branched retractile processes, which carry a number of small papilla-like projections on their inner side which is directed towards the mouth.

The perisoma, though not particularly thick, is hard and rough on account of the great number of spinose calcareous bodies which it contains. The shape of these deposits (Pl. XXXIV. fig. 15) is very various, and they are generally made up of strongly spinose spicula, which are sometimes provided with one or several small holes. The dorsal spicula are slightly larger, about 0·14 mm. to 0·2 mm. in length, and more numerous than the ventral ones, and have their spines thicker and in greater abundance. Besides this form of deposit I have found some scattered straight or slightly curved rod-like spicula, which are considerably longer than the former ones, and are either totally destitute of spines or are furnished with some minute ones at their ends. These rods, which sometimes reach a length of 0·46 mm., are more thinly scattered in the dorsal perisoma, where they even attain a very considerable size. The deposits of the pedicels (Pl. XXXIV. fig. 16), likewise of two different kinds, consist partly of spicula of the same shape as those of the dorsal surface, though smaller and with shorter spines, partly of larger, about 0·9 mm. long, straight or slightly curved rod-like ones, which are smooth excepting their slightly enlarged and truncated ends. The former ones lie closely crowded in the outwardly directed wall, but are very thinly scattered in that part of the pedicel which is directed towards the ventral surface. The latter, the rod-like spicula, on the contrary, are arranged in two longitudinal series, one along the anterior side of the pedicels and the other along the posterior one, each series containing four to six such rods, side by side. The end of the pedicel is destitute of a terminal plate, but is supported by a number of larger or smaller, more or less curved spicula, the ends of which give off small spines. The processes, also, are strengthened by two longitudinal series of rod-like spicula resembling those in the pedicels; the spaces between those two series are extremely poor in deposits. The ends of the tentacles contain larger or smaller, more or less arcuated, spicula of the same appearance as those in the ends of the pedicels.

The polian vesicle, measuring about 65 mm. in length, is widest in the middle, and decreases almost equally towards its extremities. The madreporic canal runs upwards and forwards and terminates in a madreporic plate or tubercle (Pl. XXXVIII. fig. 10), which is composed of a solid calcareous network, and has coalesced with the inside of the dorsal perisoma about 15 mm. from the anterior extremity of the body. The canal being invested by the medio-dorsal mesentery is bond-like and strengthened by a network of fine calcareous threads along the one side, while the other side has no such network. In the

connective tissue, which surrounds the canal, some scattered, rather large, more or less straight spicula are found, the ends of which are frequently provided with smaller processes or spines. The madreporic tubercle is divided by the medio-dorsal mesentery into two halves, each being flat, of an ovate form, and strongly concave along its middle, and having a length of about 4·5 mm.; the free surface through which the ambulacral system communicates with the peritoneal cavity is uneven on account of a number of wrinkles and papillæ. The large and branched ambulacral cavities of the pedicels, which lie enclosed within the body-wall, give off each a short, wide, somewhat branched cæcal prolongation or vesicle, which depends freely into the peritoneal cavity (Pl. XLI. fig. 3). The processes of the dorsal as well as of the ventral lateral ambulacra communicate exclusively with these branched vesicles. The reproductive organ is composed of two fascicles, each consisting of about twenty larger and smaller oval cæca; those fascicles communicate with a short, wide tube on each side of the medio-dorsal mesentery, which tubes pass into a common efferent duct which opens externally by a pore situated about 25 mm. from the anterior extremity of the body.

Ilyodæmon, Théel.

Ilyodæmon, Théel, Preliminary Report on the Holothuridæ, pp. 11, 12.

Tentacles fifteen, rather large and non-retractile. The lateral ambulacra of the ventral surface with large pedicels, apparently disposed in a double row all along each side of that surface. The odd ambulacrum naked. The dorsal surface with a crowded series of very numerous, retractile, slender, rather long processes, disposed in three or four irregular, close-set rows all along each of its ambulacra. Integument with numerous wheels and dichotomously branched bodies.

Ilyodæmon maculatus, Théel (Pl. XVI.).

Ilyodæmon maculatus, Théel, Preliminary Report on the Holothuridæ, p. 12.

Body elongated, of almost equal breadth throughout, about thrice as long as broad. Mouth anterior, almost ventral. Anus posterior, subdorsal. Tentacles of nearly equal size, with large circular discoidal ends, bearing round their edge small rudimentary processes; the ventral tentacles of one individual a little smaller. Pedicels of each side of the ventral surface varying in number from about twenty-nine to about eighteen; the posterior pairs smaller. Pedicels of the inner row apparently alternating with those of the outer. Processes of each of the dorsal ambulacra very numerous, about one hundred and forty to one hundred and fifty, cylindrical or fusiform; the largest as long as the breadth of the body. Back naked along its middle between the processes of both the ambulacra, except anteriorly a little behind the tentacles, where there is a small genital process. Integument thick and soft, with three sorts of calcareous deposits very

numerous: large wheels, 0·14 mm. in diameter, and with about nine spokes; small wheels, 0·036 mm. in diameter, and with about twelve spokes; and irregularly rounded flat discoidal plates, dichotomously branched, nearly of the size of the small wheels, crowded in large numbers in several places. Wheels concave, with the felly directed outwards, and the nave towards the inside of the body; between the large and small wheels there are many forms, varying much in size and shape.

Colour in alcohol, white grey, with scattered white spots caused by the crowded calcareous deposits; back and sides with numerous small, dark red, or brown points and spots; processes with a reddish band and frequently with dark red tops; terminal parts of the tentacles brown. Length, about 130 mm. Breadth about 45 mm.

Habitat.—Station 209. January 22, 1875. Lat. 10° 10′ N., long. 123° 55′ E. Depth, 95 to 100 fathoms; bottom temperature, 21·7° C.; mud. Three specimens. Station 219. March 10, 1875. Lat. 1° 50′ S., long. 146° 42′ E. Depth, 150 fathoms; mud. Two incomplete specimens. Station 192. September 26, 1874. Lat. 5° 42′ S.; long. 132° 25′ E. Depth, 129 fathoms; mud. Two individuals.

The individuals obtained at Stations 209 and 219 are extremely incomplete, having the alimentary canal totally destroyed and various portions of the body-wall torn quite in pieces. Only a single specimen is in such a state of preservation that it is possible to get a correct idea of its general appearance. After finishing the examination of those individuals, I obtained two specimens from Station 192 in a rather more complete state. The body appears to be almost equally broad throughout, becoming slightly wider and more evenly rounded anteriorly than posteriorly; the back is very convex, while the ventral surface is nearly flat. The mouth is on the ventral surface, and the anus is terminal and situated above the posterior pedicels and ought consequently to be regarded as belonging to the dorsal surface. The tentacles seem as a rule to be of equal size, though the ventral ones are sometimes slightly smaller; their free end is almost discoidally dilated, about 7 mm. in diameter, and forms a sharp edge which obviously separates the end itself from the supporting stem. This edge (Pl. XLIV. fig. 11) is crenulated with minute incisions and lobes, and on its outer side a more evident incision is often seen. As in *Lætmogone*, the tentacles seem to want true processes. One of the dorsal tentacles of one individual is incompletely developed, its terminal part being acute.

The largest individual, measuring 130 mm., has twenty-nine pedicels along the left side of the ventral surface, and probably about the same number along the right, though I feel somewhat uncertain concerning it, as a portion of this side is torn off. Another individual carries about twenty-three pedicels along each side, while a third specimen gives off twenty-six along the left and twenty-four along the right side of the ventral surface. Both of the specimens from Station 192 are likewise supplied with a variable number of pedicels, one possessing eighteen along the left

and twenty along the right side, while the other carries eighteen on the left and nineteen along the right side; consequently, the number of pedicels in this species seems to be subject to considerable variation. All the pedicels, excepting the foremost and hindmost ones, of the largest and most developed individuals are evidently disposed in a double row along each side of the ventral surface, those of the inner row alternating with those of the outer row; this arrangement of pedicels in double rows is less obvious in the younger animals. The pedicels reach a considerable size, the largest being about 15 mm. in length and about 8 mm. in diameter at the base. The dorsal processes of the largest individual are very numerous and disposed in about four very irregular rows along each ambulacrum, though anteriorly and posteriorly only two rows are distinguishable. This disposition of the processes appears most plainly on examining their vesicles from the inside of the perisoma. A narrow area along the middle of the back is destitute of processes except anteriorly where a minute one is situated, the importance of which I shall discuss further on. The individuals from Station 192 are distinguished from the others by possessing only two rows of processes along each of the dorsal ambulacra. The fusiform or conical processes are extremely flexible and of variable size, the largest measuring about 35 mm. in length and 7 mm. in diameter at the base (Pl. XLII. fig. 3).

The integument is very thick, and rather soft and pliable. The ventral perisoma contains apparently nothing but small wheels (Pl. XXXVI. fig. 17) and dichotomously branched bodies (Pl. XXXVI. fig. 18); the former are more numerous and closely-crowded, while the latter are partly scattered, partly agglomerated, thus becoming visible to the naked eye as larger and smaller white spots or dots. The deposits of the sides of the body almost correspond with those of the ventral surface, except in the neighbourhood of the dorsal processes where large scattered wheels are found. The dorsal perisoma between the series of processes is supported by a great many large wheels, while the small wheels and the dichotomously branched bodies are there fewer in number. The small wheels measuring about 0·028 mm. in diameter resemble those in *Lætmogone*, except that the hole in the centre is larger, the nave forming consequently a slender ring, from the inner edge of which commonly four minute rods run out; the number of spokes is generally twelve. The large wheels (Pl. XXXVI. figs. 12–15), from 0·14 mm. to 0·2 mm. in diameter, remind one likewise of those of the above-mentioned genus, the felly as well as the spokes being however more strongly developed; the spokes, nine in number, are attached to the posterior inner portion of the felly, and a transverse section of them presents almost the form of a triangle. The crown of those large wheels, made up of six minute rods, rises from the inner margin of the nave and sends out from its top a process of larger or smaller dimensions, which sometimes is simple as in *Lætmogone*, but often supports a triangular figure, the three acute corners of which lie

on the inner margin of the nave. The dichotomously branched bodies are discoidal and more or less circular; their appearance will be most easily understood by looking at my figures. The three above-mentioned forms of deposit are found present in more or less abundance even in the pedicels, processes, and tentacles. The end of the pedicels is strengthened by a terminal perforated plate, surrounded by numerous transversely placed spicula (Pl. XXXVI. fig. 19), which decrease in number towards the middle of the pedicel, where they cease totally. These spicula are fusiform, rather long and slender, straight or arcuated, with their ends more or less spinose, a few being branched, and others enlarged in the middle and punctured with one or more holes. The dorsal processes have only a few scattered spicula which do not lie crowded together at their tops. Many more or less arcuated spicula of very variable size are present in the tentacles. The deposits of the oral disk are partly made up of wheels of various dimensions and dichotomously branched bodies, partly of simple or branched, straight or slightly curved spinose spicula which have sometimes a cruciform shape.

The calcareous ring forms a continuous whole of an extremely fragile and spongy structure, which a solution of potass separates into pieces, though not into distinctly regular ones. The posterior part of the ring, or that portion which is directed upwards, when in its proper position, is penetrated by five rather large holes. The polian vesicle is unusually small, only 6 mm. long. The madreporic canal (Pl. XXXVIII. fig. 6) communicates with the exterior by a number of pores, from eight to about fifty, situated close together immediately in front of the genital process, and about 20 mm. behind the anterior extremity of the body. When the number of pores is great, they are closely crowded on a small space, which being slightly depressed below the surface of the surrounding perisoma, becomes strikingly like a madreporic plate (Pl. XXXVIII. fig. 7). These pores communicate with a corresponding number of minute canals which pierce the perisoma and open into a comparatively thick madreporic tube. The above-mentioned canals often bear one or more branches, and their walls contain numerous dark violet pigment cells, thus becoming most conspicuous; they are often of a flask-shaped form, and completely wanting in calcareous deposits. The madreporic canal itself is strengthened by a great number of thread-like, irregularly branched calcareous bodies (Pl. XXXVIII. fig. 8) of variable size. The pedicels communicate with ambulacral cavities, while the processes, on the contrary, are in connection with ambulacral vesicles. The spacious ambulacral cavities, which are elongated and lie in the thick layer of connective tissue of the ventral perisoma, are of two kinds according as they belong to the pedicels of the inner or outer row; those in connection with the pedicels of the outer row are widest where they communicate with the ambulacral vessels, while the other cavities are here comparatively much narrower, but increase in such a manner, that their greatest width is at a considerable distance from the ambulacral vessels. Both kinds of ambulacral cavities (Pl. XLII. fig. 4) terminate in several short cæcal prolongations.

which approach more or less the medio-ventral line. The ambulacral vesicles of the processes (Pl. XLII. fig. 3) resemble large sacks, from 10 mm. to 15 mm. long, which hang freely into the peritoneal cavity. A number of more or less spacious cavities and lacunæ which are found in the perisoma ought probably to be considered as belonging to the water-vascular system. The reproductive organ (Pl. XLVI. fig. 1) is composed of numerous bundles of cæca forming two fascicles, separated from one another by the medio-dorsal mesentery; its common efferent duct opens externally at the top of the above-mentioned genital process, which is situated immediately behind the pores of the madreporic canal; the organ attains a length of 40 mm., and its walls contain scattered spicula.

As the above description is taken from the largest individual, obtained at Station 209, it is necessary to note the peculiarities which characterise the specimens from the other localities. Those dredged at Station 219 attain a comparatively small size, the largest measuring about 80 mm. in length; their dorsal processes are not very numerous and are disposed in a single slightly irregular row along each ambulacrum; one of the individuals has only twelve tentacles, which evidently must be regarded as an abnormity; the large wheels are more numerous than in the large specimen dredged at Station 209. As is pointed out above, the individuals from Station 192 differ slightly from the typical form; their pedicels are not so obviously arranged in double rows, and only two distinct rows of dorsal processes are present along each ambulacrum; their deposits are made up of an enormous number of dichotomously branched bodies, which are not aggregated in such masses as to form white spots; their small and large wheels are very scattered. The alimentary canal, which is uninjured in these individuals, has no cloaca of importance.

Pannychia,[1] n. gen.

Tentacles twenty, rather large and non-retractile. The lateral ambulacra of the ventral surface with large pedicels, disposed in a single row all along each side of that surface. The odd ambulacrum with a double row of pedicels. The dorsal surface with a crowded series of very numerous, slender processes all along each side. Integument with numerous wheels and small wheel-shaped plates.

Pannychia moseleyi, n. sp. (Pl. XVII.).

Body elongated, almost cylindrical, several times longer than broad. Mouth anterior, subventral. Anus posterior, terminal. Tentacles of nearly equal size; their large, circular discoidal ends bearing round their edge small rudimentary processes. Pedicels thirty along the left side of the ventral surface, and twenty-nine along the right one. The odd

[1] Νύξ = night.

ambulacrum with fifty-five pedicels, smaller than the former, and disposed in a double row. Processes of each side of the dorsal surface numerous, about one hundred; the largest as long as half the breadth of the body. The anterior part of the back with a transverse, thin, lobe-like extension of the skin, sending out several processes. Integument rather thin with two sorts of calcareous deposits: large wheels, 0·24 mm. in diameter, with eleven to thirteen spokes; and small wheel-shaped plates, 0·052 mm. in diameter, with about fifteen holes.

Colour in alcohol, white grey; back dark violet, with the small processes and the top of the larger ones whitish; terminal parts of the tentacles and pedicels yellowish. Length, about 200 mm. Breadth, about 40 mm.

Habitat.—Station 164. June 12, 1874. Lat. 34° 8′ S., long 152° 0′ E. Depth, 950 fathoms; bottom temperature, 2·2° C.; grey ooze. One specimen. Station 169. July 10, 1874. Lat. 37° 34′ S., long. 179° 22′ E. Depth, 700 fathoms; bottom temperature, 4·2° C.; grey ooze. One specimen.

Although I have only had the opportunity of examining a single tolerably complete individual from Station 164, and a very defective one dredged at Station 169, I do not doubt that the variation in the number of pedicels and processes is considerable. The terminal part of the tentacles is covered with minute papilla-like projections, and, as noted in the diagnosis, one pair of small processes on the outer margin seems to be larger than the others. The pedicels of the odd ambulacrum are considerably smaller than those of the lateral ambulacra, some of them being almost rudimentary. The form of the pedicels is truncated conical, with the large rounded terminal part leathery, and measuring up to 4 mm. in diameter. The lobe-like transverse appendage on the back anteriorly is rather indistinct and macerated; it is difficult to distinguish its true shape, and from its thinness and slight height I was at first sight inclined to think that it was a piece of the outer layer of the perisoma which had been torn off and had attained that form, but on noticing its clearly marked edge and its processes, I was convinced that it was a real lobe-like appendage. The numerous dorsal processes form two longitudinal series, one along each side of the back, leaving a rather broad naked area between them; each series contains several processes side by side, though their arrangement in rows is imperceptible. Judging from the ambulacral cavities or vesicles it is evident that some of those processes belong to the lateral ambulacra of the ventral surface. The largest processes attain a length of 15 to 20 mm., but most of them, being minute and almost rudimentary, are only visible as lighter spots.

The large wheels (Pl. XXXII. fig. 1), 0·24 mm. in diameter, are almost visible to the naked eye; they are provided with eleven to thirteen spokes, and their large nave is perforated by a more or less round central hole, from the edge of which projects a crown constructed of four slightly curved arms. The wheels being slightly convex, the top of the crown lies inwards, while the felly is directed outwards; between the spokes the felly

carries round lobes, the number of which is similar to that of the spokes. The large wheels are most numerous in the walls of the processes and in the dorsal perisoma, and are on the contrary very scattered on the ventral surface and in the pedicels and tentacles. Those large wheels of the individuals dredged at Station 169 are provided with up to fifteen spokes, and with a crown constructed of from five to six arms; instead of the large hole in the centre of the nave, there are frequently found several very small ones, in which case the centre of the nave is joined to the top of the crown by a short minute rod (Pl. XXXII. fig. 6). The small wheel-shaped plates (Pl. XXXII. fig. 5), about 0·052 mm. in diameter, are slightly convex and perforated by about fifteen holes, of which the four central ones are larger than the others which surround them; these plates, which are sometimes provided with five central holes, are found everywhere in the perisoma.

The processes and pedicels contain, besides the above-mentioned forms of deposits, partly larger, scattered round plates (Pl. XXXII. figs. 7) which measure about 0·072 mm. in diameter, and are supplied with from thirty-five to fifty holes, partly a few straight or arcuated simple or branched spinose spicula (Pl. XXXII. fig. 9); in addition, one or more large plates of a more irregular form are distinguishable at the top of the processes (Pl. XXXII. fig. 8). The terminal part of the pedicels is strengthened by several layers of calcareous bodies, the innermost of which is most developed and made up of plates (Pl. XXXII. figs. 11, 12) perforated by numerous round holes, which decrease in size towards the uneven circumference; outside those lie fragile and net-like bodies with wide irregular meshes. The oral-disk is provided with numerous simple, more or less straight and spinose spicula, with the ends sometimes bipartite. The calcareous ring is rudimentary, fragile, and spongy; it has not been possible to distinguish its true form and structure.

The polian vesicle, large and wide, measures about 27 mm. in length. The madreporic canal seems to communicate with the exterior by several pores, though from want of material I do not feel convinced about it; its walls contain a thin thread-like calcareous network (Pl. XXXII. fig. 13). The pedicels are in connection with elongated ambulacral cavities within the perisoma, while the processes communicate with small branched vesicles hanging into the peritoneal cavity. The reproductive organ is composed of two large fascicles about 60 mm. in length, which are situated one on each side of the medio-dorsal mesentery; each fascicle is made up of several bundles of dichotomously branched, elongated, cæcal sacks. The genital aperture is situated about 30 mm. behind the tentacles.

Family III. Psychropotidæ.

Body more or less elongated, either subcylindrical and vermiform, or very flat and depressed, or rather high posteriorly and decreasing gradually forwards; its anterior part

always rather depressed. The perisoma along the sides of the body, as well as round its anterior and posterior extremities, thick, forming a continuous more or less thin border or brim, the breadth of which is very considerable anteriorly. Tentacles from ten to twenty. Mouth completely ventral, at a considerable distance from the anterior extremity of the body. Round the edge of the brim there is a single row of numerous, commonly minute pedicels, often resembling protuberances or wart-like prominences; the foremost of those prominences belonging to the dorsal ambulacra, the rest to the ventral lateral ones. The odd ambulacrum generally with a double row of minute retractile pedicels; in one form naked. The dorsal surface naked (?) or with a few minute processes; or with a greater or smaller number of commonly minute but sometimes rather large, retractile or non-retractile processes, disposed in a single or a double row along each ambulacrum; or with a great many minute, completely retractile processes, scattered over the lateral interambulacra; or with fewer pairs of small, non-retractile processes anteriorly and a very large appendage, crossing the odd interambulacrum at a greater or smaller distance from the posterior extremity of the body. Calcareous deposits: spicula or four-armed, cruciform bodies. Calcareous ring incompletely developed, composed of five separate pieces (?), each consisting of a very fragile network.

The presence of pedicels along the three ambulacra of the ventral surface is to be regarded as a very valuable character for this family. A single genus, *Psycheotrephes*, forms an exception to this rule by having its odd ambulacrum naked. Considering this peculiarity, as well as the number of tentacles, it seems as if this genus may be considered as a transitional form connecting the family in question with the Elpidiidæ; consequently it remains to be decided to which of these two families it ought to be referred. The presence of the brim round the flat body has decided me in classing the animal in question in the family Psychropotidæ.

The remarkable large azygous appendage which gives the genera *Euphronides* and *Psychropotes* such a peculiar appearance is completely wanting in *Benthodytes*, which by its exterior seems to approach the representatives of the family Aspidochirotæ. On a closer examination it becomes evident that *Euphronides* and *Psychropotes* are closely allied, and more than once I have hesitated whether they ought to be considered as belonging to one and the same genus or not. The former is characterised by its very depressed body, which almost reminds one of gigantic Planarians; besides, its appendage is considerably smaller in comparison with the size of the body than is the case in *Psychropotes*, and is situated comparatively far from the posterior extremity of the body. The genus *Psychropotes* on the other hand has its body almost without exception rather high posteriorly and depressed anteriorly, and its gigantic appendage, being situated close to the posterior extremity of the body, bears a strong resemblance to a tail.

TABULAR VIEW OF THE GENERA OF THE FAMILY PSYCHROPOTIDÆ.

I. Odd ambulacrum naked, ... Gen. I. *Psycheotrephes*.
II. Odd ambulacrum with a double row of pedicels.
A. Dorsal surface with a large appendage crossing the odd interambulacrum :
a. Body very depressed; appendage comparatively short, situated anteriorly on the posterior third of the body. . . . . Gen. II. *Euphronides*.
b. Body depressed anteriorly, increasing in height posteriorly; appendage very long, situated close to or not far from the posterior end of the body, ... Gen. III. *Psychropotes*.
B. Dorsal surface without any large appendage, ... Gen. IV. *Benthodytes*.

Psycheotrephes,[1] n. gen.

Body very thin and depressed, with the brim round its anterior and posterior extremities rather broad. Mouth and anus ventral, at some distances from the ends of the body. Tentacles ten. Pedicels arranged in a single row round the edge of the brim; the odd ambulacrum naked. The dorsal surface with some minute processes.

Psycheotrephes exigua, n. sp. (Pl. VIII. fig. 8).

Body broadest anteriorly, about twice as long as its greatest breadth. Mouth and anus removed to a more or less considerable distance from the extremities of the body. Tentacles of equal size; their terminal part with numerous small papillæ round the edge. Pedicels round the edge of the brim minute, hardly discernible. The dorsal surface with a single pair of minute processes situated near its middle. Integument thin, with four-armed, cruciform calcareous deposits provided with several processes, one issuing from the centre and the other from the arms.

Colour in alcohol, light greyish violet. Length, about 25 mm. Breadth, about 12 mm.

Habitat.—Station 274. September 11, 1875. Lat. 7° 25′ S., long. 152° 15′ W. Depth, 2750 fathoms; bottom temperature, 0·9° C.; radiolarian ooze. One incomplete specimen.

The only individual which has been brought home is, unfortunately, so defective as to make a detailed examination impossible. The ventral surface is almost flat, while the dorsal is slightly convex, in consequence of which the shape of the body is extremely depressed. The brim is particularly broad at the anterior and posterior extremities of the body, while elsewhere it is only visible as a more or less distinct edge along each side of the ventral surface. In consequence of the considerable breadth of the brim anteriorly, that extremity of the body presents almost a circular, discoidal appearance with the mouth and tentacles in the centre. The broad, thin part of the brim behind the anus has almost the appearance of a fin, the rays of

[1] ψυχρός = cold.

which are represented by fine canals, which connect the minute pedicels round the edge of the brim with the lateral ambulacra, and consequently penetrate the brim in its breadth. On account of the macerated condition of the perisoma, I have not been able to distinguish the anal aperture which has probably a ventral position, since no traces of it are visible on the dorsal surface. The papillæ of the terminal part of the tentacles, about twenty in number, resemble low ridges placed so as to lie from the edge towards the centre. As a portion of the ventral perisoma is torn off I am somewhat uncertain whether the odd ambulacrum is totally destitute of pedicels or not. The brim which surrounds the body carries on its edge a number of small scarcely distinguishable processes or pedicels, which by means of fine connecting canals are in communication with the ambulacral system; those canals are very obvious at both extremities of the body. Both of the dorsal processes are very minute, only one millimeter in length. The ventral surface seems to be almost destitute of calcareous bodies, while the dorsal one as well as the brim contain an abundance of slightly crowded four-armed, cruciform deposits (Pl. XXXV. fig. 12), the largest of which have their arms about 0·3 mm. long. The stems of the tentacles are strengthened by long, rather straight and large spicula, which lie transversely as well as longitudinally, the tentacles themselves thus becoming incapable of contraction (Pl. XLIV. fig. 1); the terminal part contains small spicula situated between the papilla, and like them directed from the periphery towards the centre.

Euphronides,[1] n. gen.

Body very thin and depressed, with the brim, especially round its anterior and posterior extremities, rather broad. Mouth and anus ventral, at some distances from the ends of the body. Tentacles eighteen. Pedicels arranged in a single row round the edge of the brim and in a double one along the odd ambulacrum. The dorsal surface with a few pairs of more or less minute processes, and with a large conical appendage crossing the odd interambulacrum at a considerable distance from its posterior extremity.

Euphronides depressa, n. sp. (Pl. XXVI.).

Body elongated, of almost equal breadth throughout, about thrice as long as broad. Tentacles almost equally large; their dilated terminal part with small retractile processes especially round the edge. The dorsal surface with four pairs of small processes arranged in its anterior half; the azygous large conical appendage situated at a distance of about 45 mm. from the posterior extremity of the body. Integument rough, thin, and transparent, with two sorts of calcareous deposits: unbranched more or less curved and spinose spicula; and numerous crowded four-armed, cruciform bodies of various dimensions, the arms of which are more or less curved and spinose.

[1] Εὐφρονίδης the son of the Night.

Colour in alcohol, light reddish violet. Length, about 150 mm. Breadth, about 45 mm.

Habitat.—Station V. January 28, 1873. Lat. 35° 47′ N., long. 8° 23′ W. Depth, 1090 fathoms; bottom temperature, 3·1° C.; mud. One individual. Station 300. December 17, 1875. Lat. 33° 42′ S., long. 78° 18′ W. Depth, 1375 fathoms; bottom temperature, 1·5° C.; globigerina ooze. Two specimens.

The above diagnosis as well as the following description are taken from the individual, obtained at Station V. At the end of this description, an account will be added of the differences which distinguish the specimens from Station 300. The body is nearly of an equal breadth throughout or decreases slightly posteriorly, and has its extremities equally truncated and rounded; it is remarkable for its great thinness, the dorsal and ventral surfaces being only slightly convex. The flat brim is of considerable breadth round the anterior and posterior extremities of the body, its edge being undulated, and as if it were lobed anteriorly. The mouth and anus are situated on the ventral surface, the former about 15 mm. from its anterior extremity, and the latter 7 to 10 mm. from the posterior. The eighteen retractile tentacles attain about the same dimensions; their dilated terminal part is contracted, but presents some small processes, which are retracted and seem to be placed round the edge.

The processes of the dorsal surface present a conical form, and are not capable of being retracted; the three first pairs are situated anteriorly and are very small, only from 3 to 5 mm. long; the fourth pair, on the contrary, is considerably larger, its processes measuring up to 15 mm. in length and 9 to 10 mm. in diameter at the base. The first pair is situated at a distance of 35 to 40 mm. from the anterior extremity of the body, while the fourth is placed 55 to 60 mm. from that extremity. The large, azygous, lobe-like appendage has a transverse position, crossing the odd interambulacrum about 45 mm. in front of the posterior end of the body; it reaches 40 mm. in length and its breadth at the base, measuring 16 to 18 mm., is considerably greater than its thickness. The appendage has its top rounded and is penetrated by two wide canals, which are in connection with the dorsal ambulacra. The pedicels or rather processes, which shoot out from the margin of the foremost part of the brim belong doubtless to the dorsal ambulacra; from want of materials it has been impossible to make a closer examination of it, but in other forms, which are closely allied to this species, I have found that to be the case, and it probably should be common to the whole family. The pedicels of the odd ambulacrum are disposed in two alternating rows, thirty-one in the left and thirty-five in the right one, and are small and retractile; the foremost part of that ambulacrum is naked. The pedicels of the lateral ambulacra of the ventral surface are arranged in a single row round the edge of the brim, and are small, retractile, and of a conical form, and often hardly discernible. The perisoma is thin and more or less transparent. The deposits of the ventral integument (Pl. XXXV. fig. 6) are partly made up of more or less

curved simple, slightly spinose, spicula about 0·2 mm. long, partly of three- or four-armed cruciform bodies with the arms slightly curved. On the dorsal surface, which is rather rough, four-armed bodies (Pl. XXXV. fig. 5), of variable shape, are found closely crowded together; their arms are more or less strongly arcuated and spinose, attain a length of 0·24 mm., and give off one or more processes; from the centre of these deposits a long spine runs out which gives the surface of the integument its roughness. The tentacles as well as the pedicels are strengthened by some slightly curved spinose spicula; the latter have no supporting terminal plates.

From want of material I have not been able to examine more closely the calcareous ring; but judging from what I have observed, its structure must be of great interest. The ring seems to be composed of five separate pieces resembling those in the family Elpidiidæ, but instead of a few rods running out in opposite directions, each piece consists in this species of an innumerable number of rods, which anastomose and form a kind of network which becomes most obvious towards the centre of the pieces. In the connective tissue, which surrounds the calcareous ring, a great number of deposits are found resembling in shape those of the ventral perisoma. The polian vesicle is about 20 mm. long. The madreporic canal, which seems to communicate with the exterior by a pore, contains a great number of deposits in the form of irregular unbranched or three- to four-armed, generally strongly spinose spicula. The ambulacral cavities of the small dorsal processes are very minute, while each of the two canals of the azygous appendage communicates with a large slightly curved and branched ambulacral cavity (Pl. XL. fig. 7). The cloaca being very wide fills up the posterior part of the peritoneal cavity, but it has no cæcal prolongation. The reproductive organ (Pl. XLVI. fig. 4), in the female, consists of two unbranched tubes about 32 mm. long, the posterior half of which is enlarged and sacciform, with many tuberculose prominences; the organ opens externally by a pore situated about 25 to 30 mm. behind the anterior extremity of the body.

The individuals from Station 300 are of gigantic size, the largest having a length of about 375 mm., and a breadth anteriorly of from 110 to 120 mm. The mouth is situated 45 to 50 mm. behind the anterior extremity of the body, and the anus about 20 mm. in front of the posterior extremity. The brim is very broad, especially round the anterior and posterior extremities. One of the specimens is of a light grey or somewhat violet colour, the other, on the contrary, is dark violet or rather black. The dorsal ambulacra carry anteriorly only six processes about 5 mm. long, which are indistinctly arranged in pairs. The large azygous appendage situated about 110 mm. from the posterior extremity of the body attains in its contracted state a length of 35 to 40 mm. and a breadth of 25 to 30 mm. at its base; probably it was considerably larger when fully extended. At the top of the appendage two small papillæ are distinguishable which are in communication with the two canals. The calcareous bodies, which are of the same shape as those in the

specimen from Station V., seem to be more thinly scattered, especially on the ventral surface; their central process is not smooth, but usually provided with some spines and its top is generally bipartite. Only once have I found a minute wheel resembling those in *Lætmogone*, but this has probably been torn off from another animal, and has accidentally stuck to the rough integument of the individual under examination. The cloaca is far from being as large as in the individual from Station V. The reproductive organ is very large, attains a length of 125 mm., and resembles exactly in form the one above described; each of its posterior sacciform portions measures 55 to 60 mm. in length and 16 mm. in breadth, and is furnished with round tuberculose protuberances, thus having almost the shape of a spike of maize. The walls of the reproductive organ are strengthened, as is the case with the individual from Station V., by three- or four-armed deposits, with the arms spinose and slightly curved.

Psychropotes,[1] n. gen.

Body gradually decreasing in height forwards, its foremost part being rather thin and depressed; the brim rather broad anteriorly. Mouth and anus ventral, situated at greater or smaller distances from the extremities of the body. Tentacles ten to eighteen. Pedicels arranged in a single row round the brim of the body and in a double one along the odd ambulacrum. The dorsal surface with a smaller number of more or less minute processes, and with a large, broad and flat appendage, crossing the odd interambulacrum posteriorly.

Psychropotes longicauda, n. sp. (Pl. XXVII. fig. 1, and Pl. XXVIII.).

Body elongated, from four to five times as long as broad; its height decreasing gradually forwards and its breadth slightly narrowing backwards. Tentacles eighteen, almost equally large; their large discoidal terminal part with about sixteen small retractile processes round its edge. The dorsal surface with about five pairs of minute processes anteriorly; its very large, flat appendage situated near the posterior extremity of the body. Integument rather thick and soft, with four-armed, cruciform calcareous deposits, the arms of which are partly almost straight, slender, and provided with long spines, partly more or less curved, stronger and giving off shorter spines.

Colour in alcohol greyish violet, the ventral surface brownish. Length, about 140 to 150 mm. Breadth, about 55 mm.

Habitat.—Station 156. February 26, 1874. Lat. 62° 26′ S., long. 95° 44′ E. Depth, 1975 fathoms; diatom ooze. One specimen. Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. Two specimens. Station

[1] Ψυχρός = cold.

298. November 17, 1875. Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. One specimen.

The body is 140 to 145 mm. long and reaches its greatest breadth, about 55 mm., anteriorly at the mouth or immediately behind it; it tapers slightly backwards. The height of the body decreases gradually forwards so that its anterior, nearly semi-circular end becomes rather thin and discoidal, and presents the aspect of a distinct head-part. The ventral surface is completely flat, while the dorsal, on the contrary, is convex. Another slightly smaller individual obtained at the same station (157) has its body very much swollen and almost ovate on account of the great quantity of Diatomaceæ, &c., which fills up the alimentary canal. The mouth is placed almost 25 mm. from the anterior extremity of the body, being thus situated in the centre of the anterior, flat, discoidal part of the under surface. The large anus is ventral, and is placed 10 mm. in front of the posterior extremity of the body. The odd ambulacrum is in connection with a number of small, round, retractile pedicels which are close set and disposed in an indistinctly alternating double row. The pedicels on the edge of the brim, which surrounds the body, are numerous and minute; excepting the anterior ones, which communicate with the dorsal ambulacra, all these pedicels belong to the ventral lateral ambulacra. The back is furnished with five pairs of very minute processes, of which the first is almost inconspicuous, and situated 45 mm. behind the anterior extremity of the body, while the last slightly larger pair is 75 mm. to 80 mm. distant from that extremity. The enormous dorsal appendage which arises 10 to 15 mm. from the posterior extremity of the body attains a length of 110 to 120 mm., and is almost of an equal breadth throughout, 30 to 35 mm., or slightly tapering towards the free end; it is flat, about 10 mm. thick, and forms a more or less distinct edge along each side. The rounded terminal part of the appendage is provided with two processes, of which the one is extended and digitiform, and measures 5 to 6 mm. in length. Those processes communicate with two wide canals, which penetrate the appendage in its length and open into the dorsal ambulacra (Pl. XXXVII. fig. 10). The eighteen tentacles are almost of equal size, or the ventral ones slightly smaller; their large discoidal convex end carries round the edge about sixteen small, simple, retractile processes.

The perisoma is rather thick, and contains deposits in the form of four-armed cruciform bodies of various dimensions. The deposits in the outer layer of the dorsal integument (Pl. XXXV. fig. 13) are closely crowded, with their arms rather arcuated, and supplied with a number of strong, short spines directed outwards; the largest deposits have their arms 0·4 mm. to 0·24 mm. long, while those of the smallest reach only 0·06 mm. in length. The calcareous bodies of the inner layer of the dorsal integument (Pl. XXXV. fig. 14) are remarkable for having their arms very slender, almost straight, and giving off very long and narrow spines in all directions. The deposits of the ventral surface (Pl. XXXV. fig. 16) do not lie so close set, and are commonly smaller and of a

very irregular shape, being all more or less strongly spinose; the largest ones, having their arms 0·24 mm. to 0·16 mm. in length, are much scattered in comparison with the smaller ones, the arms of which only attain to 0·08 mm. In the ventral perisoma I have found, besides the four-armed form, three-armed bodies as well as simple arcuate spicula. The pedicels (Pl. XXXV. fig. 17) are strengthened only by a few spinose spicula, and the tentacles (Pl. XXXV. fig. 15) by a number of short, thick, more or less curved ones which are very poor in spines.

The calcareous ring appears to consist of a very fragile network, which, as far as I can determine, does not form a continuous ring, but is made up of five separate pieces; from want of materials I have not been able to make a closer examination. The polian vesicle is narrow, cylindrical, and attains a length of 45 mm. The madreporic canal opens externally by three pores situated close in front of the genital pore; it is supported by a great number of closely-crowded deposits resembling those of the inner layer of the integument though of a rather more irregular shape. The cloaca is considerable, without any cæcal prolongation. The reproductive organ consists of two very wide tubes, 35 to 40 mm. long, one on each side of the dorsal mesentery; each tube carries in its posterior half a small number of large, oval cæcal sacks, about 5 mm. long, which are either simple or show a tendency to dichotomous branching. The genital pore is situated 45 mm. in front of the posterior extremity of the body.

The specimen dredged at Station 156, from a depth of 1975 fathoms, seems to bear the strongest resemblance to this species. The length of its body is 80 to 85 mm., and the dorsal appendage, which measures 80 mm., does not terminate in the same manner as in the typical form, but tapers to a point which communicates with the left of the two canals; the right canal terminates inconspicuously near the point just mentioned. The terminal part of the appendages appears in general to change its form in the very same species. The back has only four pairs of minute processes. The integument is very rough.

Concerning the specimen from Station 298 I feel somewhat uncertain whether it ought to be considered as belonging to this species or not. Its body attains the gigantic length of 260 mm. and the dorsal appendage measures 150 mm. The calcareous substance of the integument is completely dissolved. Each of the dorsal ambulacra possesses only a couple of minute processes.

Psychropotes longicauda, var. *monstrosa*, n. (Pl. XXIX. fig. 2, and Pl. XXX.).

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. One specimen.

The general appearance of the body closely resembles that of *Psychropotes longicauda* wherefore I only intend to point out the insignificant characters which distinguish them from one another. The animal, of a dirty brown colour, reaches an enormous size, its length being about 250 mm., and its greatest breadth about 95 mm.; the body narrows

slightly backwards, so that the breadth at its rounded posterior extremity is about 60 mm. As the height of the body decreases gradually forwards, the anterior broadest portion becomes flat and almost discoidal. The left ambulacrum of the dorsal surface carries only five very minute processes, while the right one is provided with seven ; all of them are usually so small that they are scarcely distinguishable. The large dorsal appendage attains a length of 110 mm., being thus comparatively shorter than in *Psychropotes longicauda*. The brim, which is of considerable breadth, especially round the anterior extremity of the body, has the appearance of being lobed in consequence of the great number of large pedicels or processes which proceed from its edge. These pedicels communicate with longer or shorter, very wide canals, which in their turn open into the ambulacral vessels; the first eighteen pedicels or rather processes are connected with the dorsal ambulacra, while the rest of them belongs to the ventral-lateral ambulacra (Pl. XXXIX. fig. 1).

The calcareous bodies bear the strongest resemblance to those of the species just mentioned, though they seem to be more dispersed especially on the ventral surface; besides, I have not been able to observe the deposits of the inner layer of the integument, and if such are present they must be extremely thinly scattered. On the contrary, I have found in the connective tissue of the integument abundance of pigment of a yellowish-brown colour.

The cæcal sacks which constitute the reproductive organ are large, more or less distinctly rounded and about 12 mm. in diameter, being thus several times larger than in *Psychropotes longicauda*.

The above summary description proves that this form is closely allied to the preceding one; the only differences to be found are the size of the body, the proportion between the length of the body and that of the dorsal appendage, the number of dorsal processes, and the presence or absence of deposits in the inner layer of the integument.

Psychropotes longicauda, var. *fusco-purpurea*, n. (Pl. XXIX. fig. 1).

Habitat.—Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. Two specimens.

The largest of the two individuals which were brought home measures 200 mm. in length and 77 mm. in breadth. This variety differs from the preceding forms by the following characteristics :—(1.) The colour is dark violet, almost black, with darker bands along the dorsal ambulacra. (2.) The dorsal appendage, 65 mm. long in the largest specimen, is smaller in proportion to the size of the body, and its obtuse end wants the digitiform processes; its left canal decreases more perceptibly upwards than the right one, and does not reach the top of the appendage. (3.) The minute processes of the dorsal surface are arranged in four pairs. (4.) The deposits do not present so great a variation in dimensions as in the preceding forms; their four slightly curved and spinose arms, measuring in length about 0·1 mm., carry a couple of larger outwardly directed spines, and the centre, where the arms are united, gives off an obtuse, short process (Pl. XXXV. fig. 11).

Psychropotes loveni, n. sp. (Pl. XXVII. figs. 2–4).

Body depressed, decreasing in height towards each extremity, of almost equal breadth throughout, from twice to twice and a half as long as broad. Tentacles ten, almost equally large; their terminal part contracted and destitute of visible processes. The dorsal surface with a pair of minute conical processes placed a little in front of its middle; its hindmost part prolonged into the large flat transverse appendage, the broad truncated top of which is provided with two short processes. Integument thin and transparent, with numerous cruciform calcareous deposits resembling those of the preceding species.

Colour in alcohol light violet; pedicels, especially those of the odd ambulacrum, tentacles, and the oral disk darker, almost blackish violet. Length, about 45 to 50 mm. Breadth, about 15 to 20 mm.

Habitat.—Station 146. December 29, 1873. Lat. 46° 46′ S., long. 45° 31′ E. Depth, 1375 fathoms; bottom temperature, 1·5° C.; globigerina ooze. One individual.

The ventral surface is flat and the dorsal one slightly convex, so that the body is very depressed; the height decreases backwards but especially forwards. The terminal part of the tentacles is contracted, so that no processes are distinguishable. The mouth and anus are situated on the ventral surface, the former 8 to 10 mm. behind its anterior extremity and the latter immediately in front of its posterior end. The pedicels are minute, and their arrangement resembles that of the preceding species. The two small conical processes in the middle of the back attain a length of only 1 to 2 mm. The large, thin dorsal appendage is at its base of the same breadth as the body itself, and its broad truncated end gives off on each side a short conical process.

The rather thin and transparent integument is supported by numerous calcareous deposits (Pl. XXXV. fig. 2), of about the same shape as those of *Psychropotes longicauda*; the arms of those deposits are usually provided with only one very long process and a few minute ones, and their length varies greatly, from 0·26 mm. to much less. The four-armed deposits of the inner layer of the perisoma (Pl. XXXV. fig. 3) are partly very slender and furnished with long spines, and partly almost smooth, and only supplied with a single central process. The deposits of the ventral surface (Pl. XXXV. fig. 1) give off a small central process, and their more or less curved arms carry some minute spines at their ends. The pedicels are almost destitute of spicula or possess only a few, while the tentacles are strengthened by many larger and smaller ones which are unbranched.

Psychropotes semperiana, n. sp.

Body elongated, about four times longer than broad. Tentacles sixteen, of nearly equal size, their large discoidal terminal part with small retractile processes especially round its edge. The dorsal surface with three pairs of small processes; its large broad and thin

appendage situated 30 to 40 mm. from the posterior extremity of the body. Integument with numerous crowded calcareous deposits of almost the same cruciform shape as those of the preceding species.

Colour in alcohol, dark violet; the ventral surface darker; tentacles light. Length, about 130 to 140 mm. Breadth, about 35 mm.

Habitat.—Station 101. August 19, 1873. Lat. 5° 48′ N., long. 14° 20′ W. Depth, 2500 fathoms; bottom temperature, 1·7° C.; mud. One rather incomplete specimen. Station 133. October 11, 1873. Lat. 35° 41′ S., long. 20° 55′ W. Depth, 1900 fathoms; bottom temperature, 1·3° C.; globigerina ooze. One specimen.

As far as regards the shape of the body this species seems to bear the strongest resemblance to the preceding ones which are characterised by having a large dorsal azygous appendage. As the specimens are rather incomplete, a more detailed examination is impossible. The mouth is as usually placed on the ventral surface, about 15 mm. behind its anterior extremity, and the anus is situated from 10 to 12 mm. in front of the posterior end. The sixteen tentacles are almost of an equal size, the ventral ones slightly smaller, and their large, discoidal, terminal part is furnished with some minute retractile processes which are present especially round the edge. Each of the dorsal ambulacra sends out three minute processes, 3 mm. long, which are arranged in pairs, the first of which is situated about 40 mm., the second about 45 mm., and the third about 70 mm. from the anterior extremity of the body. The large transverse dorsal appendage has its free end rounded, and arises 30 to 40 mm. in front of the posterior extremity of the body, thus being situated at a greater distance from that extremity than is the case in other forms of this genus. The deposits (Pl. XXXIV. fig. 10) of the integument are rather irregular and are composed of four, rarely three or five, arms; they vary considerably in size, some having their arms 0·16 mm. long, others only 0·06 mm. The top of the central process of those deposits is sometimes simple, sometimes bipartite or tripartite. The deposits of the ventral surface (Pl. XXXIV. fig. 11) consist of simple spicula or irregular three- or four-armed spinose bodies. The tentacles are supported by numerous, small, simple, curved or straight spinose spicula.

The polian vesicle has a cylindrical form and reaches a length of 25 to 30 mm. The madreporic canal opens externally by three pores, far distant from one another, and situated a little in front of the genital aperture, which lies at a distance of 35 mm. behind the anterior extremity of the body. The madreporic canal is strengthened by numerous three- or four-armed spinose deposits, resembling those of the integument though more irregular. The reproductive organ consists of two wide tubes, 35 to 40 mm. long, the posterior half of which is strongly dilated, sacciform, with a diameter of about 12 mm., and provided with a great many tuberculose protuberances or rather cæca; consequently the organ bears a strong resemblance to that of *Euphronides depressa*.

Benthodytes,[1] n. gen.

Body more or less depressed, with the anterior part of its brim rather large. Mouth ventral, at a greater distance from the foremost extremity of the body. Anus posterior, dorsal, usually almost terminal. Tentacles twelve (?) to twenty. Pedicels arranged in a single row round the brim of the body and in a double one along the odd ambulacrum. The dorsal surface seldom naked, commonly with a greater or smaller number of retractile or non-retractile, more or less inconsiderable processes, arranged in a single row all along each ambulacrum or in an irregular double row, or scattered over the lateral interambulacra.

Benthodytes papillifera, n. sp.

Body elongated, of an almost oval form, about thrice as long as broad. Tentacles twenty; some of the ventral ones slightly smaller than the others; their dilated terminal part with small retractile processes round the edge. The dorsal surface destitute of processes (?). Integument rather thick and soft with numerous conical papillæ, crowded all over the back; calcareous deposits in the form of more or less straight, spinose or almost smooth spicula.

Colour in alcohol blackish violet on the ventral surface, and rather light violet on the back; the thin brim surrounding the body is striated by lighter and darker bands. Length, about 150 mm. Breadth, about 50 mm.

Habitat.—Station 184. August 29, 1874. Lat. 12° 8′ S., long. 145° 10′ E. Depth, 1400 fathoms.; bottom temperature, 1·8° C.; grey ooze. Four very incomplete and macerated specimens. Station 300. December 17, 1875. Lat. 33° 42′ S., long. 78° 18′ W. Depth, 1375 fathoms; bottom temperature, 1·5° C.; globigerina ooze. Five specimens. Station 271. September 6, 1875. Lat. 0° 33′ S., long 151° 34′ W. Depth, 2425 fathoms, bottom temperature, 1·0° C.; globigerina ooze. Four rather macerated individuals.

The body is more depressed than in the preceding genus and its brim is rather broad. The tentacles, pedicels, &c., closely resemble those of *Benthodytes sanguinolenta*. The wide canals which belong to the lateral pedicels are plainly to be seen through the brim. A transverse row of small papilla-like prominences is present on the ventral surface immediately behind the crown of tentacles. The back seems to be destitute of processes, but if there are any which have escaped my notice, they ought to be situated in its most anterior part. The whole dorsal surface is, on the contrary, covered with closely crowded, small, conical papillæ, which do not communicate with the ambulacral system, but must be considered as prominences of the integument. Each papilla appears to contain one or more calcareous spicula (Pl. XXXIV. fig. 14), of which one always shoots out beyond

[1] Βένθος = depths of the sea.

the top; those spicula are sometimes spinose, sometimes almost smooth, and attain a length of about 0·44 mm. The pedicels of the odd ambulacrum are strengthened by more curved and transversely directed spicula. No other forms of deposit have been observed.

The calcareous ring consists of a fragile network, without any distinct radial and interradial pieces. The madreporic canal does not communicate with the exterior, but terminates in a large, almost globular, madreporic plate or tubercle, made up of a strong network, and which is intimately attached to the inside of the perisoma close to the reproductive pore. The walls of the madreporic canal are supported by rather straight and spinose spicula. The reproductive organ is composed of two smaller fascicles 35 mm. long, each made up of small bundles of dichotomous, elongated, minute cæca; the organ opens 20 to 30 mm. behind the anterior extremity of the body.

The specimens obtained at Station 184 are very macerated and in such an incomplete state as to render examination impossible. In one example I thought I could distinguish some small dorsal processes anteriorly, and in another specimen there were only nineteen tentacles to be found. The four individuals dredged at Station 271 do not quite agree with the typical forms; their body is of a sea-green colour, which inclines to red on the ventral surface; the inside of the body-wall is, on the contrary, of a dark reddish violet; the shape of their body is broader and considerably higher than in the typical forms; all deposits are destroyed.

Benthodytes typica, n. sp. (Pl. XXVII. fig. 7).

Body more or less depressed, oval, from once and a half to twice as long as broad; its brim very broad. Tentacles twenty, retractile; some of them being slightly smaller than the others; their dilated terminal part provided with small retractile processes round its edge. Each of the dorsal ambulacra with a few, about eight, very minute, completely retractile processes. Integument rather thick, soft, and transparent, with scattered, more or less curved, unbranched, and spinose calcareous spicula.

Colour in alcohol light bluish, the ventral surface blood-red or purple; the five yellow muscular bands, the deep red ambulacral vessels, and the purple circular muscular layer are conspicuous through the integument; the canals, which belong to the minute pedicels situated round the brim, present the aspect of deep reddish bands which radiate towards the circumference of the body; the ends of the tentacles are yellowish-brown. Length, about 80 mm. Breadth, about 45 mm.

Habitat.—Station V. January 28, 1873. Lat. 35° 47′ N., long. 8° 23′ W. Depth, 1090 fathoms; bottom temperature, 3·1° C.; mud. Numerous more or less macerated individuals.

The body is of an oval form decreasing evenly towards each of its rounded extremities. As will be seen from the above measurements, its greatest breadth almost approaches half of its length, but from the drawings which have been taken of fresh animals

dredged during the Challenger expedition, the breadth must have been much greater. When fully extended the body appears to be rather depressed, and its broad surrounding brim very thin, especially towards its edge. Here and there a tentacle is found slightly smaller than the others; the terminal part itself as well as its processes are covered with some minute prominences. The pedicels of the odd ambulacrum, about sixty in number, are minute and closely crowded together. The brim, which in some more extended individuals is even as broad as the body itself, is penetrated by a great number of closely-lying canals, which connect the ambulacral system with the minute conical pedicels round the edge. Those canals are plainly visible through the integument in consequence of their walls being of a dark purple colour. The dorsal processes (Pl. XLIV. fig. 8) are very minute and completely retractile; their number does not seem to exceed eight along each ambulacrum. When the body is contracted the thick dorsal perisoma forms large rounded lobes separated from one another by funnel-shaped hollows at the bottom of which the processes are to be found.

The calcareous deposits (Pl. XXXV. fig. 4) of the integument are rather scattered and consist of more or less curved unbranched and spinose spicula. The tentacles, processes, and pedicels contain also spicula of about the same shape.

The polian vesicle attains a length of from 20 to 25 mm. The madreporic canal opens externally immediately in front of the genital aperture; its walls are strengthened by a calcareous network, and by spicula (Pl. XXXVIII. fig. 5). The very narrow part of that canal which pierces the body-wall is destitute of deposits excepting its uppermost part close to the "pore," which is surrounded by a minute network. The cloaca is of considerable size. The calcareous ring seems to consist of a very fragile irregular network, the true form of which I have not been able to study. The reproductive organ consists of two small, thin fascicles, each composed of a few larger and smaller sometimes rather long cæca; the organ opens from10 to 15 mm. behind the anterior extremity of the body.

Benthodytes sanguinolenta, n. sp. (Pl. XXIII.).

Body elongated, more or less cylindrical, six to seven times longer than broad. Tentacles eighteen, with their dilated terminal part provided with small retractile digitiform processes round its edge. The dorsal surface with a great many very minute, completely retractile processes, scattered over the lateral interambulacra; the odd interambulacrum naked or with a few such processes. Integument thin and pliable; its calcareous deposits dissolved.

Colour in alcohol red, inclining to violet; the back lighter excepting its processes, which are of a darker colour. Length of the largest specimen, about 340 mm. Breadth, about 50 mm.

Habitat.—Station 298. November 17, 1875. Lat. 34° 7′ S., long 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. Three specimens.

Station 295. November 5, 1875. Lat. 38° 7′ S., long. 94° 4′ W. Depth, 1500 fathoms; bottom temperature, 1·4° C.; red clay. One specimen.

The body has an almost cylindrical form or tapers slightly backwards, and its foremost part is very much depressed and thin. The ventral surface is flat or inconsiderably convex, while the dorsal one is strongly so. The oral aperture is 25 to 30 mm. distant from the anterior extremity of the body. The ventral tentacles are a little smaller than the others. As is usual in this family the pedicels or processes round the sides of the body have a conical form, and reach greater dimensions than the minute cylindrical ones, which belong to the odd ambulacrum. The pedicels round the body may be estimated at about one hundred and forty or two hundred, while the number of those on the odd ambulacrum seems to be from seventy to a hundred. Immediately behind the ventral tentacles a transverse row of small papilla-like prominences is to be seen. The dorsal surface possesses a great many minute completely retractile prominences or processes, which closely resemble pedicels, and are scattered along the ambulacra as well as on the lateral interambulacra, while few or none are to be found on the odd interambulacrum (Pl. XLII. fig. 6). These processes are visible to the naked eye as small dark specks. The integument is rather thin and soft, and as its calcareous deposits are completely dissolved, I have not been able to distinguish their form.

The Polian vesicle presents a cylindrical form, and reaches a length of 35 mm. (Pl. XL. fig. 5). The madreporic canal does not seem to open exteriorly, but terminates in a madreporic plate or tubercle, which is attached to the inside of the body-wall, consequently the ambulacral system communicates with the peritoneal cavity; once I thought I could observe that the madreporic canal gave off a fine branch piercing the perisoma, but I am by no means sure of it. The calcareous matter being entirely dissolved, no traces of deposits are to be found in the walls of the water-vascular system. The cloaca is not very greatly developed. The intestine gives off a large, cæcal prolongation or diverticulum (Pl. XL. fig. 4), 15 mm. long, which communicates with the interior of the alimentary canal, and is situated at a distance of about 170 mm. from the anal aperture. All the individuals obtained are males; their reproductive organ is often very long, about 180 mm., and consists of two fascicles, each made up of a long wide tube which carries numerous small bundles of oval or round, more or less inconsiderable, cæca. The common duct of the genital organ opens by a pore situated about 50 mm. behind the anterior extremity of the body.

Benthodytes sanguinolenta, var. *marginata*, n. (Pl. XXV. fig. 2).

Habitat.—Station 158. March 7, 1874. Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fathoms; bottom temperature, 0·3° C.; globigerina ooze. One specimen. Station 160. March 13, 1874. Lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms; bottom temperature 0·2° C; red clay. Four specimens.

This animal bears so strong a resemblance to *Benthodytes sanguinolenta* that I am undecided as to whether I am authorised in referring it to a variety or not. The characteristics which distinguish them from one another seem to be of very little importance. The specimens at my disposal are, however, in such a state of maceration and incompleteness as to make a closer examination impossible, all traces of calcareous matter being completely dissolved. The largest specimen reaches a length of 260 to 270 mm. and a breadth of about 40 to 45 mm. In some individuals the brim round the body is much more considerable and distinct than in others. The head-part of the body is rather depressed. The large discoidal terminal part of the tentacles as well as its retractile processes are covered with small papillæ; three to four of the ventral tentacles are considerably smaller than the others. The odd ambulacrum is provided with about a hundred small cylindrical pedicels; its foremost and hindmost parts however have none. The papilla-like prominences or pedicels round the brim are minute, and estimated in number at about two hundred in all; the canals which connect them with the ambulacral system are wide, and are plainly visible in consequence of their walls being full of a dark pigment (Pl. XL. fig. 8). The dorsal ambulacra give off a great abundance of longer and shorter canals which run into a corresponding number of minute thread-like completely retractile processes (Pl. XL. fig. 6); these processes are scattered all over the lateral interambulacra and also over those parts of the odd interambulacrum which border on both of the dorsal ambulacra. The integument is very much macerated, and presents only very indistinct traces of four-armed deposits, of which the calcareous substances have been almost entirely dissolved. The pedicels and tentacles are strengthened by small transverse spicula. The colour is light grey inclining to blue or violet; the tentacles as well as the integument surrounding the mouth and along the middle of the ventral surface are of a dark violet almost black. All the interior organs closely resemble those of *Benthodytes sanguinolenta*, excepting the reproductive organ, which is smaller, from 110 to 120 mm. in length in the largest specimens, and much thinner; each of its fascicles is composed of a long, wide canal carrying a small number of thin bundles of cæca, which are long and thread-like in the females and oval and much shorter in the males.

Benthodytes abyssicola, n. sp.

Body elongated, almost cylindrical, six to seven times as long as broad. Tentacles fifteen, with their large discoidal terminal part provided with about twelve digitiform retractile processes round its edge. Each of the dorsal ambulacra with about eight to ten minute scattered processes. Integument rather thin and pliable, with scattered, cruciform calcareous deposits, the calcareous substances of which are completely dissolved.

Colour in alcohol blackish- or brownish-violet, here and there considerably lighter; in some individuals the coloration is uniform, light dirty violet. Length, about 280 mm. Breadth, about 40 mm.

Habitat.—Station 298. November 17, 1875. Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. Several specimens.

Among the specimens, which have been dredged at the above-mentioned station only a single one is completely extended and presents the shape and dimensions which are noted in the diagnosis; all the other individuals are more or less contracted, consequently the form of their body deviates in some degree from that above described. The ventral surface is nearly flat or slightly convex, and more or less like a sole, while the dorsal one is strongly convex; forwards, but especially backwards, the body is depressed, its hindmost extremity being thus almost flat. The mouth is completely ventral, while the anal aperture is dorsal, situated close above and in front of the hindmost pedicels. The fifteen tentacles are capable of being entirely drawn within the body, and their discoidal end is provided with about twelve small, retractile, digitiform processes which are arranged round its edge. The minute cylindrical pedicels of the odd ambulacrum, from fifty to sixty in number in the largest specimen, are not to be found in the foremost part of the ventral surface. The numerous pedicels round the more or less considerable brim of the body are of a conical form, retractile, and mostly visible as small tubercles; they are much larger than those belonging to the odd ambulacrum. The very thin hindmost portion of the body presents almost the aspect of a fin, on account of the small pedicels round its edge and their wide canals, which communicate with the lateral ambulacra and penetrate it. Immediately behind the ventral tentacles some small papilla-like projections are to be observed, which are indistinctly disposed in a transverse row. The back is provided with minute conical processes, from eight to ten in number, which are scattered along each of its ambulacra, and are often scarcely distinguishable.

The body-wall is thin and soft, and contains scattered cruciform calcareous deposits, the arms of which seem to be more or less spinose, and attain a length of about 0·5 mm. (Pl. XXXVI. fig. 26). Unfortunately, the calcareous substances are mostly dissolved, consequently the true shape of the deposit is scarcely discernible. Here and there some minute round or elliptical grains are to be found within the integument, but their presence ought probably to be ascribed to some foreign matters (Pl. XXXVI. fig. 27).

The calcareous ring is almost totally dissolved, wherefore it has not been possible to examine it. The Polian vesicle is cylindrical, and measures from 35 to 40 mm. The madreporic canal opens exteriorly, partly by a single pore (Pl. XXXVIII. fig. 2), partly by several (Pl. XXXVIII. figs. 1 and 3), which are thus crowded on the obtuse top of a small papilla, situated somewhat in front of the genital pore; when there is only one pore, this seems to be placed side by side with the genital aperture. The madreporic canal is strengthened by a great number of more or less regular and spinose cruciform deposits (Pl. XXXVIII. fig. 4) resembling those of the perisoma. The reproductive-organ (Pl. XLVI. figs. 9–10) consists of two fascicles about 70 mm. long, and its common

efferent duct opens by a pore situated about 45 mm. behind the anterior extremity of the body. In the male the fascicles are very thick and composed of numerous small, oblong dichotomous cæca. The female fascicles, on the contrary, are very thin, each made up of about three branches, which carry one or two unusually large, short and thick, dichotomous cæcal sacs.

Benthodytes sordida, n. sp. (Pl. XXIV.).

Body elongated, slightly tapering towards the extremities, from three and a half to five times as long as broad. Tentacles fifteen; some of the ventral ones smaller than the others; their large discoidal terminal part with numerous retractile processes. Each of the dorsal ambulacra with three rather large conical processes arranged in pairs, and with some smaller ones. Integument soft and rather thin; the calcareous deposits completely dissolved.

Colour in alcohol, dark greyish-brown inclining to blue or violet; the back slightly lighter. Length, about 280 mm. Breadth, about 60–80 mm.

Habitat.—Station 156. February 26, 1874. Lat. 62° 26′ S., long. 95° 44′ E. Depth, 1975 fathoms; diatom ooze. One individual. Station 157. March 3, 1874. Lat. 53° 55′ S., long. 108° 35′ E. Depth, 1950 fathoms; diatom ooze. Four incomplete specimens. Station 158. March 7, 1874. Lat. 50° 1′ S., long. 123° 4′ E. Depth, 1800 fathoms; bottom temperature, 0·3° C.; globigerina ooze. One specimen. Station 298. November 17, 1875. Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. One specimen.

The elongated body appears to reach its greatest width at the middle, and becomes gradually depressed anteriorly and posteriorly. The dorsal surface is strongly convex, while the ventral is slightly so or almost flat. Anteriorly the width of the body decreases, so as to form a narrower neck-like portion immediately behind the considerably broader round and flat head-part. The mouth is situated on the ventral surface in the centre of the large discoidal head. Among the fifteen tentacles some of the ventral ones are slightly smaller; their large, discoidal ends have a diameter of up to 12 mm. and carry numerous retractile processes covered with some small papillæ. The pedicels round the body, of which the foremost ones belong to the dorsal ambulacra, while all the others communicate with the lateral ventral ambulacra, present the aspect of larger and smaller protuberances round the edge of the brim. The pedicels of the odd ambulacrum resemble minute round warts with a diameter of about 3 mm. The three pairs of larger dorsal processes are thus arranged: the first one at the first fourth of the body, the second in its middle, and the third at the third fourth of the body. These processes attain a length of about 15 mm., and the circumference at their base is rather considerable. Besides these, some minute processes are scattered over both of the ambulacra, the number of which I have not been able to determine.

The calcareous deposits of the rather firm perisoma are completely dissolved; however, I believe their shape to resemble that of the deposits of *Benthodytes abyssicola*, to which this species is closely allied.

The Polian vesicle is sacciform, about 60 mm. long. The madreporic canal communicates with the surrounding medium by pores, which lie close together about 60 mm. behind the anterior extremity of the body; its walls are strengthened by numerous deposits of the same form as those in the above-mentioned species. The cloaca is elongated and attached to the inside of the body-wall by means of numerous threads and bands. The reproductive organ of the female bears a strong resemblance to that of *Benthodytes abyssicola*, though its cæca attain uncommonly great dimensions, their length being from 15 to 20 mm. and their diameter about 8 mm. Each of the two fascicles which constitute the organ is composed of a tube which carries throughout the whole of its length from eight to twelve short branches, each terminating in one or two enormous dichotomous cæca; sometimes the branches are so short that the cæca seem to proceed directly from the tubes. The aperture of the genital organ lies close to the pores of the madreporic canal.

Thus, this form differs from the closely-allied *Benthodytes abyssicola* by the very broad and thin brim round its head, by the large size and the arrangement of its dorsal processes, &c. The individual dredged at Station 158 is in such a state of contraction as to make a closer knowledge of its outer form impossible; its colour is of a blackish-violet.

The specimens which are brought home from Station 157 are males, consequently their reproductive organ differs in some degree from the one above described; each of their fascicles consists of a great many bundles of numerous small, elongated, dichotomous cæca. The colour is blackish-violet. Besides the larger processes above mentioned, the dorsal ambulacra carry five pairs of smaller ones placed in the anterior part of the back.

Benthodytes mamillifera, n. sp. (Pl. XXV. fig. 1).

Body elongated, of almost equal breadth, from four to five times as long as broad. Tentacles fifteen; some of the ventral ones smaller than the others; their large discoidal terminal part with small tuberous prominences round its edge. The dorsal surface with numerous, short, non-retractile conical processes, disposed in a more or less distinctly alternating double row all along each of its ambulacra. Integument rather thick; its calcareous deposits fully dissolved.

Colour in alcohol violet, more or less inclining to red or blue; the back lighter, with its processes almost white; the ventral surface dark violet; tentacles lighter, with brownish terminal parts. Length, about 235 mm. Breadth, about 50 mm.

Habitat.—Station 295. November 5, 1875. Lat. 38° 7′ S., long 94° 4′ W. Depth,

1500 fathoms; bottom temperature, 1·4° C.; red clay. One specimen. Station 298. November 17, 1875. Lat. 34° 7′ S., long. 73° 56′ W. Depth, 2225 fathoms; bottom temperature, 1·3° C.; grey mud. One specimen. Station 299. December 14, 1875. Lat. 33° 31′ S., long 74° 43′ W. Depth, 2160 fathoms; bottom temperature, 1·1° C.; grey mud. Eight specimens.

The body is rather depressed, especially at the ends. In some individuals only fourteen tentacles are to be found; the fifteenth is probably torn off, which must be ascribed to the macerated and incomplete state of the preserved specimens. Some of the ventral tentacles are smaller than the others; the large discoidal terminal parts are very much contracted and present small protuberances round their edges. The pedicels of the odd ambulacrum are minute, and when retracted scarcely discernible exteriorly. The pedicels round the brim are very numerous, and present the aspect of small round or conical prominences. Each of the dorsal ambulacra is provided with about forty small conical processes which are disposed in a more or less distinctly alternate longitudinal double row; the circumference of these processes at their base is pretty large, but they do not reach more than from 5 to 6 mm. in length.

The calcareous substances of the deposits of the somewhat thick perisoma are totally dissolved; in the tentacles alone some traces of spicula have been discovered. The strongly developed connective tissue is full of a reddish pigment, which is partly aggregated, partly arranged in fine and long branched threads, which in some places form clews and bear a strong resemblance to fine vessels.

The elongated Polian vesicle attains a length of from 30 to 35 mm. The hindmost portion of the intestine is dilated into a cloaca, which, however, in accordance with the state of most of the forms of this genus, does not send out any cæcal prolongation. The madreporic canal seems to open exteriorly, though I sometimes feel uncertain concerning it. The reproductive organ is composed of two small fascicles 35 mm. long, each made up of a number of bundles of elongated dichotomous cæca; its aperture is situated about 25 mm. distant from the anterior extremity of the body.

The individuals dredged at Stations 295 and 298 are of a considerably lighter colour, and the one which has been brought home from the latter station being a female, has the cæca of the genital organ more or less globular.

Benthodytes selenkiana, n. sp. (Pl. XXVII. figs. 5, 6).

Body depressed, of almost equal breadth, about twice to thrice as long as broad. Tentacles twelve (?), retracted within the mouth. The dorsal surface with small conical, not retractile processes, disposed in a more or less irregular double row all along each of its ambulacra. Integument rather thick and leathery, with four-armed deposits, the calcareous substances of which are fully dissolved.

Colour in alcohol, dirty brown. Length, about 125 mm. Breadth, about 45 mm.

Habitat.—Station 274. September 11, 1875. Lat. 7° 25′ S., long. 152° 15′ W. Depth, 2750 fathoms; bottom temperature, 0·9° C.; radiolarian ooze. One individual.

The mouth is situated 20 mm. behind the anterior extremity of the body. The pedicels of the odd ambulacrum are from thirty to forty in number. The dorsal processes, from 3 to 4 mm. long, do not seem capable of being retracted, and are disposed twenty-three along the left ambulacrum, and about twenty-one along the right one.

The calcareous deposits of the integument are entirely dissolved, but to judge from the remaining membranes which surround them, they ought evidently to have been four- or three-armed bodies. The madreporic canal seems to pierce the body-wall. The Polian vesicle is single. The cloaca is rather considerable. The reproductive organ, about 30 mm. long, consists of two fascicles of very small, slightly elongated dichotomous cæca; its aperture is situated from 28 to 30 mm. behind the anterior extremity of the body.

Tabular view of the Species of the Genus *Benthodytes*.

I. Tentacles twenty.
- A. Integument with numerous crowded papillæ on the back; no dorsal processes (?), ... } *Benthodytes papillifera.*
- B. Integument without papillæ; about eight minute processes arranged along each of the dorsal ambulacra, ... } *Benthodytes typica.*

II. Tentacles eighteen; dorsal processes numerous, minute and retractile, scattered over the lateral interambulacra, ... } *Benthodytes sanguinolenta.*

III. Tentacles fifteen.
- A. Dorsal processes arranged in a single row along each ambulacrum—
  - *a.* All dorsal processes minute, ... *Benthodytes abyssicola.*
  - *b.* Three pairs of the dorsal processes comparatively large, . *Benthodytes sordida.*
- B. Dorsal processes arranged in an irregular double row along each ambulacrum, - . . . . . } *Benthodytes mamillifera.*

IV. Tentacles twelve (?); dorsal processes arranged in an irregular double row along each ambulacrum, ... } *Benthodytes selenkiana.*

ANATOMY OF THE ELASIPODA.

External Characters.

The order Elasipoda is distinguished from all hitherto known Holothurioidea by a great number of external characters. In most cases the general appearance makes confusion between the forms of this order and those of the Apoda and the Pedata impossible. The Apoda are either of a strongly-marked worm-like, usually long, narrow, cylindrical shape, or of a fusiform one, with the posterior extremity more or less elongated and strikingly tapered. As an example of the former may be cited *Synapta*, Eschsch., *Chirodota*, Eschsch., *Haplodactyla mediterranea*, Grube, &c., and of the latter *Caudina*, Stimps., *Molpadia*, Cuv., *Haplodactyla molpadioides*, Semp., &c. In addition, the lack of any traces of pedicels, and of any external demarcation between the dorsal and ventral surfaces characterises the order Apoda. In the Pedata the external appearance is characteristic on account of its more or less distinctly traceable bilateral symmetry, but it is to be remembered that also in this order many forms are known especially in the genera *Thyone*, Oken, *Thyonidium*, Düb and Kor., *Cucumaria*, Blainv., *Ocnus*, Forbes and Goodsir, &c., in which the body is cylindrical or tapered at each end, or even pentangular, the dorsal and ventral surfaces thus being not clearly marked out. In the Aspidochirotæ, especially in the genera *Stichopus*, Brandt, and *Mülleria*, Yäger, but above all in *Psolus*, Oken, and *Colochirus*, Troschel, amongst the Dendrochirotæ, the ventral surface becomes flat, sole-like, and most evidently distinct from the highly convex dorsal surface.

In the Elasipoda the shape of the body is bilaterally symmetrical, the ventral surface being flat or slightly concave, or sometimes insignificantly convex, and as a rule clearly distinguishable from the usually strongly convex dorsal surface. A transverse section of the body (Pl. XXXVI. fig. 4) generally shows a segment, the arc of which is represented by the back, and the straight line by the ventral surface. The body is in some forms rounded or oval, and in others more or less elongated, thus bearing some resemblance to the Aspidochirotæ; sometimes, however, as, for instance, in the genus *Parelpidia*, it has the shape of a more or less narrow cylinder, thus becoming almost synapta-like, in which case there is no marked distinction between the dorsal and ventral surfaces, which can only be determined by the position of the processes and the pedicels. Accordingly, the body of the Elasipoda is generally to be considered as psolus-like, the ventral surface being with few exceptions flat and shorter than the dorsal one. Only in the genus *Parelpidia* do the ventral and dorsal surfaces seem to be of about equal size. Not a single species is found in which the dorsal surface is shorter than the ventral one, as is known to be the case in several of the Dendrochirotæ. Sometimes the breadth exceeds the height, and this occurs most conspicuously in the genera *Scotoanassa*, *Euphronides*, and *Psycheotrephes*, which

are very remarkable on account of their great flatness. In other forms as, for instance, *Scotoplanes insignis*, *Elpidia willemoësi*, &c., the body decreases in height backwards, its posterior portion becoming almost flat, while the contrary may be observed in the genus *Psychropotes*, which is remarkable for the height of its posterior and the flatness of its anterior extremity. In several species, as in *Scotoplanes robusta*, *Peniagone vitrea*, *Elpidia willemoësi*, &c., the body is produced anteriorly into a narrow, longer or shorter neck-like part, which is directed straight downwards.

Another peculiarity which characterises the external appearance in a great number of Elasipoda is the presence of a brim which surrounds either the posterior extremity of the body as in *Scotoplanes insignis*, *Elpidia willemoësi*, &c., or both the posterior and the anterior extremities, as in *Scotoanassa diaphana*, or only the anterior one, as in *Elpidia purpurea* and *Enypniastes eximia*, or which, finally, extends round the whole body, as in the Psychropotidæ, where it sharply defines the dorsal from the ventral surface. The brim in question, which originates in an enlargement of the layer of connective tissue of the perisoma, is broad and rather thin, and the wide tubes which penetrate it and unite the pedicels with the ambulacra often become visible externally, thus giving the brim a somewhat fin-like appearance. Sometimes, as in *Scotoplanes insignis* and *Elpidia willemoësi*, &c., this fin-like brim becomes bipartite at the posterior extremity. The Psychropotidæ are easily distinguished by the possession of this brim, which surrounds the body and attains such a breadth at the anterior end as to give it the appearance of a more or less distinct head.

The two orders Apoda and Pedata sometimes have the mouth and anus almost terminal at opposite poles of the cylindrical or fusiform body, sometimes on the contrary directed upwards, as in several Dendrochirotæ remarkable for their ascidia-shaped body. In a great number of Aspidochirotæ the mouth and the oral disc are more or less distinctly turned towards the ventral surface.

In the Elasipoda the mouth and the surrounding oral disk, though situated either at or near the anterior end of the body, are always more or less evidently directed towards the ventral surface; in many forms, indeed, the mouth lies in the same plane as the ventral surface. Even in forms characterised by a body of cylindrical shape, as, for instance, *Parelpidia*, the oral disk has a slight though definite ventral inclination. Again, one cannot invariably describe the mouth as terminal, because in numerous forms such as *Elpidia purpurea*, and in all the Psychropotidæ the dorsum projects considerably beyond the mouth. Now, the under surface of this projection lies in the same plane as the ventral surface or trivium, and thus the mouth seems to be placed on the ventral surface at some distance from the anterior extremity.

Here, then, it is evident that the dorsum projecting beyond the mouth constitutes in a measure the anterior end of the body, but it is of importance to remember that the peritoneal cavity does not extend beyond the mouth, or, at most, very slightly, so that

the projection is really due to an increase in thickness of the dorsal body-wall itself. At the same time, we seem to have here a more pronounced example than is elsewhere seen of the tendency of the mouth to become removed from its terminal position.

As noted above, Elasipoda are found in which the mouth is placed at the end of a narrow neck-like part, which is bent downwards so as to form an angle with the ventral surface; this is the case in *Peniagone vitrea*, *Elpidia willemoësi*, &c. In a very few forms among the Elasipoda, as, for instance, in the genera *Deima* and *Benthodytes selenkiana*, &c., the mouth and the tentacles are capable of being entirely retracted within the body. All the individuals of the genus *Deima* I have had at my disposal are especially remarkable for the fact that the tentacles are always enclosed within the cavity, which forms the most anterior part of the alimentary canal and communicates with the exterior by an aperture which seems capable of being entirely closed (Pl. XLIII. fig. 3). This aperture lies in the centre of a radially-wrinkled disk, and is surrounded by a single crown of small papillæ (Pl. XLIII. fig. 2), the importance of which will be discussed further on. I do not think it probable that *Deima*, in which any solid oral disk seems absent, should not be able to extend the disk and its tentacles outside the body. It is unnecessary to state that this capacity of retracting the mouth and tentacles within the body is not peculiarly characteristic of a few forms in the order Elasipoda; for numerous species among previously known Holothurioidea, and particularly the Dendrochirotæ, also possess this power.

In the Pedata and the Apoda the tentacles are generally arranged in a single row round the mouth, and it is well known that only in a very few cases, viz., the genus *Phyllophorus*, Grube, and *Synapta bifaria*, Semper, exceptions are found where the tentacles are disposed in two circles, an outer and an inner one. The tentacles, though usually of equal size, are sometimes unequal, as in *Echinocucumis*, Sars, and sometimes, as is the case in a great number of the Dendrochirotæ, a couple of the ventral ones is considerably smaller than the others. It is also well known that the genus *Thyonidium*, Düb. and Kor., is characterised by the possession of five pairs of large alternating with five pairs of smaller tentacles, and that *Orcula*, Troschel, carries from ten to twenty tentacles, of which five are always smaller than the rest. The tentacles vary highly in shape, and are grouped by Semper in the following manner:—tentacula peltata in the Aspidochirotæ; arborescentia in the Dendrochirotæ; peltata and pinnata in the Molpadidæ; digitata, pinnata, and peltato-digitata in the Synaptidæ. In *Haplodactyla*, Grube, belonging to the Molpadidæ, the tentacles present their simplest conformation, and deviate from the common type in being unbranched and without any enlarged terminal part, thus plainly showing that the tentacles in general are to be regarded as simply modified pedicels. The tentacles in the orders Apoda and Pedata varying in number from ten to twenty-five, are in general a multiple of five, but notwithstanding this exceptional forms are not infrequently met with, which possess twelve, thirteen, eighteen, or nineteen tentacles.

On examining the tentacles in Elasipoda one finds that they are always arranged in a single crown. I must say, however, that I feel somewhat uncertain concerning the tentacles in the genus *Deima*, because I never saw them fully extended (Pl. XLIII. fig. 3). When drawn inside the body and closely crowded they appear to be irregularly disposed, and have almost the aspect of a double crown. The tentacles of the Elasipoda are generally to be regarded as equal in size, though it may be noted that sometimes one or several present a distinct tendency to become smaller than the rest. A great number of individuals of the same species having very often been at my disposal, I have had the opportunity of observing that while the tentacles in the more adult individuals are of equal size, those in the young forms are often unequal, one or more being sometimes almost rudimentary; in *Oneirophanta* especially this is obvious, while at the same time it becomes evident that no given tentacle is smaller than the other. However, it must not be overlooked, that even in fully-developed individuals of the above cited genus as well as of *Ilyodæmon*, *Orphnurgus*, &c., some of the tentacles are more or less incompletely developed, only existing in the shape of small protuberances.

The tentacles of the Elasipoda, from ten to about twenty in number, vary considerably in shape; they resemble most the peltate or digitate type as found in the Aspidochirotæ and in some of the Synaptidæ. A more or less stiff stem supports the terminal part, which is either large, round, more or less discoidal, and without any visible processes, or with rudimentary ones as is the case in *Lætmogone*, *Ilyodæmon*, *Achlyonice*, or which is comparatively small and provided with many or few, larger or smaller, simple, digitiform or branched processes (comp. Pl. XLIV.). *Deima* bears comparatively minute tentacles, which seem capable of being fully retracted; in most of the other forms which belong to the order in question, only the processes or their tops are retractile. The tentacular suckers, which according to Quatrefages[1] and Semper are found in a few Synaptidæ, are altogether lacking in the Elasipoda.

The Holothurioidea possess besides tentacles two kinds of external ambulacral appendages, which according to Semper are termed "ambulacral pedicels" and "ambulacral papillæ." These two kinds of appendages are either found in the same animal as, for instance, in *Colochirus*, Troschel, *Mülleria*, Jäger, *Stichopus*, Brandt, and in numerous species of the genus *Holothuria*, L., &c., or they exist singly in different species, consequently there are either only pedicels present as in the most species of *Cucumaria*, Blainville, *Thyone*, Oken, *Thyonidium*, Düb. and Koren, *Holothuria vagabunda*, Sel., &c., or only ambulacral papillæ as in *Holothuria albiventer*, Semp., *Holothuria squamifera*, Semp., &c. The ambulacral pedicels are cylindrical, usually of a comparatively inconsiderable size, and terminate in a kind of disk-like sucker, which is strengthened by a calcareous plate or plates; the ambulacral papillæ, on the contrary, are conical and without any terminal disk-like sucker, are usually dorsal in position, and

[1] Mémoire sur la Synapte de Duvernoy (Annales des scienc. nat., 2 sér. tom. xvii., 1842).

sometimes attain a considerable size as in *Colochirus quadrangularis*, Less., *Stichopus naso*, Semp., *Holothuria armata*, Sel., &c. The pedicels, which seem to be indefinite in number can with few exceptions be entirely retracted within the body-wall; they are either irregularly scattered all over the body as in *Thyone*, Oken, &c., or disposed in rows all along the five ambulacra as in *Cucumaria*, Blainv., &c., or they are found only on the ventral surface, where they are generally arranged in three rows as in *Colochirus*, Troschel, *Psolus*, Oken, &c. The ambulacral papillæ, which are present in the genera *Stichopus*, Brandt, *Mülleria*, Jäger, *Colochirus*, Troschel, and in most species of the genus *Holothuria*, L., are sometimes disposed in more or less plainly marked rows, but are ordinarily scattered, and show no traces of any regular arrangement; in some cases they are found not only on the dorsal surface, but dispersed all over the body, as in several forms of the group *Sporadipus*, Grube. The form and the position of the pedicels and processes as well as their number being usually well-defined are highly remarkable in the Elasipoda, and give the external configuration of the body its characteristic appearance. Consequently, it is of the greatest importance to point out as plainly as possible in what respects these organs differ from those in the Pedata. I never found any pedicels fully corresponding to what Semper terms "ambulacral pedicels," and it would be more correct to class all the pedicels of the Elasipoda under the head of "ambulacral papillæ." Thus, when describing the order in question, I prefer to give the name "pedicels" to the ambulacral appendages on the ventral surface, these being exclusively adapted to purposes of locomotion, contrary to those on the dorsal surface, which may be called "processes." Just as the ventral is in most cases obviously distinct from the more or less highly convex dorsal surface, so a generally striking difference may be observed between the ventral pedicels and the dorsal processes, this difference being not only conspicuous in the external shape, in the size and in the number, but also in the corresponding ambulacral cavities or ampullæ, which will be described more in detail under the rubric "water-vascular system." Only a few examples in the Psychropotidæ, viz., *Benthodytes sanguinolenta* and *Benthodytes typica*, exist, which correspond with several forms in the Pedata in carrying on the dorsal surface a number of appendages which by their narrow cylindrical shape, their minute size, and their capability of being entirely retracted within the integument, bear the strongest resemblance to true pedicels. My intention is to give a summary account of these appendages a little further on after having first described the pedicels more in detail.

Two kinds of pedicels are distinguishable in the Elasipoda; the first, small, and often resembling rounded protuberances, are generally strengthened by a small number of spicula, their rounded or slightly flattened ends being without any calcareous terminal plate; the second, large, generally cylindrical or conical, more or less stiff, not retractile, but to a certain degree contractile, and with their tops either large, sole-like, or discoidal, as in *Orphnurgus*, *Lætmogone*, &c., or more or less tapered as in *Scotoplanes globosa*, &c.

or, finally, decreasing to a narrow, tube-shaped, retractile prolongation, as, for instance, in *Elpidia glacialis*, &c. But as a matter of fact a strict separation of these pedicels into two groups is not possible, the interval between them being filled up by a series of gradations. Both kinds of pedicels differ from those in the Pedata by the notable peculiarity that they show no traces of a calcareous terminal plate;[1] the genera *Ilyodæmon* and *Lætmogone* are most singular exceptions to this, having the ends of their pedicels supported by one or more perforated plates. In the Psychropotidæ, which in many respects may be regarded as intermediate between the true Elasipoda and the Pedata, the pedicels, having lost much of the typical form characteristic of the deep-sea Holothurians and evidently approaching those in the Pedata, belong to the first, that is to say, to the small kind. Some of these pedicels are more or less minute, and are arranged in a double row all along the odd ambulacrum; others are slightly larger and form a single row round the margin of the brim of the body. The large cylindrical pedicels which, on the contrary, are present in the other two families, are disposed in a single row along each of the lateral ambulacra on the ventral surface. As the only known exceptions I may cite *Oneirophanta mutabilis* and *Ilyodæmon maculatus* in which the pedicels in question are disposed in a double alternate row along each side of the ventral surface, while the first-mentioned species as well as the genus *Pannychia* are the only forms excepting the family Psychropotidæ which carry pedicels on the odd ambulacrum, the former carrying few, the latter many. As above mentioned, only a comparatively small number of the Elasipoda have all three ambulacra provided with pedicels, while the majority carry along each side of the ventral surface only a single row of large cylindrical, locomotory pedicels. These large pedicels, which are to be regarded as direct protuberances of the body-wall are often strengthened by calcareous deposits, more or less closely resembling those in the perisoma in form as well as in number. Thus, for instance, if the body-wall itself is firm and brittle, as in *Oneirophanta*, *Deima*, &c., the pedicels also become highly brittle and inflexible. In order to give an idea of the size of these larger pedicels I refer to the following list:—

	Length.	Diameter at the base	Diameter at the top.
Oneirophanta mutabilis, ...	16 mm.	6·5 mm.	5 mm.
Deima validum, ...	10 „	10 „	—
Lætmogone violacea, ...	12 „	8·5 „	4·5 mm.
Ilyodæmon maculatus, ...	15 „	8 „	5–6 „
Orphnurgus asper, ...	20 „	6 „	4 „

Here I may again refer to the peculiarity, which has already been mentioned in my

[1] Special attention should be paid to what has been pointed out in the description of species given above, that various representatives, especially in the Psychropotidæ, for some reason or other possess no calcareous deposits, wherefore it is possible—though not probable—that in these very animals calcareous terminal plates should have existed supporting the ends of the pedicels.

description of the species, that the posterior pedicels in several forms of the family Elpidiidæ as, for instance, in *Scotoanassa diaphana*, *Scotoplanes insignis*, *Elpidia willemoësi*, &c., are webbed together by a thin skin, which gives to these forms a most peculiar appearance. Besides, it must not be forgotten that the posterior pedicels in *Parelpidia elongata* differ from the anterior, elongate, cylindrical ones, and present a form peculiar to themselves; these posterior pairs of pedicels (Pl. I. figs. 3 and 4), are large, flattened, oar-shaped, taper towards their tops into an acute point, while the odd, hindmost, and very flattened pedicel attains a considerably greater breadth and has its obtuse end incised. The lateral pedicels in the family Elpidiidæ vary considerably as to their position and deserve special attention. They are, for instance, more thinly scattered anteriorly than posteriorly, where they are commonly crowded close together, side by side. The genera *Parelpidia* and *Peniagone*, excepting *Peniagone affinis*, *Elpidia purpurea*, *Elpidia verrucosa*, *Scotoplanes robusta*, *Scotoplanes insignis*, and *Scotoanassa diaphana* carry pedicels either round the posterior half of the ventral surface or only round the hindmost portion of the body. Besides, the size of the lateral pedicels seems to vary considerably in the very same animal. In the family Psychropotidæ the lateral pedicels are nearly of the same size all round the body, while in the two other families it may be affirmed as a rule that the size decreases posteriorly, so that the most posterior pairs become obviously smaller than the anterior or almost rudimentary. Nevertheless, I have found cases, as, for instance, *Parelpidia elongata*, which form exceptions to this rule in having the posterior considerably larger than the anterior pedicels.

The most characteristic mark of the Elasipoda, and that which gives them their symmetrical appearance, is that the pedicels along each side of the ventral surface correspond in number as well as in shape and size, and, being distinctly opposed to one another, constitute pairs. It sometimes happens, however, though rarely, that the number of pedicels on one side exceeds that on the other, but considering that this is the case in one individual while another of the same species has an equal number of pedicels along each side, this must be regarded only as an individual peculiarity. But, besides this symmetry in the arrangement of the pedicels, there may often be observed in the different species a tendency in the pedicels to become definite and fixed in number. Numerous individuals of *Elpidia glacialis* and *Scotoplanes globosa* having been at my disposal, I have found as a rule that the former species is always provided with four pairs of pedicels and the latter with seven pairs. Unfortunately, I have had only one or two individuals of most species for my examinations; consequently I am not able to cite more examples, though I am fully convinced that all forms belonging to the family Elpidiidæ possess in common with the two forms above mentioned an almost fixed number of pedicels. Before concluding my account of the pedicels, it is necessary to notice the two forms *Oneirophanta mutabilis* and *Ilyodæmon maculatus* in which the pedicels are arranged in a double row along each side. This arrangement in a

double row is often not very plainly marked, and now and then there is only a single though slightly irregular row distinguishable. The pedicels in the inner row being fewer in number and smaller in size than those in the outer row seem to be developed subsequently; and this fact becomes most evident on examining very young individuals in which the inner pedicels are usually rudimentary, while those in the outer row are well developed.

The dorsal surface is supplied with processes which in most cases strikingly differ from the pedicels, but which sometimes, as, for instance, in *Benthodytes sanguinolenta* (Pl. XLII. fig. 6) and *Benthodytes typica* (Pl. XLIV. fig. 8) resemble the pedicels in Pedata by their smallness and cylindrical shape as well as by their capability of being entirely retracted within the body, but it must be remembered that their rounded terminal part is without the characteristic disk-like sucker with its supporting calcareous plate. It is of great importance to pay special attention to the fact that—though the difference between the ventral and dorsal ambulacral appendages is generally so plainly marked that no further explanation is necessary with regard to the two terms "pedicels" and "processes"—a transition, nevertheless, is found between them, consequently, no definite limit can be marked; however, their functions being unquestionably diverse, the use of different terms is fully justified. Even those Elasipoda which carry on their dorsal surface small foot-like appendages never use the rounded, convex dorsum for the purpose of locomotion, but move forwards on their flat, ventral surface, which becomes fully evident when we consider the position of the mouth, &c. Thus it would be inaccurate to term these foot-like dorsal appendages pedicels, which, being present only in a few forms, are most certainly just as inapplicable for the purpose of locomotion as the large dorsal processes or appendages.

The dorsal ambulacral appendages are either simple or compound; the former I prefer to call processes, and the latter appendages. Both kinds are often found in the same animal, and vary considerably in size as well as in form and position.

The processes are regularly more or less elongated, conical, and sometimes tuberculous, and often attain a size so considerable as not to admit of being retracted within the body, excepting in the genus *Ilyodæmon*, which seems to have all the dorsal processes completely retractile, which is probably owing to their communication with true ampullæ (Pl. XLII. fig. 3). In the Deimatidæ the processes attain the greatest size, and it ought to be specially pointed out that *Oneirophanta mutabilis* and *Lætmogone wyville-thomsoni* carry processes of the same length as the body itself, thus reaching a length of 125 mm. or more. The processes are in general more or less flexible, but in certain forms, as, for instance, in the two species of *Deima*, they are very stiff and directed straight out from the body, thus bearing a resemblance to gigantic spines. Sometimes, as in *Parelpidia*, the processes are extremely minute, almost rudimentary. I have recently drawn attention to the small foot-like and completely retractile processes in *Benthodytes sanguinolenta* and *Benthodytes typica*.

The dorsal processes belong in general to the dorsal ambulacra, but exceptions have been found in *Deima*, *Oneirophanta*, *Orphnurgus*, and *Pannychia*, which carry processes not only all over the dorsal ambulacra but also in a row situated above the pedicels along each side of the body; these lateral processes are in communication with the ventral lateral ambulacra, which thus carry both pedicels and processes. *Colochirus*, Troschel, &c., among the Pedata, proves that this is a peculiarity not exclusively characteristic of these four forms. In all the Deimatidæ, as well as in several forms belonging to the Psychropotidæ, the dorsal processes are arranged in one or several rows along each ambulacrum. Those animals which, as, for instance, *Oneirophanta* and *Deima* are provided with processes of unusual size and length, have them disposed only in a single row. Very rarely, and, as far as I know, only in *Benthodytes sanguinolenta*, and possibly in *Pannychia moseleyi*, the processes are found scattered over the lateral interambulacra. In the family Elpidiidæ, on the contrary, traces of such an arrangement in rows are obvious, but the processes are fewer in number and the rows have a tendency to become dissolved. A closer examination of the representatives of the family in question shows that the processes do not as a rule change their position, but are situated at fixed places, either anteriorly, or both anteriorly and posteriorly, thus leaving a greater or smaller portion in the middle of the back devoid of all processes. At the same time it will be seen that the number of the processes is definite, as in *Scotoplanes globosa* which always carries only three pairs,—a very remarkable peculiarity, which is, doubtless, to be found in most of the representatives of the family in question, though through lack of necessary material I have not been able to distinguish it; in some forms, as, for instance, in *Elpidia glacialis*, they vary a little in size as well as in position, but even here can be found traces of a tendency to become definite in number and position. In the Elpidiidæ the processes are most evidently disposed in pairs, and though the latter themselves are of a very variable size when compared to one another, nevertheless each pair is made up of processes of equal size.

As before noted another kind of dorsal ambulacral appendage is present, which, being generally odd and very large, traverses the bivium from the one ambulacrum to the other, and appears to be made up of one pair of processes or more, viz., it is penetrated by one or several pairs of wide tubes which are in communication with the two dorsal ambulacra. It is most evident that since the animals are supplied with such a large and long appendage, which either has its free end rounded or provided with lobe-like processes, their appearance is highly characteristic. In *Peniagone*, *Scotoanassa*, &c., the appendage in question is situated anteriorly, and is usually broad, flat, and made up of several pairs of canals; in *Euphronides* it is placed a little behind the middle of the dorsum, and presents a more conical form, while in *Psychropotes* it protrudes near the posterior extremity of the body, and is remarkable for its gigantic size and tail-like aspect; the appendages of the two last-mentioned genera are penetrated by a single pair

of canals. Besides these transverse appendages, one or several pairs of more or less rudimentary processes seem to be present as a rule.

The Body-wall.

The structure of the solid sac termed the body-wall or the perisoma, which encloses the spacious peritoneal cavity and gives to the animals their form, has been already very satisfactorily described by Baur,[1] Semper,[2] Teuscher,[3] &c., and, the material being so softened and macerated by a long immersion in spirit as to make a closer histological examination impossible, I have nothing of importance to add to their investigations, and refer to the splendid memoirs of these authors. Notwithstanding the previously-known facts, I think it may be well to state some points which I have observed when examining the deep-water forms, and which may possibly aid to throw light upon the whole class.

The body-wall consists, as already known, of an outer cellular ectoderm, covered externally with a very thin, transparent cuticule; beneath the ectoderm is a layer of connective tissue, the corium, within which are to be seen circular and longitudinal muscular fibres lined internally with a delicate peritoneum. Corium is of the greatest importance not only in being the secreting layer of the calcareous deposits peculiar to the Echinoderms, but also by reason of its more or less considerable thickness, which occasions striking changes in the shape of the body. The thickness of this layer of connective tissue varies much in different species, and even in the same individual is not always uniform throughout the whole body. According to Selenka,[4] the body-wall in the genus *Stichopus*, Brandt, is always thicker along the interval between the ventral and dorsal surfaces; the same applies to the Elasipoda, in which *Deima* and *Oneirophanta* form good examples, having the large, branched, ambulacral cavities of their lateral pedicels and processes lying inside the thick layer of connective tissue. This peculiarity distinguishes to a very great extent the whole of the Psychropotidæ, the representatives of which have the perisoma increased in thickness all around the body, so as to form a more or less considerable brim (Pl. XL. fig. 6). The singular large appendage which is present on the back in a great number of Elasipoda is likewise for the most part made up of connective tissue.

The tentacles, the pedicels, and the processes are composed of the same layer of tissues as the body-wall proper, excepting that no circular muscular fibres are to be found. In various forms, as, for instance, in *Deima validum*, &c., the layer of connective tissue,

[1] Beiträge zur Naturgeschichte der *Synapta digitata*, 3 Abhandlungen, mit 8 Tafeln (Nov. Act. Acad Cæs. Leop.—Carol., tom. xxxi., Dresden, 1864).

[2] Reisen im Archipel der Philippinen, ii., 1, Holothurien, Leipzig, 1868.

[3] Beiträge zur Anatomie der Echinodermen (Jenaische Zeitschr. f. Naturwiss. Bd. x., Jena, 1876).

[4] Beiträge zur Anatomie und Systematik der Holothurien (Zeitschr. für wissensch. Zoologie, xvii., 1867, p. 315).

particularly that in the processes, attains a high degree of development (Pl. XXXVII. fig. 8). In the pedicels of the above-mentioned species I have found that the connective tissue consists of three easily distinguishable layers,—an outer which contains the large calcareous plates, an intermediate of a loose and fibrous texture in which small spicules of various shapes are present, and an inner layer which forms a dense, thick, hyaline and elastic tunic immediately beneath which the muscular coat of longitudinal fibres is situated. The tunic in question, which is distinguished by having numerous transverse closely-placed wrinkles of about equal size, seems to be very intimately united with the longitudinal muscular layer, because when isolating them from one another the tunic bears evident impressions of the muscular fibres. I did not ascertain that the processes or the tentacles of this animal possessed such an elastic tunic, which however should be present; it was probably very thin, and thus escaped my attention. In the dorsal processes of *Lætmogone wyville-thomsoni* I have likewise observed a corresponding membrane or tunic.

The principal forms in which the calcareous deposits are presented in the Elasipoda are, strictly speaking, only three—spicules, wheels, and plates. The body-wall is usually supple and pliable because its calcareous skeleton is composed of spicules or wheels which are more or less dispersed in the substance of the corium; in *Elpidia glacialis, Elpidia verrucosa, Scotoplanes murrayi, Peniagone vitrea, Scotoanassa diaphana,* &c., these spicules lie so closely crowded and overlapping one another that the perisoma becomes exceedingly brittle, while at the same time the animal loses the power of changing the shape of its body in proportion to the degree of hardness of the integument. In a very few cases, *Deima* and *Oneirophanta*, the integument is strengthened by a great number of perforated, larger and smaller, conspicuously overlapping plates (comp. Pl. XXXI.), which constitute an almost continuous and immovable shell.

Different kinds of calcareous bodies are often found in one and the same animal; thus *Lætmogone wyville-thomsoni* is provided with wheels and simple spicules (Pl. XXXI. figs. 14–16), *Lætmogone violacea* with wheels and cruciform bodies (Pl. XXXVI. figs. 20–24), and *Ilyodæmon maculatus* is most particularly characteristic in having, besides wheels, dichotomously branched, flat and discoidal bodies, which are partly scattered, partly crowded in great numbers (Pl. XXXVI. figs. 12–19).

The spicules appear variously shaped, but are, nevertheless, derived from two principal forms—simple and branched (Pls. XXXII.–XXXV.). Among the former there is to be noted, firstly, the C-curved type, which has hitherto been regarded as characterising the genus *Stichopus*, Brandt, but is now known to be present in all the representatives of the genus *Scotoplanes*, and in some of the genus *Peniagone;* secondly, the simple, straight, or inconsiderably curved, spinose rods, which are found in several species, as, for instance, in *Scotoplanes albida, Scotoplanes globosa,* &c.; and lastly, the minute more or less highly arcuated and spinose spicules, conspicuously thickened in the middle,

which are seen in *Irpa*, Dan. and Kor., and *Kolga*, Dan. and Kor. Special attention should be paid to the peculiarity that the C-curved bodies which are found in *Stichopus*, Brandt, as well as in the Elasipoda always present a significant dilation at their middle. The branched spicules seem to be present in the majority of the deep-water forms, and may be considered as especially characteristic of the two families Elpidiidæ and Psychropotidæ; they are made up of four or sometimes three more or less spinose and arcuate arms, and are supplied either with only a single outwardly-directed spinose central process or with several such, which give to the surface of the body-wall a high degree of roughness. It is very surprising to find the wheel-shaped deposits represented in several forms of Elasipoda, for these calcareous bodies have always been considered as characteristic of only a few genera of the apodal Holothurids, viz., *Myriotrochus*, Steenstrup, *Chirodota*, Eschscholtz, *Trochoderma*, Théel, and *Acanthotrochus* Dan. and Kor. Two kinds of wheels are distinguishable, viz., large or true wheels and small ones resembling plates, the former of which seem to be never present unless associated with the latter as is the case in *Lætmogone*, *Ilyodæmon*, and *Pannychia*, while the latter, on the contrary, seem to be more independent of the presence of the former, and are sometimes found together with spicules (Pl. XXXII. figs. 21–23, and Pl. XXXIII. fig. 6), as in *Achlyonice lactea*, *Elpidia ambigua*, &c. I do not intend to give any detailed account of the structure of the wheels, but refer back to the description of the species. I only intend to draw attention to the fact that the regularly large nave has in its centre a large hole, from the edge of which an inwardly-directed crown, made up of four to five arcuated arms, rises. I have observed, especially in *Pannychia* and *Ilyodæmon*, that this central hole is sometimes covered with a thin, transparent calcareous membrane pierced by a few sometimes minute openings (Pl. XXXII. fig. 6), the centre of this calcareous membrane being connected with the top of the crown by a short, straight, calcareous rod.

The plates which are present in *Deima* and *Oneirophanta* are of a different structure; those which belong to the former genus are composed, that is to say made up of several layers (Pl. XXXI. figs. 5 and 11), while the plates in the latter genus are simple, discoidal, and flat. The simple as well as the compound plates vary considerably in size, the larger being mingled with the smaller ones; the largest plates I have seen in *Oneirophanta* measure about 2 or 3 mm. in diameter, while those in *Deima fastosum*, attain to 5 mm., and in *Deima validum* to about 7 mm. diameter. The simple plates are perforated by numerous holes, which are always largest at the centre and diminish gradually towards the circumference, where they become almost indistinguishable; the innermost layer of the compound plates resembles the simple ones in the fact that the perforation is more regular and the rather rounded holes decrease towards the circumference, and upon the upper surface of this inner plate, or rather layer, rises a more irregular network, which in *Deima fastosum* appears like a large conical knob (Pl. XXXI. fig. 10), while in *Deima validum* it does not attain such a development, but only gives

to the exterior surface of the plates a slightly convex aspect. The compound plates are built up in the following manner :—from the upper surface of a more or less regularly perforated simple plate, that is to say, from the innermost layer of the compound plates, which thus seems to be developed first, a number of minute processes rise, from the tops of which branches run out which join with one another and constitute an irregular network, which in its turn gives rise to another net-work which lies above it, &c. *Oneirophanta* furnishes most evident examples that the development takes place as above described, because the plates, though they are simple, carry on their upper surface one or several small processes (Pl. XXXI. fig. 1), which in most cases remain unbranched, but which sometimes give off small branches from their tops, which unite and form a rudimentary network on the upper surface of the plate.

Both plates and wheels take their origin from the same typical form, viz., a small spicule provided with four short arms (Pl. XXXII. fig. 3), and more than once I have had occasion to state the correctness of this view. In its first stage of development the plate always presents the appearance of a spicule, the four arms of which increase in size and give off branches, which, connected with each other, form the larger holes which are always situated in the centre of the plate; round the edge of this primary plate new holes arise successively by means of the development of new processes which become connected with one another. Though it may seem very strange, the wheels in the Elasipoda are developed in the same manner. As has been already noted the wheels in this order are remarkable for having a small central crown made up of four, rarely five or six, short arched arms; this crown, which ought to be regarded as a four- to six-armed spicule (Pl. XXXII. fig. 3), becomes first visible, and its more or less curved arms, being linked together by their ends so as to form four to six holes, give rise to an irregular ring (Pl. XXXII. fig. 2), which is the first indication of any nave. This nave increases in size and gives off round the edge small, conical processes (Pl. XXXII. fig. 4), which growing larger become spokes which in their turn send out branches towards each side; these branches joined together with one another form the felly. The wheels in *Myriotrochus*, Steenstrup, *Trochoderma*, Théel, *Chirodota*, Eschsch., &c., which lack the crown as well as the large hole in the centre of the nave, are developed in a slightly different manner. In these forms the wheels do not take their origin from a spicule but from a calcareous star, which gives off as many small processes or rays as there are spokes; the further development takes place as above described.

When the calcareous bodies are examined with a high magnifying power and treated with a dilute acid and some colouring matter, it will easily be seen that they are surrounded by a thin membrane which sometimes seems to communicate with fine threads, which either belong to the surrounding connective tissue or are nerve fibres. A central canal is often discernible within the calcareous deposits. In the hope of obtaining a favourable specimen for showing how the calcareous deposits are developed,

I examined the very minute pedicels in some very young individuals of *Oneirophanta*, which pedicels were evidently in an early state of evolution. The extremely thin walls of the pedicels contained only a few small, simple spicules, which, more or less developed, were always surrounded by an evident sheath, and this when treated with hæmatoxylin became deeply coloured and very manifest. Supposing the sheaths to be developed first,—the calcareous matters being subsequently produced by them,—I expected to find small empty sheaths, and I succeeded in doing so. The smallest sheath I could discover attained the inconsiderable length of 0·08 mm. (Pl. XXXVI. fig. 8), and was consequently extremely minute in proportion to the adjacent more developed sheaths, which had a length of about 0·7 mm. The walls of the sheaths are extremely thin and contain scattered cells. I did not discover any epithelial lining, which Semper[1] has observed inside the sheaths in the Synaptidæ. As the material which has been at my disposal has not been sufficient to admit any satisfactory examination, it is possible that such an epithelial lining is present though it has escaped my attention. When stained with a solution of hæmatoxylin the sheaths become violet, while the structureless matters which they contain remain almost colourless. The sheaths increase and gradually assume the shape of a spicule. I have first discovered calcareous matter inside them when they have attained a length of about 0·20 mm., which, in the shape of a minute, elongate bright body (Pl. XXXVI. figs. 10 and 11), is situated in the centre of the hitherto structureless substance; sometimes two small calcareous bodies are present. At the same time that the carbonate of lime appears, a concentric structure becomes obvious within the substance enclosed by the sheath, which structure is most conspicuous round the minute recently-formed calcareous body. The sheaths increase, approaching gradually the shape of the future calcareous spicule, while the calcareous deposits themselves grow larger, until they finally become most closely encircled by the wall of the sheaths. It is most probable that a solution of lime-salts is secreted by the walls of the sheaths, and that the calcareous bodies are deposited from this secretion.

The shape of the calcareous deposits varies at different places in the body. There is, for instance, a certain difference traceable between the deposits of the dorsal surface and those of the ventral one with regard to their shape as well as to their number. The dorsal surface seems regularly to be rougher than the ventral, and consequently the calcareous deposits of the latter surface are often fewer in number, smaller and of a more irregular form, their outwardly-directed processes, which cause the roughness, being short or sometimes altogether wanting. The tentacles, the pedicels, and the dorsal processes are towards their ends strengthened by a greater or smaller number of more or less simple spicules, the shape of which is discussed under the description of the species. The dorsal processes are usually supported by a smaller number of spicules, which seem sometimes to be absent, in which case the walls of the processes are provided with

[1] Reisen im Archipel der Philippinen, pp. 30, 31, pl. vii. fig. 2, d.

calcareous deposits of the same shape as those which are present in the real body-wall. In the processes of *Oneirophanta mutabilis*, a number of long rods are found, the ends of which are enlarged, flattened, and perforated (Pl. XXXI. fig. 2); it is most peculiar that these rods do not lie transversely but in the direction of the length of the processes, the flexibility of which becomes thus rather limited. In *Lætmogone* (Pl. XXXIV. fig. 1), *Ilyodæmon*, and *Pannychia* (Pl. XXXII. fig. 11) alone the terminal parts of the pedicels are supported by one or several perforated terminal plates, which in the last-mentioned genus are covered externally by another more irregular and fragile network. It is of great interest to note that this exterior network can be developed from the small wheels which are present in a great number in the body-wall and even in the pedicels; a glance at Plate XXXII., fig. 12, will give plain evidence of this fact. The felly of the wheels gives off branches which become connected with one another, and construct an irregular network which grows gradually larger, while at the same time the original wheel becomes reduced and finally totally disappears.

Concerning the two muscular layers of the body-wall I have nothing of importance to note. In different species these layers attain different degrees of thickness. The circular muscular fibres, or rather the transverse ones, constitute a thin layer which, extending from the one ambulacrum to the other, seems to be divided into five areas separated from one another by the ambulacra. Danielssen and Koren[1] have stated the same to be the case in *Kolga hyalina*. According to these authors, however, *Elpidia glacialis* should have a continuous circular muscular layer anteriorly as well as posteriorly, while this layer should be divided into areas at the middle of the body.[2] The longitudinal muscular fibres are disposed in five simple bands; no sign of a division into two parts is present, if the tendency of the muscular fibres to be crowded towards each side be not regarded as such, only a few fibres being discernible along the middle of each muscular band. The connective tissue which combines the muscular fibres contains in general calcareous spicules. The longitudinal muscular bands do not send out retractor muscles towards the gullet.

The Calcareous Ring.

All the Elasipoda possess an internal skeleton in the shape of a calcareous ring, which surrounds the gullet and is in most cases of such a peculiar structure that it forms an important characteristic of the order in question. Unfortunately, the material which has been to my disposal was too insufficient to allow an examination of as many forms as was desirable, notwithstanding which the results of my researches

[1] Echinodermer fra den Norske Nordhavsexpedition, p. 86 (Nyt Magazin for Naturv., Bd. xxv., 2; Christiania, 1879).

[2] *Loc. cit.*, p. 100.

are of the highest interest. The composition of the calcareous ring in the Pedata and Apoda being already well known it is unnecessary to enter into particulars. The ring is composed of ten or more usually solid pieces or ossicles of a net-shaped structure, the five pieces of which, corresponding to the longitudinal muscles, are termed radial. In very few cases as, for instance, in *Embolus*, Selenka, the calcareous ring is entirely absent, and sometimes it is more or less rudimentary.

In the Deimatidæ the calcareous ring is made up of a fragile spongy network. When trying to isolate the ring from the surrounding tissues it is very often spoiled because of its fragility. In *Lætmogone* the ring (Pl. XXXVII. fig. 11) seems to constitute a thin continuous network without any visibly separate ossicles and with its exterior part presenting numerous larger or smaller wrinkles. By treating it with a solution of potass, the ring is usually broken in pieces, but five large irregular fragments are commonly left, which are the radial ossicles. To judge by the insufficient material which has been at my disposal, the calcareous ring in *Ilyodæmon maculatus* is constructed in the same manner as that of the former species, though it differs by being perforated for the passages of the ambulacral nerves and vessels. In *Oneirophanta mutabilis* the ring is more plainly made up of radial and interradial pieces, the radial ones being comparatively solid, of a more definite shape, and notched instead of being perforated (Pl. XXXVII. fig. 4). The interradial pieces, fifteen (?) in number, are more fragmental, cup-shaped, and extremely fragile. The calcareous ring (Pl. XXXVII. fig. 3) seems to be of the same construction in *Deima* as in *Oneirophanta*, though possibly more fragile.

Amongst the three families which belong to the order Elasipoda, the Deimatidæ and particularly the genus *Oneirophanta* bear the strongest resemblance to the Apoda and the Pedata with regard to the composition of the calcareous ring. The Psychropotidæ seem to form a transition between the Deimatidæ and the Elpidiidæ, but, unfortunately, I have not had the opportunity to study the structure of their calcareous ring more in detail. Most of the representatives of this family being in a highly macerated condition, the calcareous matters being almost dissolved, and the individuals which remained in an uninjured state being very few in number, any more detailed examination has been impossible. Though the imperfection of our knowledge at present precludes positive assertion, there is every reason to believe that the calcareous ring in the family in question must be highly undeveloped, and made up of an extremely thin and fragile network which does not always form a continuous ring, but, as in *Euphronides depressa* is composed of five small pieces separated from one another. From what I have been able to observe in the Psychropotidæ, each piece seems to bear a certain resemblance to the spicules which compose the ring in some of the Elpidiidæ, but with the difference that, instead of a few, a great number of rods are present, which anastomose with one another and form a network.

All the thirty-one known forms of the Elpidiidæ seem to be characterised by having the calcareous ring composed of only five spicules which are either firmly united with one another, thus forming a pentagonal figure which surrounds the gullet as in *Elpidia glacialis*, or are more loosely combined with one another, by having the arms of the spicules not lying side by side as in the preceding species, but only joined with one another by their ends as is the case in *Kolga hyalina*, Dan. and Koren, or, lastly, the spicules are separated at certain distances from one another, as is plainly shown in most of the species. The various kinds of rings may with advantage be described more in detail.

Each spicule which composes the ring consists of a short, insignificant central part, from which a greater or smaller number of rod-like arms diverge towards each side; the ends of these are in general flat, enlarged, perforated and branched, but sometimes simple, pointed, or slightly obtuse. In *Elpidia glacialis* each spicule consists of only eight arms in all, two of which—viz., those two which are placed posteriorly and internally when the ring is in its proper position—are large and, lying along their whole length side by side and closely united to the corresponding arms of the adjacent spicules, help to form a pentangular figure; of the rest of the arms the posterior outer ones join one another at their ends, and this sometimes seems to be the case even with the anterior inner ones. A correct idea of the composition of this calcareous ring may be gained by referring to my report on the Elpidia.[1] According to Danielssen and Koren[2] each spicule in *Irpa abyssicola* is likewise composed of eight rod-like arms, four of which diverge towards each side, but judging by the description and plates given of these authors, the combination between the separated spicules cannot take place in the same manner as in *Elpidia glacialis;* most probably some of the arms reach or cross the corresponding arms of the adjacent spicules, thus constituting a pentagonal ring.

According to the observations of the same authors[3] each spicule in *Kolga hyalina* gives off fourteen rods, seven of which diverge towards each side; several of the posterior rods, which are the longest, join their ends to those of the adjacent spicules, thus forming a complete pentagonal ring. In all the eight or nine species of this family which I have had the opportunity to examine, the five spicules are found at certain distances from one another, consequently no complete ring is present. Each spicule in *Scotoplanes globosa*, *Scotoplanes papillosa* (Pl. XXXVII. fig. 12), and *Scotoplanes robusta* (Pl. XXXVII. fig. 9) is made up of eight rods, of which four diverge towards each side. *Peniagone vitrea* possesses spicules, which send out about sixteen rods, eight towards each side; and each spicule in *Elpidia willemoësi* (Pl. XXXVII. fig. 1) and *Parelpidia elongata* (Pl. XXXVII. fig. 2) is remarkable for possessing as many as twenty or thirty rods.

[1] Mémoire sur l'Elpidia (Kongl. Sv. Vet.—Akad. Handl., Bd. xiv. No. 8, Stockholm, 1877).

[2] Echinodermer fra den Norske Nordhavsexpedition (Nyt Mag. for Naturvid., Bd. xxiv. 3).

[3] Echinodermer fra den Norske Nordhavsexpedition (Nyt Mag. for Naturvid., Bd. xxv. 2, 1879).

The Nervous System.

The nervous system corresponds fully with that in other Holothurioidea. It consists of a ring (Pl. XLV. fig. 5), which lies superficial to the calcareous ring and to the circular water-vessel, and which sends off five cords, which proceed along the middle line of the longitudinal muscular bands, to the opposite extremity of the body. From the five cords already mentioned branches proceed to the pedicels and processes, while the ring gives off nerves to the tentacles as well as to the mouth. There is no difficulty in following the nerve-branches to the tops of the pedicels and tentacles, but I have not been able to discover in what manner they terminate. It would seem that they divide into fine filaments which are in relation to the more or less elongated cells which are present in great numbers at the ends of the pedicels and tentacles.

In all the Elasipoda there exists a very well-developed delicate peripheral plexus of nerves (Pl. XLV. fig. 1), formed by the branching and interjunction of an indefinite number of larger and finer threads or fibres, which are in connection with numerous ganglionic cells with distinct nuclei, and are often produced into several processes or threads (Pl. XLV. figs. 2, 3); even in the pedicels, tentacles, and dorsal processes such a network is present. The large ambulacral nerves as well as their branches often contain pigment, which is most obvious in *Lætmogone*. Considering the more or less macerated condition of the animals, any closer examination of the histological structure of the nerves has been rendered impossible. What I have been able to distinguish concerning it seems to confirm the correctness of the observations so carefully made by Semper,[1] and Teuscher.[2] Plate XLII., fig. 1, represents a transverse section of an ambulacrum in *Lætmogone wyville-thomsoni* showing the relative position of the radial ambulacral vessel and the neural canal, &c. Leaving the nerves, I now purpose to treat the sensory organs of the Elasipoda.

There is much reason to believe that the dorsal processes and appendages perform in a similar or higher degree than the tentacles the function of tactile organs. Resembling the pedicels in structure, they differ from them by their position and unusual length, size, and flexibility, as well as by their lack of any terminal sucker, and they seem to be organs particularly suited to bring the animals into relation to surrounding bodies. An unusual abundance of nerves radiating towards the exterior layer of the perisoma is a special characteristic of the processes (Pl. XXXVII. fig. 8).

In the Deimatidæ and the Psychropotidæ I have found only the sensory organs just mentioned, but most representatives of the Elpidiidæ possess, besides these, olfactory organs in the form of auditory sacs. It is an already well known fact that

[1] Reisen im Archipel der Philippinen, ii., 1, Holothurien, Leipzig, 1868.

[2] Beiträge zur Anatomie der Echinodermen (Jenaische Zeitschrift für Naturwiss., x., Jena, 1876).

several of the Synaptidæ have such olfactory organs either attached to the nerve-ring itself or lying immediately in its proximity. Lately Danielssen and Koren as well as myself have exhibited in our respective reports that *Elpidia glacialis* and *Kolga hyalina* are provided with such organs not only at the nerve-ring but also all along the two lateral ambulacral nerves of the trivium.

In *Elpidia glacialis* the main nerve-cords, excepting the odd one of the ventral surface, communicate at their junction with the pharyngeal ring with a small auditory sac. On making a closer examination of the ambulacral nerves one will find that each of the ventral lateral cords carries these sacs, usually five or slightly more, scattered all over their length, while the remaining nerve-cords seem to be without any such; one or two may usually be observed near the points where the pedal nerves join the main cords. The auditory vesicles are provided interiorly with an epithelial lining, are spherical, about 0·2 mm. in diameter, and seem in general to be attached close to the nerve-cords; they contain five to twenty otoliths of a characteristic ovate shape, with one of the ends rounded, while the other is slightly tapered and truncated. The otoliths (Pl. XXXVI. fig. 25) measure in length about 0·036 mm. and in breadth 0·02 mm., and are made up of from three to four distinct layers, the innermost of which has a granular appearance. When regarding the layers posteriorly, viz., from the rounded end, they are marked out by concentric circles.

Danielssen and Koren mentioned in their already cited memoirs that *Kolga hyalina* possesses no less than fifty-six auditory sacs, two of which are situated close to each of the chief dorsal nerves not far from the ring and twenty-six along each lateral ventral nerve. It is most probably a fact that the odd main cord is regularly without any auditory vesicles, and that the dorsal cords only possess such vesicles anteriorly in the neighbourhood of the pharyngeal ring; at least I never found any exceptions to this rule. According to Danielssen and Koren, each auditory vesicle in the above-mentioned species contains from 20 to 130 otoliths, the form of which is either oblong and composed of different layers, or round and presenting concentric circles. I suppose that these latter, the rounded ones, are only the former observed from the round end, and thus the layers must of course present the appearance of concentric circles. My intention is to enumerate below all the cases in which auditory vesicles have been found, but I draw a special attention to the fact that I have not had the opportunity of examining as many forms as I should have wished, owing to the scanty material at my command.

In *Kolga nana* about thirteen auditory vesicles are present along each of its ventral, lateral nerve-stems, each vesicle containing about twenty otoliths.

In *Parelpidia elongata* auditory vesicles are found at the nerve-ring enclosing up to thirty or thirty-five otoliths, the length of which varies from 0·021 mm. to 0·04 mm.

Elpidia incerta possesses a great number of auditory vesicles disposed along each side

of the ventral surface. I counted eighteen to twenty attached to the anterior half of the nerve-stems, to which they seem to be connected either directly or by means of a short branch.

In *Peniagone vitrea* and *Peniagone affinis* a greater number of vesicles are to be observed along both of the ambulacral nerves just mentioned.

There is no doubt that the majority of the Elpidiidæ are characterised by possessing auditory vesicles, and that these are generally disposed in the same manner as in *Elpidia glacialis* and *Kolga hyalina*. Their number as well as that of the otoliths seems to vary very considerably, the latter being sometimes, though in a very few cases, altogether wanting. The otoliths in all the species I have seen are distinguished by the same characteristic ovate shape, with one end rounded and the other tapering and truncated.

The Alimentary Canal.

With the exception of a few Synaptidæ, in which it takes a straight antero-posterior course, the digestive tract of the Pedata and Apoda, as well as of the Elasipoda, is of a considerable length and arranged in convolutions. It descends from the mouth to the opposite extremity of the body, where, turning upon itself, it mounts up towards its anterior portion, whence, turning back again, it once more passes backwards directly to the anus (Pl. XL. fig. 2). Thus one can distinguish the following portions of the digestive tract, one descending, another ascending, and a third again descending. As previously pointed out the mouth as well as the anus change their positions in the Elasipoda ; the former always has a more or less ventral inclination and is often directed straight downwards, and has a perfectly ventral aspect in the whole of the Psychropotidæ, while the latter is alternately ventral, terminal, and dorsal. The oral aperture, which is closed by a sphincter formed of numerous circular muscular fibres, is situated in the centre of the oral disk, which, surrounded by the tentacles, is only to be regarded as a part of the body-wall itself. The space between the tentacles and the mouth is termed the atrium. As is already known, in the Dendrochirotæ the oral end of the body bears a certain resemblance to a proboscis which is capable of retraction, a capability depending upon the thinness of the integument of the proboscis itself. In the Elasipoda the oral disk is in general thick and almost inflexible because of the more or less crowded calcareous bodies in it, consequently it is not retractile (Pl. XLIII. fig. 1). But exceptions have been found, and particularly in the genus *Deima*, where the oral disk seems to be more or less allied to that of the Dendrochirotæ, and deserves therefore to be described more in detail.

In all the representatives of the genus *Deima* which have been at my disposal, no tentacles have been apparent externally. One finds in the centre of a disk-like portion of the body-wall an aperture, which is closed by large circular muscular fibres (Pl. XLIII. figs. 2, 3.) The disk in question is supplied with a number of radiate wrinkles,

and is surrounded by a simple crown of very minute papillæ, the importance of which will be discussed under the rubric "ambulacral system." By means of this aperture the external medium communicates with a spacious cavity, inside which the small completely retractile tentacles are situated, disposed near and around the aperture. It is most probable that the tentacles can be extended outside the body. In the retracted condition of the tentacles and the surrounding perisoma, no traces of any oral disk corresponding to that in the rest of Elasipoda have been found, unless the insignificant circular fold which lies close behind the tentacles may be considered as such. Even in a few other cases, as, for instance, in *Benthodytes selenkiana*, &c., the crown of tentacles can be drawn within the body, but this seems to take place in the same manner as in the Aspidochirotæ, the oral end of the body not being transformed into a proboscis.

The most anterior portion of the alimentary canal is usually dilated into a cavity (Pl. XLIII. fig. 1), which is termed the oral cavity, and which extending backwards close to the circular water-vessel is attached by numerous fine threads to the calcareous ring, to the tentacular canals, &c.; behind the oral cavity a narrower, usually very short, sometimes red or violet portion is to be observed, termed the pharynx, which is separated by a minute circular fold or valve (Pl. XLIII. fig. 1, and Pl. XXXVI. fig. 1) from the long and wide intestine, which, forming the convolutions spoken of before, terminates in the anus, which is closed by a muscular sphincter. The pharynx, which is surrounded anteriorly by the circular water-vessel (Pl. XLIII. fig. 1), and the circular pseudhæmal vessels, is connected with these by numerous strong threads. The cloaca, or the most posterior dilated portion of the intestine being attached to the body-wall by numerous powerful bands and threads is either of very little importance, as in the Deimatidæ and in several forms of the two other families, or it is, on the contrary, well developed and of an unusual size, as is the case in *Elpidia verrucosa*, *Scotoplanes robusta*, *Euphronides depressa*, &c. Some of the representatives of the Elpidiidæ are characterised not only by having an uncommonly large cloaca, but particularly by the fact that the latter gives off a large, wide cæcal prolongation towards the left side, which sometimes extends forwards towards the middle of the body, attaining, at the same time, a very remarkable breadth; such a cloaca is present in the following species:—*Achlyonice paradoxa*, *Scotoplanes globosa*, *Scotoplanes albida*, *Elpidia glacialis*, *Kolga nana*, and *Kolga hyalina*, Dan. and Kor. Sometimes the cloaca seems to vary in size in different individuals of the same species, as in *Benthodytes abyssicola*, &c. In *Deima fastosum* the cloaca is separated from the intestine itself by a small circular fold. In *Oneirophanta* and *Deima* the hindmost or anal portion of the digestive tract is noticeable in that it can be extended beyond the anus which thus becomes surrounded by a circular mound (Pl. XL. fig. 3). By a careful investigation one will find that this anal portion consists of a highly muscular double-wall including a large circular cavity, which, as far as I

can judge, possesses no aperture. I have not the least idea of the functions of this cavity, but aggregations of corpuscles resembling blood having often been found within it, it may possibly communicate with the pseudhæmal vessels.

The digestive tract in *Benthodytes sanguinolenta* as well as in *Benthodytes sanguinolenta*, var. *marginata*, is especially characterised by its second descending portion carrying a large, wide cæcal appendage or "diverticulum" about 15 mm. long (Pl. XL. fig. 4), which is situated far from the anus, in the largest individuals at a distance of about 170 mm., and which opens within the digestive tract by a very wide aperture; its structure does not differ greatly from that of the digestive tract.

Having nothing of importance to add to that which already is known, I think it unnecessary to give an account of the histological structure of the walls of the alimentary canal. I only refer to the Plate XXXVI., figs. 1 and 2, which represent some sections showing the different layers which compose the walls. The digestive tract is often strengthened by calcareous spicula of varying shape and size.

The cavity or sinus, which is enclosed between the most anterior portion of the digestive tract and the surrounding water-vascular ring with its five main branches, and which is termed the "œsophageal sinus," is either almost entirely closed by a thin membrane, as in *Lætmogone* (Pl. XLIII. fig. 4), *Elpidia glacialis*, *Benthodytes sanguinolenta* (Pl. XL. fig. 5), *Ilyodæmon maculatus*, &c., or this membrane is absent (Pl. XLIII. fig. 6), the sinus thereby communicating directly with the peritoneal cavity, as in *Oneirophanta*, *Orphnurgus*, &c.

Throughout the whole of its course, the alimentary tube is connected with the wall of the body by a dorsal mesentery, which either, as in *Oneirophanta*, *Lætmogone*, &c., consists of a continuous more or less fenestrated membrane, or, as in *Scotoplanes globosa*, &c., is reduced to bands and threads. The mesentery is usually strengthened by calcareous spicula of varying shape and size.

The Pseudhæmal System.

The pseudhæmal system in the Elasipoda closely resembles that in the rest of the Holothurioidea; and this having been already most carefully described by Tiedemann, Semper, &c., does not require any further explanation. I only intend to point out some peculiarities, especially with regard to the arrangement of the vessels, which in a more or less important degree distinguish the order in question. However, it ought to be remembered that any closer examination of the hæmal system has not been possible because of the materials having been highly macerated and softened by long immersion in spirit.

The ventral and dorsal stems seem usually to consist of but a single vessel. None of the Elasipoda possessing any respiratory trees, no traces are discernible of the large *rete*

mirabile which proceeds from the dorsal vessel in the Aspidochirotæ and Molpadidæ, and comes into relation with the left respiratory tree. In immediate relation to and seemingly grown together with the water-vascular ring is the annular plexus of the pseudhæmal vessels, which communicates by a larger branch with the reproductive organ. By means of injections I have not only succeeded in distinguishing most plainly the large main-vessels and their branches which are often most conspicuous in *Oneirophanta*, &c. (Pl. XL. fig. 2), but also a delicate plexus of very fine vessels inside the walls of the digestive tract (Pl. XL. fig. 1 and Pl. XXXVI. figs. 1, 2).

One or more transverse commissural vessels may always be found. *Oneirophanta mutabilis* possesses two such vessels, which connect the first descending and the ascending portions of the ventral main vessel with one another; one of these commissural vessels (Pl. XL. fig. 2, *e*) is comparatively long and crosses the other which is much shorter (Pl. XL. fig. 2, *f*), and which divides at both ends into several minute branches. In *Deima validum* the dorsal as well as the ventral stems carry commissural branches, the former one, and the latter two. The dorsal branch connects the first descending portion of the dorsal main vessel,—with which it is in communication by numerous small branches,—with the ascending portion of the same vessel. One of the ventral commissural branches runs out from the ventral vessel not far from the annular plexus and extends to the ascending portion of this vessel, while the shorter and thicker branch, proceeding a little behind the joint of the former, passes into the anterior curve of the ventral main vessel. Judging from what I have been able to observe in numerous species, a great variety seems to exist with regard to the size and position of these commissural vessels. The walls of the pseudhæmal system being often strengthened by numerous calcareous bodies of varying shape, the vessels themselves often become hard and brittle, as, for instance, in *Deima fastosum;* in this species these deposits have the form of large, close-lying, perforated plates of a highly variable appearance, which attain a length of from 0·60 mm. to 0·70 mm. (Pl. XXXV. figs. 7, 8). In *Lætmogone wyville-thomsoni*, &c., the vessels are on the contrary supported by scattered, spinose, branched or simple spicules (Pl. XXXVI. fig. 3).

The Ambulacral System.

The general presence of a more or less complicated system of ambulacral vessels is one of the most marked peculiarities of the Echinoderm type, and every contribution to the knowledge of that system of vessels ought to be of the greatest interest and value. The deep-sea Holothurids present an abundance of peculiarities, and their water-vascular system, remarkable in more than one respect, departs in many ways from what is supposed to characterise this class of animals.

The general characters of the water-vascular system of the Elasipoda do not differ

essentially from those of the Pedata. There is always a circular canal which surrounds the gullet and sends forwards five "main canals" (Pl. XLIII. fig. 4, *k*), which divide into branches communicating with the tentacles, and give off five radial ambulacral vessels which run backwards along the longitudinal muscular bands, separating them from the ambulacral nerves. In my report on the genus *Elpidia*[1] I showed that this genus had only two radial ambulacral vessels, one along each side of the ventral surface. After that, Danielssen and Koren not only established the truth of my observations concerning *Elpidia*, but also asserted that their own new genera *Irpa* and *Kolga* had only two radial vessels. Having most carefully examined the rich material of partly enormous forms brought home by the Challenger Expedition, I am fully convinced that all the Elasipoda are provided with five radial ambulacral vessels. By injecting the odd ambulacral vessel, which is easily done in *Lætmogone*, *Oneirophanta*, *Scotoplanes globosa*, and in many other large forms, not only does the vessel in question become filled with colouring matter, but also the circular canal and its branches, and the same result is attained by filling the dorsal ambulacral vessels or their processes with some coloured liquid. Even by means of transverse sections of these ambulacra one can easily be convinced that these vessels are present in all forms which I have examined, and, consequently, even in *Elpidia glacialis* and *Kolga nana* (Pl. XLII. fig. 8). It must be admitted that I have had no opportunity to examine *Irpa abyssicola* and *Kolga hyalina* described by Danielssen and Koren, but it would be very singular if such closely allied forms should form exceptions to the rule.

Danielssen and Koren[2] are right in not agreeing with the opinion expressed by me concerning the lateral ventral ambulacral vessels of *Elpidia glacialis*. In fact, I succeeded no better in distinguishing the true lateral ventral vessels than the other vessels, for what I described as such are only the large very remarkable ambulacral vesicles or rather cavities which communicate with the pedicels, lie side by side and are closely united with one another, thus appearing like a large wide canal which runs along each side of the body and is divided by very thin double walls into cavities, corresponding to the pedicels in number. These partition walls were most strictly described by me, and the figures 4, 28 and 29 in my memoir on the *Elpidia* give a true idea of their appearance. The extremely narrow and fine ambulacral vessels which become distinguishable only in transverse sections, had escaped my attention. Thus, it is evident that the general arrangement of the water-vascular system in the Elasipoda corresponds to that in the Pedata.

The circular water-vessel, which in some forms, as, for instance, in *Oneirophanta*, *Deima*, *Orphnurgus*, &c., is very wide, but in others, as, for instance, in *Benthodytes sanguinolenta*, &c., seems to be comparatively much narrower, does not closely

[1] Kongl. Svenska. Vetenskaps Akademiens Handlingar, Bd. xiv. No. 8, Stockholm, 1877.

[2] Echinodermen fra den Norske Nordhavsexpedition (Nyt Magazin for Naturv., Bd. xxv. 2, Christiania, 1879).

surround the gullet, but is attached to it by a great many filaments (Pl. XLIII. fig. 1), an interval being thus constituted, which connects the œsophageal sinus with the peritoneal cavity; when this communication exists as, for instance, in *Oneirophanta, Deima*, &c., the openings between the five main canals never appear closed, consequently, even here the sinus communicates with the peritoneal cavity. In *Benthodytes sanguinolenta, Lætmogone*, and many other forms where such a circular interval is present between the gullet and the circular water-vessel, the œsophageal sinus is closed by a very thin membrane which not only unites the five main vessels with one another, but is continued as a circular band lying close behind the circular vessel connecting this with the œsophagus (Pl. XL. fig. 5, *m*). Sometimes as in *Ilyodæmon maculatus*, &c., the circular water-vessel carries a great many very small cæcal sacs, the function of which is unknown. Most of the Elasipoda are provided with a single Polian vesicle, but in *Parelpidia elongata, Parelpidia cylindrica, Elpidia incerta, Elpidia willemoësi, Peniagone horrifer* and *Peniagone vitrea*, a couple of such cæcal prolongations of the circular water-vessel may be observed. These vesicles are always ventral in position, and when only one is present it lies to the left. In the family Elpidiidæ the Polian vesicle has a rounded form, and does not attain any considerable size, while in the two other families it is more elongated, almost cylindrical and often remarkably large. Its size varies most strikingly in different members of the same species, this being most apparent in *Oneirophanta;* one individual of this form dredged at Station 244 is remarkable for possessing a Polian vesicle, which measures about 134 mm. and is almost as long as the animal itself. Even *Orphnurgus asper* is distinguished by a Polian vesicle of unusual size. As a matter of fact, the number of Polian vesicles varies in a remarkable manner in the Pedata, but above all in the Apoda, though it must be remembered that even in these orders many forms have only a single one.

The tubular prolongations of the circular water-vessel, which are termed the madreporic canal, always single in the Elasipoda, run in the medio-dorsal line, and are intimately attached to the interradial dorsal mesentery (Pl. XLIII. fig. 4, *a*, and fig. 6, *a*). It is very well known that in the other Holothurioidea, if, even as a rule, a single dorsal madreporic canal with a single terminal madreporic tubercle is present, many exceptions are to be found, which having been fully described in the splendid memoirs of Semper and Selenka do not require repetition here. For a long time it was considered as characteristic of all the Holothurioidea that the madreporic tubercle was always internally placed, consequently the interior of the ambulacral system could not communicate with the exterior, but only with the peritoneal cavity. As will be presently pointed out, many of the deep-sea Holothurids form exceptions in having the stone canal piercing the perisoma in the medio-dorsal line at greater or smaller distances from the crown of tentacles, thus bringing the water-vascular system in communication with the exterior as is the case in other Echinoderms. In Elasipoda two kinds of madreporic canals are

apparent, and it is of importance to note carefully that their ends, even if they do not pierce the perisoma, are always closely united to and fused with the body-wall in the medio-dorsal line; no Elasipoda are found in which the madreporic canal depends freely into the peritoneal cavity or is attached only to the dorsal mesentery. In the following species the water-vascular system communicates with the exterior by one or several pores:—*Lætmogone wyville-thomsoni*, *L. violacea*, *L. spongiosa*, *Ilyodæmon maculatus*, *Achlyonice paradoxa*, *Scotoplanes globosa*, *S. papillosa*, *S. robusta*, *Kolga nana*, *K. hyalina*, *Parelpidia cylindrica*, *Elpidia purpurea*, *E. incerta*, *E. willemoësi*, *Peniagone wyvillii*, *P. vitrea*, *P. affinis*, *Benthodytes typica*, *B. abyssicola*, *Psychropotes longicauda*, and *P. semperiana*. I am fully convinced that only in a few forms, viz., *Oneirophanta mutabilis*, *Orphnurgus asper*, *Irpa abyssicola*, *Elpidia glacialis*, and *Benthodytes papillifera*, the madreporic canal does not open externally but is intimately united to the body-wall in its medio-dorsal line; concerning the rest of Elasipoda the material has been too scanty to allow of any satisfactory researches.

When examining that group of the Elasipoda in which the ambulacral system does not open externally, one finds that in most cases the madreporic canal terminates in a larger or smaller porous tubercle or plate, one side of which is closely united to the body-wall, while the other is free. In *Orphnurgus*, &c., the madreporic tubercle is divided by the mesentery into two halves, each being flat, slightly concave, and measuring about 4·5 mm. in length (Pl. XXXVIII. fig. 10). The size, form, and structure of this tubercle are highly variable in the different species. In *Orphnurgus* the network which composes it is of a very solid structure, the free surface being roughened by numerous calcareous papillæ. In *Oneirophanta* the tubercle is more convex but without the solid structure present in *Orphnurgus* (Pl. XXXVIII. figs. 11, 12), and in *Benthodytes papillifera* it has an almost globular shape. *Elpidia glacialis* has, on the contrary, no madreporic tubercle, —according to Danielssen and Koren traces of one are present in a thin very minute network,—and it appears that the terminal part of the stone canal ends cæcally within the body-wall.

In most forms where the water-vascular system is in communication with the exterior, the madreporic canal usually opens by one (Pl. XXXVIII. figs. 2 and 5) but not infrequently by several pores. Danielssen and Koren[1] were, some years ago, the first to describe, in their report on the Echinoderms dredged during the Norwegian North Atlantic Expeditions, a Holothurid, *Kolga hyalina*, which had the madreporic canal running out in a pore. At about the same time I observed the very same peculiarity in several of the Challenger Holothurioidea. The pore or pores always pierce the body-wall at the very place where, in the other Elasipoda, the madreporic tubercle joins the body-wall, that is, in the medio-dorsal line at a longer or shorter distance from the

[1] Nyt Magazin for Naturvidenskaberne, Bd. xxv. 2, Christiania, 1879.

crown of tentacles, and close to the genital aperture. I intend to point out those cases in which several pores are to be seen.

When examining the madreporic canal in *Lætmogone wyville-thomsoni* it will be found that, proceeding as usual from the dorsal part of the ambulacral ring, it runs upwards and backwards, being enveloped by the dorsal mesentery, and is attached at the medio-dorsal line about 30 mm. behind the tentacular crown (Pl. XLIII. fig. 4, *a*). The terminal part is surrounded and entirely enveloped by a rather thick layer of connective tissue, and gives off, four, five, or up to nine very fine branches, which pierce the body-wall, and open at the tops of small papillæ, 2 or 3 mm. long. These papillæ vary in position; they are either closely crowded in front of, or at one side of, or behind the large genital process, or they are situated in a semicircle along one side of the latter (Pl. XXXVIII. fig. 9, *a*). The fine canals, which pierce the perisoma, are rendered most distinct because of the great abundance of red and violet pigment present in their walls. A transverse section of the papillæ proves that they are made up of a very thick layer of connective tissue, containing a multitude of filaments, cells, and pigment, and that the canal which penetrates them is very narrow, scarcely a fifth of the diameter of the papillæ themselves.

In *Ilyodæmon maculatus* (Pl. XXXVIII. fig. 6) the terminal part of the madreporic canal divides into a greater or smaller number, sometimes up to fifty, branches, which penetrate the body-wall immediately in front of the genital process, and about 20 mm. behind the anterior extremity of the body. The fine canals, which do not run out in any papillæ, are often slightly expanded and branched, and contain a great quantity of pigment, but no deposits are present in them; their walls are extremely thin, and lined by an epithelium consisting of small, flat cells, which differ most strikingly from the elongated, closely-crowded, cylindrical cells, which line the true madreporic canal. In *Benthodytes abyssicola* the madreporic canal sometimes runs out by a single pore (Pl. XXXVIII. fig. 2, *a*), sometimes by four pores, which lie together at the top of a small obtuse papilla (Pl. XXXVIII. fig. 1). The canal is often more or less strengthened by calcareous deposits, but it may also lack such, as, for instance, in *Kolga hyalina*, Dan. and Kor. The fine canals or branches, which penetrate the body-wall seem to be always without calcareous matters.

The five main canals, which proceed from the circular vessel of the ambulacral system, are long and wide in some forms, and are always attached to the most anterior portion of the alimentary canal by numerous threads or filaments (Pl. XLIII. fig. 1, *a*). Their communication with the circular vessel is effected by means of a wide opening, while their anterior, slightly distended ends, lying close to the calcareous ring, open into the tentacles and the radial ambulacral vessels by a minute orifice. In *Deima fastosum* especially I have had the opportunity of observing the manner in which the main canals terminate in the tentacles and the ambulacral vessels. The anterior slightly distended end of these canals (Pl. XLIII. fig. 7, *a*) lies close to the posterior portion of

the calcareous ring, to which it is closely united, and opens by a minute orifice into a very narrow duct, which lies close to the inwardly-directed side of the calcareous ring, and turning round the anterior portion of this latter, passes into the radial ambulacral vessel (Pl. XLIII. fig. 7, *y*). That part of the narrow duct which is situated at the inwardly-directed side of the calcareous ring, and which presents a small expansion, gives off two pairs of branches (Pl. XLIII. fig. 7, *c*) the posterior being longer than the anterior one; these branches are the true tentacular canals.

In *Oneirophanta* and *Deima*, &c., the tentacular cavities reach a considerable size, and are supported posteriorly by the calcareous ring (Pl. XLIII. fig. 1, *k*); anteriorly they pass into the branches or processes of the terminal part of the tentacles, but if there be no such, as in *Ilyodæmon maculatus*, *Lætmogone*, &c. (Pl. XXXIX. fig. 4, and Pl. XLIV. figs. 11 and 14), the water-vascular system gives off a number of branched or unbranched cæcal prolongations within the thick sole-like terminal part. The tentacles of the Elasipoda never possess ampullæ. The five radial ambulacral vessels, which run backwards along the longitudinal muscular bands, on the inner side of the ambulacral nerves, and which sometimes, as in *Lætmogone wyville-thomsoni*, reach a considerable width (Pl. XLII. fig. 1, *e*), commonly give off very short lateral branches which enter pedicels and processes; in some cases there are no such lateral branches present, but the pedicels and processes communicate directly by a minute aperture with the ambulacral system. A transverse section of an ambulacrum shows very distinctly that the radial ambulacral vessels are separated from the neural canal by a firm, apparently homogeneous elastic layer of connective tissue (Pl. XLII. fig. 9, *e*). It is rare to meet with Elasipods, in which exist true ampullæ, freely depending into the peritoneal cavity, notwithstanding which two kinds of such ampullæ may be observed—the simple and the branched. The simple ampullæ have been found only in *Ilyodæmon maculatus* (Pl. XLII. fig. 3), where they attain a considerable size, from 10 mm. to 15 mm., thus exceeding the Polian vesicle in size, and where they are only present in communication with the dorsal ambulacra. The branched ampullæ, which are met with in *Orphnurgus asper* (Pl. XLI. fig. 3, *b*), and *Pannychia moseleyi*, really belong to the processes and consist of small vesicles, which send out a number of very short, but comparatively wide cæcal prolongations. The pedicels appear regularly to lack such ampullæ, at least I did not find them, excepting, as in *Orphnurgus asper*, in communication with the large ambulacral cavities or rooms (Pl. XLI. fig. 3, *c*), which will be described further on.

Often no ampullæ nor anything corresponding to them can be discerned, and this seems to be especially the case in the Psychropotidæ, where, however, canals very commonly occur remarkable for their length and width, which lie within the perisoma and are in direct communication with the pedicels and processes. In this family the broad, flat, characteristic brim which surrounds the body is penetrated by a

great many of these canals, very wide, lying side by side (Pl. XL. fig. 8, *b*); and these taper towards the margin of the brim and enter the often minute tuberculate pedicels or processes, which are situated in the margin. Special attention should be paid to the width of these canals, of which *Euphronides depressa* (Pl. XXXIX. fig. 1) affords a striking example, but at the same time it becomes evident that these canals are fully analogous to the lateral branches, which the radial ambulacral vessels in Pedata give off to the pedicels and processes.

A remarkable peculiarity in a great number of Elasipoda is the presence of large ambulacral cavities, which lie enclosed within the perisoma, and being in direct communication with the pedicels and processes should be regarded as only continuations of these. Two kinds of such cavities are present, the branched and the unbranched, the former being found in *Oneirophanta*, *Deima*, *Orphnurgus*, *Ilyodæmon*, and *Achlyonice*. In *Oneirophanta mutabilis* the lateral pedicels as well as the processes are in communication with large branched ambulacral cavities. The cavities which belong to the processes of the dorsal ambulacra are enclosed within the odd interambulacrum (Pl. XXXVI. fig. 4), and those communicating with the processes of the lateral ventral ambulacra lie within the lateral interambulacra, while those of the pedicels, principally belonging to the trivium, send out numerous branches into the lateral interambulacra (Pl. XLI. fig. 2, *g*). Each cavity resembles a flat room of considerable width which gives off in all directions branched and unbranched, longer and shorter cæcal prolongations (Pl. XLI. figs. 1, 2). Since the cavities of the lateral ventral ambulacra are closely crowded, the thick perisoma of each side of the body contains a very complicated system of cavities and canals. Here and there the radial ambulacral vessels seem to send out a larger or smaller cæcal prolongation, which does not communicate with any pedicels and processes (Pl. XLI. fig. 1, *e*).

As to the ambulacral cavities, *Deima* closely resembles the above-mentioned form. It has already been noted that true unbranched ampullæ are present in communication with the dorsal processes only in *Ilyodæmon maculatus*, while the pedicels of this species without ampullæ communicate with elongated cavities which run towards the medioventral line and terminate in some small branched and unbranched prolongations (Pl. XLII. fig. 4). But, even in *Orphnurgus*, *Achlyonice*, *Pannychia*, &c., plain evidence is given that the ambulacral cavities or vesicles of the processes do not always resemble those of the pedicels. In the first-mentioned genus all the processes are in communication with small branched ampullæ, while the pedicels proceed from somewhat large ambulacral cavities, which give off a small number of large, obtuse, slightly branched prolongations (Pl. XLI. fig. 3); it is, however, to be noted that these cavities send out a branched freely depending ampulla of the same appearance as that of the processes, though slightly smaller, thus constituting a combination of cavities and ampullæ. In *Achlyonice* the ambulacral cavities of the dorsal processes are small, oval, and unbranched (Pl. XLI.

fig. 5, *a*), while those of the pedicels having an elongated shape and being directed towards the middle line of the ventral surface are remarkable in that their blind end is slightly expanded and terminates in numerous, ten or more, cæcal branches. As above stated, the processes in *Pannychia* communicate with small branched vesicles, while the pedicels are provided with elongated ambulacral cavities.

The genus *Lætmogone* amongst the Deimatidæ (Pl. XLII. figs. 2 and 7), as well as most of the representatives of the Elpidiidæ (Pl. XLII. fig. 5, *c*, and Pl. XXXVI. figs. 5 and 6), are provided with unbranched ambulacral cavities, the form and appearance of which have already been demonstrated in the description of the species. The cavities, especially those belonging to the pedicels, seem in general to become elongated and tapered towards their cæcal end, which lies more or less close to the medio-ventral line, while their opposite portion, from which the pedicels proceed, often attains a considerable width; sometimes, as in *Lætmogone violacea*, *Scotoplanes globosa*, *Elpidia glacialis*, &c., this portion is so broad and wide that the cavities of the different pedicels become closely crowded side by side and separated from one another by a thin wall only (Pl. XLII. fig. 2, and Pl. XXXVI. fig. 5).

In the two known species of *Deima* a canal system is present which, as far as I know, does not exist in any other Holothurid. As may be remembered these two forms carry a great number of minute papillæ arranged in a single crown round the anterior aperture of the body (Pl. XLIII. fig. 2, *a*, and fig. 5, *a*), inside which the tentacles are situated. These papillæ, which are strengthened by small branched and perforated, irregular calcareous deposits, are in communication with fine canals (Pl. XLIII. fig. 5, *d*), which lie closely crowded side by side and are intimately united with one another, thus forming a continuous whole which closely surrounds the tentacular cavities. The canals being directed outwards and backwards, it has been possible to follow them as far as the neighbourhood of the most anterior part of the radial ambulacral vessels. The walls of the canals are made up of longitudinal fibres, and are supported by small, branched, scattered calcareous spicules. Along each of the canals a distinct nerve-branch is visible. There is no doubt that this system of canals is connected with the ambulacral system, and in *Deima validum* it appeared to me that this communication takes place just where the radial ambulacral vessels begin.

In some Elasipoda, as, for instance, in *Ilyodæmon maculatus*, &c. (Pl. XLII. fig. 3, *c*), larger or smaller cavities are present in the more or less thick perisoma, which cavities should be regarded as belonging to the water-vascular system. The walls of the ambulacral system frequently contain a varying quantity of calcareous deposits.

The Reproductive Organs.

In all the Elasipoda, without any known exceptions, the sexes are distinct, as is the case in the majority of the other Holothurioidea. Generally, the reproductive organs are more or less bilaterally symmetrical, consisting of two fascicles of longer or shorter,

simple or dichotomously branched cæca, attached one on each side of the medio-dorsal mesentery. But in several representatives of the Elpidiidæ, as, for instance, *Elpidia glacialis*, *Scotoplanes globosa*, *Scotoplanes robusta*, *Achlyonice paradoxa*, &c., there is only a single fascicle to be seen. As to their general appearance the generative organs of this order present a great resemblance to those of the Dendrochirotæ and the Aspidochirotæ, the former having two fascicles, the latter, with a few exceptions, but a single one.

Concerning the form, number, and size of the cæca which compose the reproductive organs, there exists a great variation in the different species. The cæca of *Oneirophanta mutabilis* are always unbranched, being more numerous, narrower, and more regularly cylindrical in the males than in the females (Pl. XLVI. figs. 6, 7). *Deima fastosum* has the generative cæca, six to seven in each fascicle, unbranched and cylindrical, (Pl. XLVI. fig. 8), while the other species of the same genus has each fascicle made up of five to six elongated very slender tubes, bearing larger and smaller spherical cæcal branches (Pl. XLVI. fig. 5). The reproductive organs in *Euphronides depressa* are very remarkable, for each fascicle—in the largest specimen, about 125 mm. long—is reduced to a single tube, the posterior half of which is greatly distended so as to take the shape of an oval elongated sac, covered with tuberculate protuberances (Pl. XLVI. fig. 4). In most cases, however, the reproductive organs of the Elasipoda are formed after the same plan as those in other Holothurioidea, wherefore I refer to the description of the species instead of detailing their shape here.

But the genital glands of the different sexes do not always quite agree with one another, of which fact *Benthodytes abyssicola*, *B. sordida*, &c. (Pl. XLVI. figs. 9 and 10), afford striking examples, their male organs being composed of very numerous and minute dichotomously branched cæca, while the female organs are very thin, and made up of comparatively very few, large and voluminous, slightly dichotomous cæca.

The single efferent duct, attached to the medio-dorsal mesentery, passes forwards and always opens in the medio-dorsal line, its communication with the exterior being commonly at a rather considerable distance from the crown of tentacles. As a rule, the genital aperture is situated immediately in the body-wall, but it is not infrequently placed at the top of a genital process, which in *Lætmogone* and *Ilyodæmon* attains a considerable length (Pl. XLIII. fig. 4, *c*, and Pl. XXXVIII. figs. 6, 7, 9). In one individual of *Lætmogone wyville-thomsoni* I noticed that this genital process bore a small branch near its middle, and in another specimen the top itself was divided into four parts.

A transverse section of the genital process shows very distinctly that it is built up of a very thick, dense, almost cartilaginous layer of connective tissue, the canal itself being thus very narrow. At the base it may easily be observed that this layer is composed of three different layers; the outer, which is a continuation of the integument of the body-wall itself, is separated from the inner, which has a yellow colour, by a dense

membranous layer, which is strengthened by some muscular elements and seems to include some small cavities.

As in all previously known Holothurids, the efferent duct is generally simple, but in some cases it may be observed that its end, when piercing the perisoma, gives off some very fine branches, each communicating with the surrounding medium by a pore. In *Elpidia purpurea* and *Peniagone vitrea* the efferent duct divides into two narrow divergent branches, which pass in opposite directions through the perisoma, and open externally, one on each side of the madreporic pore. In *Peniagone wyvillii* the efferent duct (Pl. XXXVII. fig. 6, *e*) is surrounded by the same thick and dense sheath of connective tissue which envelops the madreporic canal, and divides into two short, wide, and divergent canals, each of which, when the inside of the perisoma is reached, terminates in about eight long slender canals, which run within the perisoma, and communicate with the exterior by pores. These pores are scattered, not only over the anterior portion of the odd interambulacrum, but sparsely on the lateral interambulacra also.

The walls of the reproductive organs are often strengthened by calcareous deposits, which in some forms, as, for instance, *Deima fustosum*, &c., are very closely crowded, and covering one another, the walls thus becoming very hard and brittle. Having nothing of importance to add to the facts already known regarding the histological structure, I only refer to Plate XXXVII., which shows some sections of the reproductive organs.

General Remarks.

The most remarkable and distinguishing characteristic of the Elasipoda is their agreement in several important points, in their inner as well as their outer organisation, with the larval state, an agreement more close than occurs in any previously known Holothurid. The following characteristics are especially worthy of note as reminiscences of the development of the Holothurioidea :—

1. The strongly marked bilateral symmetry of the body and the fact that the highly convex dorsal surface is often extended further than the mouth, which thus becomes fully ventral in position.

2. The presence of pedicels on the ventral surface only, and their arrangement in pairs, but, above all, in the Elpidiidæ, their small number and their occasional position on the posterior part of the body only.

3. The simple shape of the calcareous deposits of the body-wall.

4. The simple conformation of the calcareous ring.

5. The communication of the water-vascular system with the exterior.

6. The absence of respiratory trees and ciliated cups.

Our present knowledge of the development of the higher Holothurids is rather unsatisfactory, and confined to that of a few forms. However, the development of *Holothuria tremula*, Gunner, *Holothuria tubulosa*, Gmelin, and *Cucumaria doliolum*,

Grube, has been most carefully described by Joh. Müller,[1] Selenka,[2] Danielssen and Koren,[3] and Kovalewsky.[4] According to these authors the gastrula, as it grows larger, assumes a distinctly bilateral form; the ventral surface becomes more or less flattened or concave, the dorsal, on the contrary, convex, and the latter projects slightly beyond the mouth and terminates anteriorly, as in *Cucumaria doliolum*, in a rounded præ-oral prominence (Kopfkegel, according to Selenka). The mouth is thus fully ventral. As development advances, the larva loses more or less of its primitive bilaterality, and the mouth becomes more terminal in position. In fact, a bilateral symmetry is distinctly traceable even in many adult forms of shallow-water Holothurids, as, for instance, *Psolus*, *Colochirus*, and the Aspidochirotæ, but, as it seems to me, this bilaterality is nowhere so conspicuous as in the deep-water Holothurids in question. In many Elasipoda the convex dorsal surface projects further than the mouth, which is thus rendered thoroughly ventral in position. That portion of the back which lies in front of the mouth strikingly resemble the rounded præ-oral prominence of the larva of *Cucumaria doliolum*.

As a matter of fact, the first pedicels which become developed not only belong to the ventral surface, but are even disposed in pairs and situated near the posterior extremity of the larva. It is rather surprising to find numerous examples of deep-sea Holothurioidea, as, for instance, *Elpidia purpurea*, *Scotoplanes robusta*, most of the species of *Peniagone*, *Scotoanassa*, &c., which are provided with only a few pairs of pedicels, situated on the posterior part of the ventral surface, while the rest of that surface is completely devoid of pedicels. Moreover, the pedicels of the Elasipoda belong exclusively to the ventral surface, and are distinctly opposed across that surface so as to form pairs with each other. Thus it seems as if even with respect to the pedicels, the conformity between the larvæ and the adult in the Elasipoda is more striking than that which exists in the Apoda and the Pedata.

The simplest forms of calcareous deposits are spicules, and these also appear first in the body-wall of the larvæ of the Pedata, while it is a well known fact that the larvæ of the *Synapta* are provided with small wheel-shaped plates, which are evidently a much more complicated kind of deposit than the former. The perisoma of the Elasipoda, excepting *Deima* and *Oneirophanta*, is regularly strengthened by spicules and wheels, the former of which are far more common than the latter. Thus it must, I think, be admitted that the Elasipoda present a singular resemblance to the larval forms as to their calcareous deposits, these having remained at such a low degree of development. As a matter of fact, simple unbranched spicules alone are found in several species, but spicules with three or four arms

[1] Abhandlungen d. Königl. Akad. d. Wissenschaften zu Berlin, 1846–1854.

[2] Zur Entwickelung der Holothurien (*Holothuria tubulosa* and *Cucumaria doliolum*), (Zeitschrift für wissenschaftliche Zoologie, xxvii., 1876, pp. 155–179, pls. ix.–xiii.).

[3] Bidrag til Holothuriernes udviklingshistorie (Fauna littoralis Norvegiæ, ii., 1856. pp. 47–54, pls. vii., viii.).

[4] Entwickelungsgeschichte der Holothurien (Mémoires de l'Acad. imp. d. Sc. de St. Pétersbourg, vii. série, tom. xi., No. 6, 1867, pp. 1–8, pl. i.).

are by far most commonly seen in the deep-water Holothurioidea in question. Supposing that the four arms of these deposits, instead of being free and independent, were connected at their ends with one another, each spicule would give origin to a plate with four holes, representing the first stage in the development of a plate or wheel. The process by which the plates and wheels of Elasipoda are developed from a spicule has been already sufficiently explained in the foregoing anatomical description. Besides, I may be justified in comparing the wheels of the Elasipoda with those of the larva of *Synapta*, but, as they are constructed in a different manner, the resemblance which they present is more apparent than real. In fact, all the wheels of the Elasipoda have the nave perforated by a large hole, from the edge of which rises a crown of four to six arcuate rods, while, on the contrary, the wheels of the larva of *Synapta*, in conformity with those of other Apoda, as, for instance, *Chirodota*, *Trochoderma*, and *Myriotrochus*, are devoid of a central hole as well as of a crown. The only exception to this rule occurs in the very strange minute hat-shaped bodies in *Elpidia glacialis*, which, however, by possessing a central crown composed of three rods, seem to approach more nearly to the wheels of the Elasipoda[1] than to those of the Apoda.

According to Müller, Baur,[2] Metschnikoff,[3] &c., the first traces of a calcareous ring in the larvæ appear as separate unbranched spicules surrounding the œsophagus. As the spicules grow larger, their ends become bipartite and gradually dichotomous; finally, the spicules become connected with one another so as to form a complete ring. On comparing the larval ring with that of the Elasipoda, some very singular similarities present themselves. In fact, the whole family Elpidiidæ is distinguished by possessing a calcareous ring composed of spicules, which strikingly remind one of those of the larvæ, excepting that the branches or arms, which radiate from their ends, are more outgrown. However, it is of importance to remember that the ring is made up of only five radial pieces, while the larvæ, as it seems, have commonly ten, five radial and five interradial, the former five being probably first developed. The five spicules of the Elasipoda being, with a few exceptions, separated from one another, the resemblance becomes more striking. In the Deimatidæ the ring is in a somewhat more advanced state of development, the spicules having been converted into a fragile spongy network.

The larvæ of the Apoda and Pedata always have the madreporic canal in communication with the surrounding medium by an opening on the dorsal surface, but eventually the canal loses its connection with the exterior so as to hang loosely in the peritoneal cavity

[1] In my memoir on the *Elpidia glacialis* I also described some large wheels which differ most strikingly in shape from those of other Elasipoda, and present the greatest resemblance to those occurring in the Apoda. Danielssen and Koren are doubtless right in supposing that these wheels had accidentally stuck to the rough surface of the integument, and I feel the more convinced of it as I could never find them in more than one single individual.

[2] Beitrage zur Naturgeschichte der *Synapta digitata*, ii., Dresden, 1864, pp. 36, 37.

[3] Studien über die Entwickelung der Echinodermen und Nemertinen (Mémoires de l'Acad. imp. d. Sc. de St Pétersbourg, vii. série, tom. xiv., No. 8, 1869, pp. 6, 7, pl. i. fig. 11).

of the adult animal. Most of the Elasipoda are remarkable in having the water-vascular system in persistent communication with the exterior, thus obviously resembling the larval state. In the rest of the species, the madreporic canal neither opens externally by a pore, nor does it hang freely into the interior, but its end is intimately joined to the dorsal perisoma and is sometimes, as it were, blind and inserted in it. This must, of course, be considered as a transitional state between the larva and the fully-developed animal. Not long ago Ludwig[1] published an account of a young *Chirodota rotifera*, Pourtalés, in which the madreporic canal had begun to detach itself from the dorsal body-wall; it had already lost its pore on the exterior, and the blind end was enclosed within the perisoma.

The respiratory trees and ciliated cups become developed only in a more advanced condition of the larvæ. Thus it seems to me as if the persistent absence of such organs in the Elasipoda indicated a certain conformity to the earlier stages of the Holothurids.

It follows from the facts above mentioned that the Elasipoda have retained many peculiarities characteristic of the larvæ of the Apoda and Pedata, and consequently that they have in many respects persisted without any sensible change for very long periods of time, and that they do not bear any genetic relation to the present representatives of the Apoda and Pedata, but are derived from ancestral forms of extreme antiquity.

On comparing the organisation of the recent Holothurioidea—the Elasipoda as well as the Apoda and Pedata—in the different stages of their development, and considering that the development of the embryo records the ancestral history of the species, it seems highly probable that the common progenitors of the three orders of Holothurioidea were characterised by a more or less distinctly-marked bilateral form, by a water-vascular system composed of a circular vessel, tentacular canals and a madreporic canal communicating with the exterior, by a calcareous ring, composed of spicules separated from one another, and by the absence of respiratory trees and ciliated cups, &c.

Danielssen and Koren[2] insist on the Elasipoda being placed very low in the series of Holothurids, but in this I cannot quite agree with them. The presence of a well-developed ambulacral system with five radial ambulacral vessels in connection with pedicels is considered as a marked peculiarity of the Echinoderm type; besides, in the more typical Echinoderms, as, for instance, the Echinoidea and Asteridea, &c., the madreporic canal terminates beneath a part of the apical system of ossicles, the pores of which place the ambulacral system in communication with the exterior. Now, it seems to me to be rather evident that those Holothurids must be regarded as higher in the Echinoderm chain, in which the water-vascular system has attained a higher degree of development,

[1] Ueber eine lebendiggelärende Synaptide (Archives de Biologie, ii. 1881, pp. 41–56, pl. iii.).

[2] Echinodermer fra den Norske Nordhavsexpedition (Nyt Magazin for Naturvidenskaberne, xxv. 2, 1879, pp. 102–104).

and there is no doubt, indeed, that the Elasipoda as well as the Pedata approach much nearer in this respect than the Apoda to the typical Echinoderms. I cannot conceive how the fact that the Elasipoda have retained more larval characteristics than the Apoda can in any way subvert this opinion. Lastly, concerning the mutual position of the Elasipoda and the Pedata, the former certainly are in one respect more nearly related to the typical Echinoderms than are the latter, viz., by their madreporic canal often communicating with the exterior, and that too not only by one pore but sometimes by a great number of pores crowded close together so as to form a kind of exterior "madreporic tubercle," but this peculiarity alone does not seem to me to decide their relative position. No doubt, the Pedata have, on the other hand, many important characteristics which may entitle them to a higher place in the series of Echinoderms.

But disregarding their position as Echinoderms, and considering only their general development as animals, I cannot but think that the Elasipoda have already in certain respects attained a higher development than all the other Echinoderms, and that this development is gradually advancing in a direction approaching the higher classes of animals. This opinion is founded on the following reasons :—

1. The form of the body is distinctly bilaterally symmetrical, with the ventral and dorsal surfaces clearly distinguishable from each other, with the mouth on the ventral surface and often with a head-portion plainly marked off from the rest of the body.

2. The ambulacral appendages of the ventral surface alone are intended for locomotion, these being in the typical Elasipoda particularly large and arranged on each side of the body in a single row ; and the locomotive organs of the one side are accurately opposed to those of the other side so as to form distinct pairs, almost recalling the legs of an insect or the locomotory organs of one of the Polychœta, &c.

3. These locomotory organs show the most evident tendency to appear in fixed places and in a fixed number in every species of the more typical Elasipoda, and that their number is often rather limited, as, for instance, in *Elpidia glacialis*, which has always four pairs of pedicels, *Scotoplanes globosa*, which has five pairs, &c.

4. The dorsal appendages are so modified as to perform functions far different from those of the ventral appendages.

5. These dorsal appendages, like the ventral ones, have a tendency to become fixed in number so that every species may have a certain number situated in a certain place on the back.

EXPLANATIONS OF THE PLATES.

PLATE I.

Parelpidia cylindrica, n. sp.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size.

Parelpidia elongata, Théel.

„ 3. Dorsal view; natural size.
„ 4. Ventral view; natural size.

PLATE II.

Scotoplanes mollis, Théel.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size.

Kolga nana, Théel.

„ 3. Dorsal view; twice the natural size.
„ 4. Ventral view; twice the natural size.

Scotoplanes papillosa, Théel.

„ 5. Dorsal view; natural size.
„ 6. Ventral view; natural size.

PLATE III.

Elpidia verrucosa, Théel.

Fig. 1. Dorsal view; one and a half times the natural size. *a*, holes after the dorsal processes, which are broken off.
„ 2. Ventral view; one and a half times the natural size.

Scotoplanes murrayi, Théel.

„ 3. Dorsal view; about four times the natural size.
„ 4. Ventral view; about four times the natural size.

PLATE IV.

Scotoplanes globosa, Théel.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size.

PLATE V.

Achlyonice paradoxa, Théel.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size.

Scotoplanes globosa, Théel.

„ 3. Side view; natural size.

PLATE VI.

Scotoplanes robusta, n. sp.

Fig. 1. Side view; natural size.
„ 2. Dorsal view; natural size.
„ 3. Ventral view; natural size.

PLATE VII.

Scotoplanes insignis, n. sp.

Fig. 1. Dorsal view; natural size.
„ 2. Side view; natural size.
„ 3. Ventral view; natural size.

Elpidia purpurea, n. sp.

„ 4. Dorsal view; natural size.
„ 5. Side view; natural size.
„ 6. Ventral view; natural size.

Peniagone vitrea, n. sp.

„ 7. Dorsal view; one and a fifth the natural size.
„ 8. Side view; one and a fifth the natural size.
„ 9. Ventral view; one and a fifth the natural size.

PLATE VIII.

Elpidia incerta, n. sp.

Fig. 1. Side view; natural size.

Elpidia willemoësi, n. sp.

Fig. 2. Side view; natural size.
„ 3. Ventral view; natural size.

Peniagone affinis, n. sp.

„ 4. Ventral view; natural size.
„ 5. Dorsal view; natural size.

Enypniastes eximia, n. sp.

„ 6. Ventral view; natural size. *b*, the anterior brim or appendage; *m*, mouth; *t*, tentacles.
„ 7. Dorsal view; natural size. *a*, anus; *b*, the anterior brim or appendage, which is penetrated by a number of wide canals lying side by side.

(Owing to the highly macerated materials, the figures of this animal are most defective).

Psycheotrephes[1] *exigua*, n. sp.

Fig. 8. Ventral view; twice the natural size.

PLATE IX.

Peniagone naresi, n. sp.

Fig. 1. Side view; natural size. *a*, the left dorsal ambulacrum, giving off branches to the large appendage.
„ 2. Ventral view; natural size.

(The posterior portion of the only individual I have seen is torn off, wherefore the figures are defective).

Scotoanassa diaphana, n. sp.

Fig. 3. Ventral view; natural size. *a*, the anterior brim; *b*, the posterior brim with the pedicels in its margin.
„ 4. Side view; natural size.
„ 5. Dorsal view; natural size.

Peniagone challengeri, n. sp.

„ 6. Ventral view; natural size.
„ 7. Side view; natural size.
„ 8. Dorsal view; natural size.

[1] This seems a more correct name than *Psychotrephos*, used on the plate.

PLATE X.

Peniagone lugubris, n. sp.

Fig. 1. Side view; natural size.

Peniagone horrifer, n. sp.

„ 2. Side view; natural size.

Peniagone wyvillii, n. sp.

„ 3. Ventral view; natural size.

„ 4. Side view; natural size.

Peniagone atrox, n. sp.

„ 5. Side view; natural size. *a*, the brim-like fold on the left side of the dorsal surface.

All the animals which are figured on this plate are highly macerated and deformed by long immersion in spirits, consequently I am not quite sure of the correctness of my idea of their true shape.

PLATE XI.

Lætmogone wyville-thomsoni, Théel.

Fig. 1. Side view; natural size. *a*, genital process.

PLATE XII.

Lætmogone wyville-thomsoni, Théel.

Fig. 1. Dorsal view; two-thirds the natural size. *g*, genital process.

„ 2. Ventral view; two-thirds the natural size.

PLATE XIII.

Lætmogone violacea, Théel.

Fig. 1. Side view; natural size.

„ 2. Ventral view; natural size.

„ 3. Dorsal view; natural size.

PLATE XIV.

Lætmogone spongiosa, Théel.

Fig. 1. Side view; natural size.

„ 2. Dorsal view; natural size.

„ 3. Ventral view; natural size.

PLATE XV.

Orphnurgus asper, Théel.

Fig. 1. Ventral view; natural size.
„ 2. Dorsal view; natural size.

PLATE XVI.

Ilyodæmon maculatus, Théel.

Fig. 1. Side view; natural size.
„ 2. Dorsal view; natural size. *a*, anus; *b*, the space where the pores of the madreporic canal are situated; *c*, genital process.
„ 3. Ventral view; natural size.

PLATE XVII.

Pannychia moseleyi, n. sp.

Fig. 1. Ventral view; natural size.
„ 2. Dorsal view; natural size.

PLATE XVIII.

Deima validum, Théel.

Fig. 1. Side view; natural size.

PLATE XIX.

Deima validum, Théel.

Fig. 1. Dorsal view; two-thirds the natural size.
„ 2. Ventral view; two-thirds the natural size. *a*, the anterior aperture closed and encircled internally by the tentacles; *b*, anal aperture.

PLATE XX.

Deima fastosum, Théel.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size. *m*, the anterior aperture closed, inside which the tentacles are situated; *a*, anus.

PLATE XXI.

Deima fastosum, Théel.

Fig. 1. Side view; natural size.

Oneirophanta mutabilis, Théel.

„ 2. Side view; natural size.

PLATE XXII.

Oneirophanta mutabilis, Théel.

Fig. 1. Dorsal view; natural size.
„ 2. Ventral view; natural size. *a*, anal aperture.
„ 3. Ventral view of a smaller individual; natural size. *x*, Stylifer infested the ventral perisoma.

PLATE XXIII.

Benthodytes sanguinolenta, n. sp.

Fig. 1. Ventral view; natural size.

PLATE XXIV.

Benthodytes sordida, n. sp.

Fig. 1. Ventral view; natural size.
„ 2. Dorsal view; natural size.

PLATE XXV.

Benthodytes mamillifera, n. sp.

Fig. 1. Dorsal view; natural size.

Benthodytes sanguinolenta, var. *marginata*, n. sp.

„ 2. Ventral view; natural size.

PLATE XXVI.

Euphronides depressa, n. sp.

Fig. 1. Dorsal view; three-fourths the natural size.
„ 2. Ventral view; three-fourths the natural size.

PLATE XXVII.

Psychropotes longicauda, n. sp.

Fig. 1. Side view; natural size.

Psychropotes lovéni, n. sp.

„ 2. Ventral view; natural size.
„ 3. Side view; natural size.
„ 4. Dorsal view; natural size.

Benthodytes selenkiana, n. sp.

„ 5. Ventral view; natural size.
„ 6. Dorsal view; natural size.

Benthodytes typica, n. sp.

Fig. 7. Ventral view; slightly magnified.

PLATE XXVIII.

Psychropotes longicauda, n. sp.

Fig. 1. Ventral view; natural size.

„ 2. Dorsal view; natural size.

PLATE XXIX.

Psychropotes longicauda, var. *fusco-purpurea*, n.

Fig. 1. Side view; natural size.

Psychropotes longicauda, var. *monstrosa*, n.

„ 2. Side view; natural size.

PLATE XXX.

Psychropotes longicauda, var. *monstrosa*, n.

Fig. 1. Ventral view; natural size.

PLATE XXXI.

Oneirophanta mutabilis, Théel.

Fig. 1. Diverse forms of calcareous plates from the body-wall; diameter of the largest ones 2·2 mm.

„ 2. Calcareous rods from the dorsal processes.

„ 3. Spicula from the pedicels.

Deima validum, Théel.

„ 4. Calcareous plate from the body-wall; diameter 7 mm.

„ 5. A piece of the same plate highly magnified, showing two distinct layers.

„ 6. The outlines of several smaller plates from the body-wall.

„ 7. Spicula from the ends of the pedicels.

„ 8. Spicula from the layer of connective tissue of the body-wall outside the plates.

„ 9. Net-shaped body from the connective tissue of the body-wall inside the plates

Deima fastosum, Théel.

„ 10. A large plate from the body-wall, surrounded by a number of smaller ones exposed *in situ*; diameter of the largest one 5 mm.

„ 11. A piece of a plate highly magnified, showing several distinct layers.

„ 12. Spicula from the ends of the pedicels.

„ 13. Spicula from the tentacles.

Lætmogone wyville-thomsoni, Théel.

Fig. 14. Large wheel, seen from above ; diameter about 0·14 mm.
,, 15. Small wheel, seen from above ; diameter 0·04 mm.
,, 16. Spicula from the ventral perisoma ; length about 0·38 mm.

PLATE XXXII.

Pannychia moseleyi, n. sp.

Fig. 1. Large wheel, from above ; diameter 0·24 mm.
,, 2. The second stage in the development of a large wheel, presenting the four-armed crown already formed ; the ends of the arms are connected with one another so as to give rise to a ring which becomes the nave.
,, 3. The first stage in the development of a large wheel, showing a four-armed spiculum, the arms of which grow larger and constitute the crown.
,, 4. A later stage in the development of a large wheel, showing the nave nearly fully developed ; the spokes are indicated by a series of outgrowths or processes round the margin of the nave. The space enclosed by the dotted lines marks a thicker portion, which is the centre of the growth of the nave, and which doubtless is the original ring formed by the arms of the crown which are being linked together.
,, 5. Small wheel-shaped plate ; diameter 0·052 mm.
,, 6. The central part of a large wheel, from above, showing that the large central hole is covered with a very thin calcareous membrane, pierced by six minute holes ; the dotted lines mark the crown composed of six arms, seen through the thin membrane just mentioned.
,, 7. Perforated plate from the dorsal processes ; diameter 0·092 mm.
,, 8. Irregular, perforated plate from the ends of the dorsal processes ; diameter 0·092 mm.
,, 9. Spicula from the ends of the dorsal processes.
,, 10. Spicula from the tentacles.
,, 11. Calcareous terminal plate from the ends of the pedicels.
,, 12. Irregular net-shaped bodies, lying outside the former and evidently formed by outgrowths of small wheel-shaped plates, which gradually change their original form so that they finally vanish.
,, 13. Calcareous network form the madreporic canal.

Scotoplanes albida, n. sp.

,, 14. Straight, spinous spiculum measuring about 0·57 mm. ; and C-shaped bodies from 0·056 mm. to 0·1 mm. in length.
,, 15. Spicula from the pedicels.

Parelpidia elongata, Théel.

Fig. 16. Four-armed deposits from the body-wall; the arms about 0·12 mm. long.
,, 17. Spicula from the pedicels.

Elpidia rigida, n. sp.

,, 18. Four-armed deposits from the body-wall; the arms about 0·48 mm. long.
,, 19. Spicula and four-armed deposits from the pedicels.
,, 20. Deposits from the tentacles.

Achlyonice lactea, n. sp.

,, 21. Three-armed deposits with the longest arms about 0·22 mm.; and a small wheel measuring 0·06 mm. in diameter. Taken from the dorsal perisoma.
,, 22. Deposits from the ventral perisoma.
,, 23. Spicula from the pedicels.

PLATE XXXIII.

Kolga nana, Théel.

Fig. 1. Deposits from the body-wall, about 0·08 mm. long.
,, 2. Spicula from the pedicels.

Elpidia incerta, n. sp.

,, 3. Four-armed deposits from the body-wall, with the arms from 0·06 mm. to 0·16 mm.
,, 4. Deposits from the pedicels.

Peniagone atrox, n. sp.

,, 5. Larger and smaller four-armed deposits from the body-wall; the arms of the largest deposits 0·12 mm. long.

Elpidia ambigua, n. sp.

,, 6. Four-armed deposit with the arms 0·18 mm. long, and wheel, measuring 0·048 mm. in diameter.

Scotoplanes insignis, n. sp.

,, 7. Three-armed deposit and C-shaped bodies; the arms of the former 0·24 mm. long, and the latter measuring about 0·1 mm. in length.

Peniagone horrifer, n. sp.

,, 8. Deposits from the pedicels.
,, 9. Four-armed deposits from the body-wall, with the arms about 0·06 mm. long.

Elpidia willemoësi, n. sp.

Fig. 10. Four-armed deposits with the arms from 0·08 mm. to 0·22 in length.
„ 11. Deposits from the tentacles.
„ 12. Deposits from the pedicels.

Elpidia purpurea, n. sp.

„ 13. Four-armed deposits from the body-wall; the arms of the largest deposits about 0·1 mm. long.
„ 14. Deposits from the tentacles.

Peniagone naresi, n. sp.

„ 15. Unbranched or irregularly branched spicula, three-armed bodies with the arms from 0·06 mm. to 0·22 mm., and C-shaped deposits measuring in length about 0·068 mm.

Peniagone challengeri, n. sp.

„ 16. Four-armed deposits of various dimensions, the largest having the arms 0·2 or 0·3 mm. long.

Scotoplanes mollis, Théel.

„ 17. C-shaped bodies, about 0·12 mm. long.

PLATE XXXIV.

Lætmogone wyville-thomsoni, Théel.

Fig. 1. Terminal plates from the ends of the pedicels.

Scotoplanes murrayi, Théel.

„ 2. Spicula and C-shaped bodies from the body-wall; the former about 0·6 mm. and the latter about 0·12 mm. in length.

Elpidia verrucosa, Théel.

„ 3. Four-armed deposits from the body-wall, with arms about 0·5 mm. long.
„ 4. Deposits from the pedicels.

Kolga nana, Théel.

„ 5. Straight and horse-shoe-shaped spicula, and a net-shaped plate.

Scotoplanes robusta, n. sp.

„ 6. Three-armed body with the arms about 0·24 mm. in length, and C-shaped ones about 0·1 mm. long.
„ 7. Deposits from the pedicels and tentacles.

Scotoplanes globosa, Théel.

Fig. 8. C-shaped spicula, the largest 0·16 mm. long.

,, 9. Straight spicula, the largest about 0·92 mm. long.

Psychropotes semperiana, n. sp.

,, 10. Three, four and five-armed deposits from the back with the arms from 0·06 mm. to 0·16 mm. in length.

,, 11. Deposits from the ventral surface.

Peniagone affinis, n. sp.

,, 12. Four-armed deposits from the ventral perisoma, with the arms about 0·14 mm.

,, 13. Four-armed deposits from the dorsal perisoma, with the arms about 0·28 mm. in length.

Benthodytes papillifera, n. sp.

,, 14. Spicula, 0·44 mm. long, from the dorsal perisoma.

Orphnurgus asper, Théel.

,, 15. Spicula from 0·14 to 0·2 mm. long, from the body-wall.

,, 16. Spicula from the pedicels.

Peniagone vitrea, n. sp.

,, 17. Four-armed deposits from the body-wall, with the arms 0·16 mm. long.

,, 18. Deposits from the oral-disk.

PLATE XXXV.

Psychropotes lovéni, n. sp.

Fig. 1. Four-armed deposits from the ventral perisoma, with the arms about 0·13 mm. long.

,, 2. Four-armed deposits from the outer layer of the dorsal integument, with the arms about 0·26 mm. long.

,, 3. Four-armed deposits from the inner layer of the dorsal integument, with the arms about 0·18 mm. long.

Benthodytes typica, n. sp.

,, 4. Spicula from the body-wall.

Euphronides depressa, n. sp.

,, 5. Four-armed deposits from the dorsal perisoma, the largest having the arm about 0·24 mm. long.

,, 6. Deposits from the ventral perisoma.

Deima fastosum, Théel.

Fig. 7. Deposits from the pseudhæmal vessels, which accompany the intestine.
„ 8. Deposits from the free connecting stems of the pseudhæmal system.
„ 9. Deposits from the walls of the reproductive organs.
„ 10. Deposits from the walls of the alimentary canal.

Psychropotes longicauda, var. *fusco-purpurea*, n.

„ 11. Four-armed deposits, with the arms about 0·3 mm. long.

Psycheotrephes exigua, n. sp.

„ 12. Four-armed deposits, with the arms about 0·1 mm. long.

Psychropotes longicauda, n. sp.

„ 13. Four-armed deposits from the outer layer of the dorsal integument, the arms from 0·06 mm. to 0·4 mm. long.
„ 14. Four-armed deposits from the inner layer of the dorsal integument.
„ 15. Deposits from the tentacles.
„ 16. Deposits from the ventral body-wall; the arms from 0·08 mm. to 0·24 mm. long.
„ 17. Deposits from the pedicels.

Scotoanassa diaphana, n. sp.

„ 18. Four-armed deposits, with the arms up to 0·016 mm. long.

PLATE XXXVI.

Oneirophanta mutabilis, Théel.

Fig. 1. Longitudinal section of the hindmost portion of the œsophagus and of the foremost part of the intestine. *a*, epithelium; *b*, outer layer of connective tissue; *c*, circular muscular layer; *d*, longitudinal muscular layer; *e*, inner layer of connective tissue; *f*, layer of glands; *g*, epithelium; *h*, pseudhæmal vessels; *v*, valve on the transition between the œsophagus and the intestine.[1]
„ 2. Transverse section of the intestine and the ventral pseudhæmal stem which accompanies it. *a*, epithelium; *b*, outer layer of connective tissue; *c*, circular muscular layer; *d*, longitudinal muscular layer; *e*, inner layer of connective tissue; *f*, layer of glands; *g*, epithelium; *h*, pseudhæmal vessels within the walls of the intestine; *i*, the ventral pseudhæmal stem; *k*, epithelium; *l*, circular muscular layer; *m*, layer of connective tissue; *n*, inner epithelium.

[1] Where no measurements are given, the figures are more or less strongly magnified.

Lætmogone wyville-thomsoni, Théel.

Fig. 3. Deposits from the pseudhæmal vessels.

Deima validum, Théel.

, 4. Diagram exhibiting the relation of the dorsal and ventral surfaces and the position of the processes and pedicels. *a*, dorsal surface ; *b*, ventral surface.

Scotoplanes globosa, Théel.

,, 5. View of the ambulacral cavities of the pedicels, seen from the peritoneal cavity. *a*, ambulacral cavities ; *b*, one of the lateral ambulacra ; *c*, openings into the pedicels ; *x*, communication between the ambulacral cavities and the ambulacral canal. Natural size.

,, 6. View of the ambulacral cavities of the foremost pair of dorsal processes, seen from the peritoneal cavity. *a*, ambulacral cavities ; *b*, the dorsal ambulacra ; *c*, openings into the dorsal processes. Natural size.

Deima fastosum, Théel.

,, 7. Calcareous deposits from the system of fine canals which are in connection with the minute papillæ which surround the anterior aperture of the body.

Oneirophanta mutabilis, Théel.

,, 8. A minute sheath with structureless contents and without any traces of calcareous deposits ; length about 0·08 mm. *a*, cells.

,, 9. Slightly larger sheath without calcareous matters.

,, 10. Sheath 0·20 mm. long. *a*, cells ; *b*, the contents with traces of concentric structure at the centre of the sheath ; *c*, a minute calcareous body in the centre of the sheath.

,, 11. Another slightly larger sheath. *c*, calcareous bodies. All these four stages of development of spicula are taken from a very minute pedicel of a very young individual from Station 146.

Ilyodæmon maculatus, Théel.

,, 12. A later stage of development of a large wheel, seen from below.

,, 13. An early stage of development of a large wheel, seen from below.

,, 14. A slightly more advanced stage of development of a large wheel ; seen from below.

,, 15. A fully developed large wheel, seen from above ; diameter from 0·14 mm. to 0·2 mm.

,, 16. Deposits within the water-vascular system.

,, 17. Small wheel, seen from above ; diameter about 0·028 mm.

,, 18. Dichotomously branched body of about the same size as the small wheels.

,, 19. Spicula from the pedicels.

Lætmogone violacea, Théel.

Fig. 20. Side view of a large wheel; diameter about 0·2 mm.

„ 21. Cruciform bodies from 0·072 mm. to 0·2 mm. in diameter.

„ 22. Spicula from the pedicels.

„ 23. Spicula from the tentacles.

„ 24. Spiculum from the ventral perisoma; length about 0·16 mm.

Kolga nana, Théel.

„ 25. Otolith; length about 0·028 mm.

Benthodytes abyssicola, n. sp.

„ 26. The sheath of a four-armed deposit, the calcareous substances being dissolved; the arms about 0·5 mm. long.

„ 27. Minute bodies within the integument.

PLATE XXXVII.

Elpidia willemoësi, n. sp.

Fig. 1. One of the five pieces or spicula which compose the calcareous ring.

Parelpidia elongata, Théel.

„ 2. One of the five pieces or rather spicula which compose the calcareous ring.

Deima fastosum, Théel.

„ 3. A portion of the calcareous ring. *a*, notch for the passage of the ambulacral nerves, &c.

Oneirophanta mutabilis, Théel.

„ 4. Side view of a portion of the calcareous ring. *a*, radial piece; *b*, interradial pieces; *x*, notch for the ambulacral nerves, &c.

Lætmogone wyville-thomsoni, Théel.

„ 5. Genital process with four tops.

Peniagone wyvillii, n. sp.

„ 6. A piece of the dorsal body-wall seen from the inner side, showing the foremost parts of the dorsal ambulacra and the terminations of the madreporic canal and the reproductive organs. *a*, perisoma near the tentacles; *b*, that part of the perisoma which is more distant from the tentacles; *c*, dorsal nerve stems; *d*, dorsal radial ambulacral vessels and dorsal longitudinal muscular bands; *e*, common efferent duct of the reproductive organs, which divides into two canals, each of which gives off a number of long

and very slender branches; *f*, the madreporic canal enveloped by the same thick sheath of connective tissue, which surrounds the common duct of the genital organs; *x*, pores of the fine branches of the genital organs.

Lætmogone wyville-thomsoni, Théel.

Fig. 7. Transverse section of a follicle of the male reproductive organs, showing a series of longitudinal folds. *a*, epithelium; *b*, circular muscular fibres; *c*, layer of connective tissue with the epithelial lining.

Deima validum, Théel.

„ 8. Transverse section of a dorsal process. *a*, outer layer of connective tissue covered with an epithelium; *b*, inner layer of connective tissue; *m*, nerve fibres; *n*, the large nerve branch; *o*, inner covering.

Scotoplanes robusta, n. sp.

„ 9. One of the five pieces which compose the calcareous ring.

Psychropotes longicauda, n. sp.

„ 10. Diagrammatic view of a transverse section of the large dorsal appendage; twice the natural size. *a*, the canals which communicate with the dorsal ambulacra; *b*, nerves; *c*, connective tissue.

Lætmogone wyville-thomsoni, Théel.

„ 11. The calcareous ring viewed from above and from behind; twice the natural size. *x*, the ambulacral canals and nerves.

Scotoplanes papillosa, Théel.

„ 12. One of the five pieces which compose the calcareous ring.

Oneirophanta mutabilis, Théel.

„ 13. View of a transverse section of a follicle of the female reproductive organs. *x*, outer epithelium; *y*, circular muscular fibres; *z*, layer of connective tissue; *a*, inner epithelium; *b*, ovisac; *c*, germinal vesicle; *d*, germinal spot; *e*, vitellus; *f*, vitelline membrane.

PLATE XXXVIII.

Benthodytes abyssicola, n. sp.

Fig. 1. A small portion of the dorsal perisoma, seen from the outside, showing the openings of the madreporic canal and of the reproductive organs. *a*, pores of the madreporic canal; *b*, genital pore.

„ 2. The same openings of another individual. *a*, the pore of the madreporic canal; *b*, the genital pore.

Fig. 3. Transverse section of the dorsal perisoma to show the termination of the madreporic canal and the reproductive organs. *a*, pores of the madreporic canal; *b*, genital pore; *x*, perisoma; *A*, madreporic canal; *B*, efferent duct of the genital organs.

„ 4. Calcareous deposits from the madreporic canal.

Benthodytes typica, n. sp.

„ 5. Transverse section of the dorsal perisoma, showing the termination of the madreporic canal. *a*, that part of the madreporic canal which pierces the perisoma; *b*, funnel-shaped hollow in the dorsal integument; *c*, calcareous network surrounding the pore of the madreporic canal; *d*, spicula; *e*, epidermis; *f*, circular muscular fibres with epithelial lining; *g*, connective tissue.

Ilyodæmon maculatus, Théel.

„ 6. Transverse section of the dorsal perisoma showing the termination of the madreporic canal and the reproductive organs. *A*, madreporic canal; *B*, efferent duct of the reproductive organs; *a*, pores of the madreporic canal; *b*, genital process; *e*, epidermis; *f*, circular muscular fibres with epithelial lining; *g*, connective tissue.

„ 7. The pores of the madreporic canal and the genital process, seen from above. *s*, pores of the madreporic canal; *g*, genital process.

„ 8. Calcareous deposits from the madreporic canal.

Lætmogone wyville-thomsoni, Théel.

„ 9. Termination of the madreporic canal and the reproductive organs. *A*, madreporic canal; *B*, efferent duct of the reproductive organs; *a*, papillæ communicating with the madreporic canal; *b*, genital process; *c*, branch of the genital process.

Orphnurgus asper, Théel.

„ 10. View of the madreporic plate and the terminal part of the madreporic canal; seen from below.

Oneirophanta mutabilis, Théel.

„ 11. Side view of the madreporic canal. *a*, madreporic canal; *b*, efferent duct of the reproductive organs; *c*, mesentery; *m*, circular water-vessel; *x*, inner surface of the body-wall; *y*, madreporic tubercle.

„ 12. View of the madreporic tubercle, seen from below.

Benthodytes sordida, n. sp.

„ 13. Calcareous deposits from the madreporic canal.

PLATE XXXIX.

Psychropotes longicauda, var. *monstrosa*, n.

Fig. 1. The anterior portion of the body with the ventral perisoma, the alimentary canal, &c., removed to show that system of water-vascular vessels which penetrates or rather constitutes the brim round the body; twice the natural size. *a*, the brim which is rather broad especially round the anterior extremity of the body; *b*, terminal part of the madreporic canal; *c*, the foremost portion of the reproductive organs; *d*, ventral lateral ambulacra; *e*, dorsal ambulacra; *f*, the two dorsal main canals which connect the dorsal ambulacra and tentacles with the water-vascular ring; *g*, passage to the tentacles; *h*, a part of the brim deprived of the outer layer of the integument to show more distinctly the close-lying canals which enter the processes round the edge of the brim; *x*, processes or pedicels.

Elpidia verrucosa, Théel.

„ 2. Upper view of some pyramidal papillæ of the dorsal integument with their deposits, *in situ*.

Achlyonice paradoxa, Théel.

„ 3. A piece of the integument showing holes and cavities.

Lætmogone wyville-thomsoni, Théel.

„ 4. Inner view of the terminal part of a tentacle, the stem having been cut off; *a*, the rest of the stem; *b*, holes from canals lying within the thick sole-like end of the tentacle.

Lætmogone spongiosa, Théel.

„ 5. Traces of wheel in the integument.

„ 6. Traces of star-like deposit in the integument.

Achlyonice paradoxa, Théel.

„ 7. Traces of three-armed deposit in the integument.

PLATE XL.

Oneirophanta mutabilis, Théel.

Fig. 1. Injected pseudhæmal vessels from the ventral walls of the intestine. *a*, the large ventral stem; *b*, branches given off to the walls of the intestine; *c*, plexus of fine vessels within the walls of the intestine.

„ 2. Ventral view of the digestive tract, showing the pseudhæmal vessels; almost

natural size. *a*, water-vascular ring; *b*, Polian vesicle; *c*, circular pseudhæmal vessel; *d*, ventral pseudhæmal stem; *e*, the long commissural vessel; *f*, the short commissural vessel; *x*, anal termination of the digestive tract.

Fig. 3. Posterior portion of the digestive tract opened. *a*, cloacal dilatation; *b*, anal portion of the digestive tract which is capable of being retracted within the body as well as extended beyond it; *c*, space enclosed by the double walls of the anal portion of the digestive tract; *d*, that part of the perisoma which surrounds the anus; *x*, muscular threads.

Benthodytes sanguinolenta, n. sp.

„ 4. A portion of the intestine; twice the natural size. *a*, intestine; *b*, diverticulum.

„ 5. Ventral view of the anterior part of the alimentary canal. *a*, water-vascular ring; *b*, ventral pseudhæmal vessel; *c*, oral portion of the digestive tract, visible through the mesentery which surrounds it; *d*, intestine; *e* dilatation of the intestine; *m*, mesentery; *o*, the main canals which proceed from the water-vascular ring; *p*, Polian vesicle.

Benthodytes sanguinolenta, var. *marginata*, n.

„ 6. Transverse section of the body; twice the natural size. *A*, dorsal surface; *B*, ventral surface; *D*, peritoneal cavity; *a*, processes of the dorsal ambulacra; *b*, pedicels of the odd ambulacrum; *c*, pedicels of the ventral lateral ambulacra; *m*, ventral ambulacra; *n*, dorsal ambulacra.

Euphronides depressa, n. sp.

„ 7. View of a part of the inner side of the odd interambulacrum; twice the natural size. *a*, dorsal ambulacra; *b*, ambulacral cavities communicating with the two canals which penetrate the azygous appendage; *x*, the connection of the cavities with the dorsal ambulacra.

Benthodytes sanguinolenta, var. *marginata*, n.

„ 8. Diagrammatic outlines of the lateral pedicels; twice the natural size. *a*, one of the lateral ambulacra; *b*, cylindrical cavities which enter the pedicels; *c*, pedicels; *d*, communication between the ambulacrum and the pedal cavities.

PLATE XLI.

Oneirophanta mutabilis, Théel.

Fig. 1. Upper view of a piece of the dorsal perisoma deprived of the outer layer of connective tissue which contains the calcareous deposits. *a*, longitudinal muscular band; *b*, transverse muscular layer; *c*, large branched ambula-

cral cavities, communicating with a dorsal process; *d*, base of a dorsal process directed outwards, the rest being cut off; *e*, small ambulacral cavity which does not communicate with any process; *l*, nerve branches; *m*, larger nerve passing to the process; *n*, ambulacral nerve stem. The radial ambulacral vessel does not appear.

Fig. 2. View of the ambulacral cavities which belong to one of the ventral lateral ambulacra, seen from the inner side of the body-wall; most of the connective tissue is removed. *a*, ventral lateral ambulacral vessel; *b*, longitudinal muscular band; *c*, transversal muscular layer; *d*, branch of the ambulacral vessel passing to a pedicel; *e*, openings into the pedicels, visible through the thin layer of circular muscular fibres as darker spaces; *f*, branched ambulacral cavities belonging to the pedicels and lying within the ventral perisoma; *g*, parts of the same ambulacral cavities crossing the radial ambulacral vessel and extending beyond it, thus lying within the lateral interambulacra; *h*, ambulacral cavity belonging to one of the processes of the ventral lateral ambulacrum; *k*, opening into this process, visible through the thin circular muscular layer as a darker space.

Orphnurgus asper, Théel.

„ 3. View of a portion of one of the ventral lateral ambulacra, seen from the peritoneal cavity; *a*, branched ambulacral cavity belonging to a pedicel and enclosed within the ventral perisoma; *b*, branched ambulacral vesicle or "ampulla" communicating with one of the processes of the ventral lateral ambulacrum and depending freely into the peritoneal cavity; *c*, branched ampulla-like prolongation of the ambulacral cavity just mentioned; *d*, longitudinal muscular band and radial ambulacral vessel.

Oneirophanta mutabilis, Théel.

„ 4. Transverse section of one of the ventral lateral ambulacra and of the adjacent body-wall. *a*, radial ambulacral vessel; *b*, ambulacral cavity of a process; *c*, ambulacral cavity of a pedicel from the outer row; *d*, ambulacral cavity of a pedicel from the inner row; *e*, cavities communicating with adjacent processes or pedicels; *f*, inner pedicel; *g*, outer pedicel; *h*, process.

Achlyonice paradoxa, Théel.

„ 5. View of the anterior part of the odd interambulacrum, seen from the inner side. *a*, ambulacral cavities of the dorsal processes; *b*, longitudinal muscular bands and ambulacral vessels; *x*, the anterior part of the odd interambulacrum.

PLATE XLII.

Lætmogone wyville-thomsoni, Théel.

Fig. 1. Transverse section of one of the ambulacra; the outer layer of the integument is removed. *a*, outer pigmentary layer of the ambulacral nerve; *b*, inner pigmentary layer of the ambulacral nerve; *c*, thick yellowish almost structureless membrane separating the nerve from the ambulacral vessel; *d*, neural canal; *e*, ambulacral vessel; *f*, longitudinal muscular band; *g*, transversal muscular layer; *h*, layer of connective tissue of the integument; *k*, small wheels; *l*, spicula; *m*, yellowish pigment; *n*, nerve; *p*, violet pigment; *s*, larger cells.

Lætmogone violacea, Théel.

„ 2. View of the ambulacral cavities of the pedicels, seen from the inner side of the body-wall; most of the integument is removed. *a*, radial ambulacral vessel; *b*, ambulacral cavities lying closely crowded side by side within the ventral perisoma; *c*, pointing out the position of the pedicels; *n*, ambulacral nerve; *m*, longitudinal muscular band.

By mistake this figure is referred to *Lætmogone wyville-thomsoni* on the plate, and the lithographer has wrongly drawn the dotted line at *m* beyond the inner limit of the muscular band.

Ilyodæmon maculatus, Théel.

Fig. 3. Transverse section of the dorsal perisoma showing the dorsal ambulacra and the processes which communicate with them; twice the natural size. *a*, ambulacral vesicles or ampullæ; *b*, dorsal processes; *c*, cavities within the perisoma.

„ 4. View of the ambulacral cavities of the pedicels, seen from the outer side of the body; most of the integument is removed. *a*, radial ambulacral vessel; *b*, branched ambulacral cavities with their bases placed side by side; *f*, bases of the pedicels, the rest of them being cut off; *m*, longitudinal muscular bands.

Kolga nana, Théel.

„ 5. View of a portion of the left ventral interambulacrum, seen from the inner side. *a*, odd ambulacrum; *b*, the left ventral lateral ambulacrum; *c*, ambulacral cavities of the pedicels; *d*, auditory vesicles.

Benthodytes sanguinolenta, n. sp.

„ 6. Diagrammatic side view of a minute dorsal process, highly magnified. *a*, ambulacrum; *b*, the integument; *c*, process.

Lætmogone wyville-thomsoni, Théel.

Fig. 7. View of an ambulacral cavity of a dorsal process, seen from above ; most of the integument is removed. *a*, ambulacrum ; *b*, ambulacral cavity ; *d*, opening of the process into the ambulacral cavity. The process itself is cut off, only its basal portion being left.

Kolga nana, Théel.

„ 8. Half-schematic transverse section of the odd ambulacrum ; *a*, connective tissue of the integument ; *c*, longitudinal muscular band ; *d*, ambulacral vessel ; *n*, radial nerve stem.

Oneirophanta mutabilis, Théel.

„ 9. Half-schematic representation of a transverse section of a dorsal ambulacrum. *a*, inner layer of connective tissue of the integument ; *b*, transverse muscular layer ; *c*, longitudinal muscular layer ; *d*, ambulacral vessel ; *e*, thick hyaline membrane separating the ambulacral vessel from the radial nerve cord ; *f*, cavities or branches which probably belong to the ambulacral cavities of the dorsal processes ; *g*, epithelium lining the perivisceral cavity ; *n*, radial nerve cord.

PLATE XLIII.

Oneirophanta mutabilis, Théel.

Fig. 1. Longitudinal section of the head-part. *a*, main canals which combine the water-vascular ring with the tentacles and the radial ambulacral vessels ; *b*, water-vascular ring ; *c*, circular pseudhæmal vessels ; *d*, ventral pseudhæmal vessel ; *k*, calcareous ring ; *m*, elastic bands and threads ; *n*, nerve ring ; *o*, anterior portion of the oral cavity ; *p*, posterior portion of the oral cavity ; *r*, œsophagus ; *s*, intestine ; *t*, tentacular cavities ; *v*, circular fold or valve ; *x*, Polian vesicle.

Deima fastosum, Théel.

„ 2. View of the perisoma round the anterior closed aperture of the body ; twice the natural size. *a*, minute papillæ placed in a ring round the disk-like portion of the perisoma ; *b*, aperture into the foremost portion of the alimentary canal.

„ 3. Side view of the foremost portion of the alimentary canal, with the left side removed to show the position of the tentacles. *a*, the oral cavity ; *b*, tentacles retracted ; *c*, anterior aperture of the alimentary canal ; *d*, perisoma round the aperture ; *e*, layer of circular muscles ; *f*, fold. Twice the natural size.

Lætmogone wyville-thomsoni, Théel.

Fig. 4. Side view of the anterior portion of the body, with the left side removed to show the position of the inner organs. *a*, madreporic canal; *b*, papillæ in connection with the madreporic canal; *c*, genital process; *d*, efferent duct of the reproductive organs; *e*, pseudhæmal vessels; *f*, calcareous ring; *g*, reproductive organs; *h*, Polian vesicle; *i*, water-vascular ring; *k*, main canals combining the water-vascular ring with the tentacles and the radial ambulacral vessels; *m*, radial ambulacral vessels; *t*, tentacles; *x*, the foremost portion of the perisoma of the left side turned forwards.

Deima fastosum, Théel.

,, 5. A part of the system of canals which surround the foremost portion of the alimentary canal and are in connection with the small papillæ which are presented in figure 2 of this plate. *a*, papillæ; *b*, part of the disk-like perisoma which surrounds the anterior aperture of the body; *c*, the blind ends of the canals cut off; *d*, canals; *e*, nerves.

Oneirophanta mutabilis, Théel.

,, 6. Side view of the anterior portion of the body with the left side removed to show the inner organs. *a*, madreporic canal; *b*, efferent duct of the reproductive organs; *c*, pseudhæmal vessel passing to the reproductive organs; *d*, male reproductive organs; *e*, mesentery; *f*, dorsal pseudhæmal vessel; *g*, intestine; *h*, Polian vesicle; *i*, ventral pseudhæmal vessel; *k*, elastic bands and threads; *l*, circular pseudhæmal vessel; *m*, water-vascular ring; *n*, radial ambulacral vessels; *o*, minute apertures visible through the thin walls of the water-vascular system, by which apertures the five main canals communicate with the tentacles and the radial ambulacral vessels; *p*, opening formed by the medio-dorsal mesentery; *r*, main canals. Natural size.

Deima validum, Théel.

,, 7. View of the termination of the odd ventral main canal into the tentacles and odd radial ambulacral vessel. *a*, a portion of the odd main canal; *b*, calcareous ring; *c*, branches of the main canal passing to the tentacles; *m*, tentacular cavities; *n*, nerve ring; *o*, tentacular nerves; *k*, the same minute canals which are represented in the figures 2 and 5 of this plate; *x*, odd radial ambulacral vessel; *y*, branch of the main canal which passes into the odd radial ambulacral vessel; *z*, ventral body-wall. The tentacles as well as the ends of the fine canals are removed.

PLATE XLIV.

Psycheotrephes exigua, n. sp.

Fig. 1. View of the outwardly directed side of a tentacle.

Scotoplanes mollis, Théel.

„ 2. Processes of one of the dorsal ambulacra.

Orphnurgus asper, Théel.

„ 3. Terminal part of a tentacle.

Scotoplanes murrayi, Théel.

„ 4. Terminal part of a tentacle.

Peniagone wyvillii, n. sp.

„ 5. Terminal part of a tentacle.

Elpidia purpurea, n. sp.

„ 6. Terminal part of a tentacle.

Peniagone wyvillii, n. sp.

„ 7. Branch of the terminal part of a tentacle.

Benthodytes typica, n. sp.

„ 8. A dorsal process retracted. *a*, canal which pierces the perisoma and combines the dorsal process with one of the dorsal ambulacra.

Scotoanassa diaphana, n. sp.

„ 9. Terminal part of a tentacle.

Peniagone vitrea, n. sp.

„ 10. Terminal part of a tentacle.

Ilyodæmon maculatus, Théel.

„ 11. Terminal part of a tentacle showing branched canals which communicate with the tentacular cavity and lie enclosed within the thick sole-like terminal part.

Scotoplanes globosa, Théel.

„ 12. Terminal part of a tentacle.

Deima validum, Théel.

„ 13. Longitudinal section of the end-portion of a slightly retracted pedicel. *a*, outer layer of the integument containing calcareous plates;

b, inner layer of the integument with scattered spicula; *c*, muscular layer.

Lætmogone wyville-thomsoni, Théel.

Fig. 14. Diagrammatic view of a transverse section of the thick terminal part of a tentacle. *a*, tentacular cavity; *b*, branched canals lying within the thick sole-like terminal part.

PLATE XLV.

Oneirophanta mutabilis, Théel.

Fig. 1. Plexus of pigmented nerves from the integument.
„ 2. Nerve-cell produced into three processes.
„ 3. Nerve-cell produced into several processes.
„ 4. Portion of a nerve-branch from a dorsal process.
„ 5. Nerve-ring. *a*, branches passing to the tentacles; *b*, radial nerve-stems; *c*, branches passing to the oral disk and the oral cavity.
„ 6. Cells from the connective tissue of the integument. *a*, cell produced into five processes; *b*, cell with three processes; *c*, cell with two processes.

PLATE XLVI.

Ilyodæmon maculatus, Théel.

Fig. 1. View of the reproductive organs with the branches of the one side removed. *a*, efferent duct.

Lætmogone wyville-thomsoni, Théel.

„ 2. A portion of the female reproductive organs.
„ 3. A portion of the male reproductive organs.

Euphronides depressa, n. sp.

„ 4. View of the female reproductive organs taken from the animal dredged at Station V. Twice the natural size.

Deima validum, Théel.

„ 5. View of the reproductive organs; the tubes of the one side removed. Twice the natural size. *a*, efferent duct.

Oneirophanta mutabilis, Théel.

„ 6. View of the male reproductive organs. Twice the natural size. *a*, efferent duct.

Fig. 7. View of the female reproductive organs. Twice the natural size. *a*, efferent duct.

Deima fastosum, Theel.

„ 8. View of the reproductive organs. One and a half times the natural size. *a*, efferent duct.

Benthodytes abyssicola, Theel.

„ 9. View of the male reproductive organs. Twice the natural size. *a*, efferent duct.

„ 10. View of the female reproductive organs. Twice the natural size. *a*, efferent duct.

INDEX

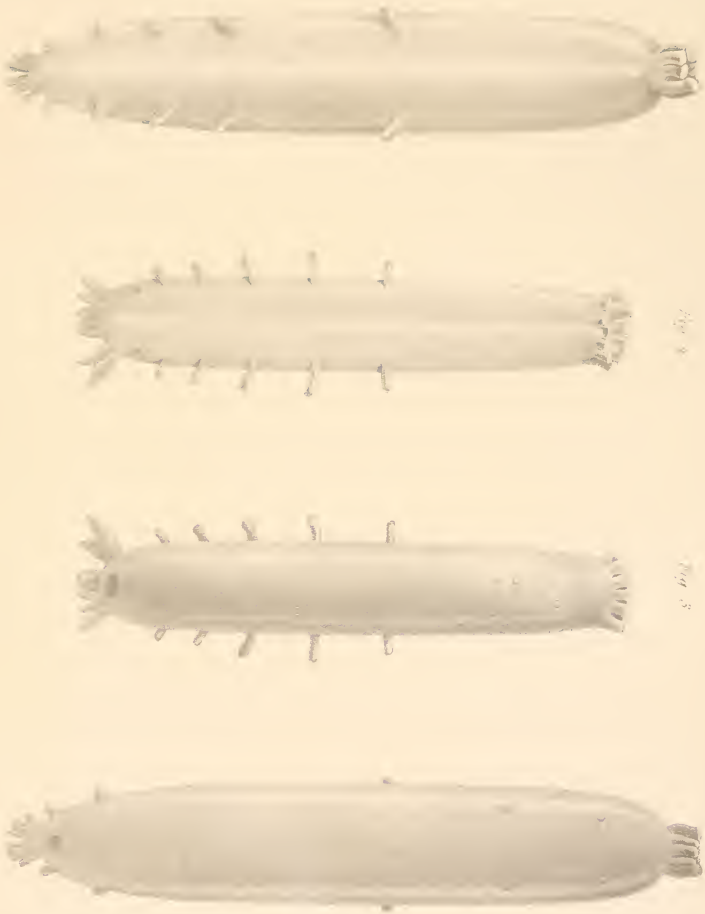


Fig. 1

Fig. 2

Fig. 3

Fig. 4

1-2. PARELPIDIA CYLINDRICA, Gab. 3-4. PARELPIDIA ELONGATA, Thér.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

1-2, SCOTOPLANES MOLLIS, Theel. 3-4, KOLGA NANA, Theel. 5-6, SCOTOPLANES PAPILLOSA, Theel.

Fig. 1.

Fig. 2.

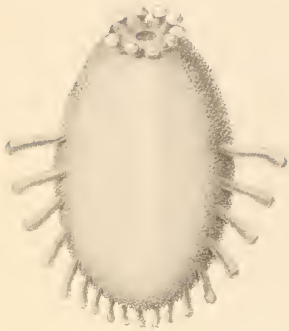


Fig. 4.

Fig. 3.

1-2, ELPIDIA VERRUCOSA, [illegible] 3-4, SCOTOPLANES MURRAYI, [illegible]

Fig. 1

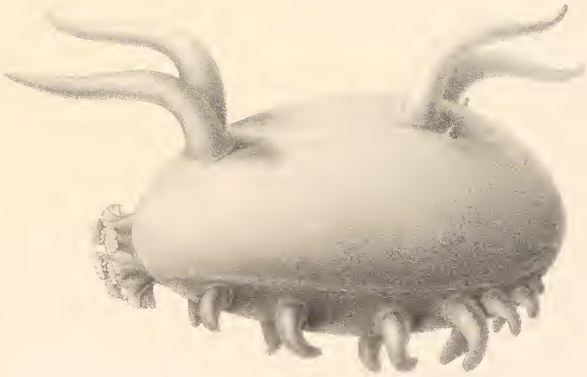
Fig. 2

SCOTOPLANES GLOBOSA, Thes.

Fig. 1

Fig. 2.

Fig. 3.



1-2. ACHLYONICE PARADOXA, Théel 3. SCOTOPLANES GLOBOSA, Théel.

Fig. 2.

Fig. 3

Fig. 1

SCOTOPLANES ROBUSTA, n. sp.

Fig. 1.

Fig. 2

Fig. 3.

Fig. 4.

Fig. 5

Fig. 6

Fig. 7

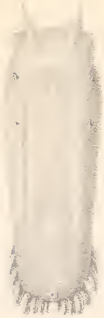


Fig. 8.

Fig. 9.

1-3, SCOTOPLANES INSIGNIS, n sp 4-6, ELPIDIA PURPUREA, n sp
7-9, PENIAGONE VITREA, n sp

Fig. 1.

Fig. 2

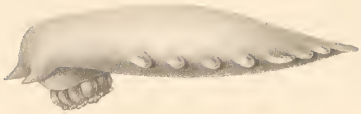


Fig. 4.

Fig. 3.

Fig. 5.

Fig. 6.

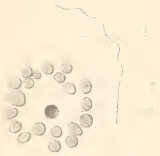
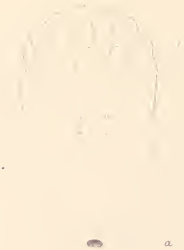


Fig. 8

Fig. 7



Tuxen & Lundberg del.

1. ELPIDIA INCERTA, n sp. 2-3, ELPIDIA WILLEMOESI, n sp. 4-5, PENIAGONE AFFINIS, n sp.
6-7, ENYPNIASTES EXIMIA, n sp. 8, PSYCHOTREPHOS EXIGUA, n sp.

Fig. 1

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

1-2, PENIAGONE NARESI, n. sp. 3-5, SCOTOANASSA DIAPHANA, n. sp.
6-8, PENIAGONE CHALLENGERI, n. sp.

Fig. 1

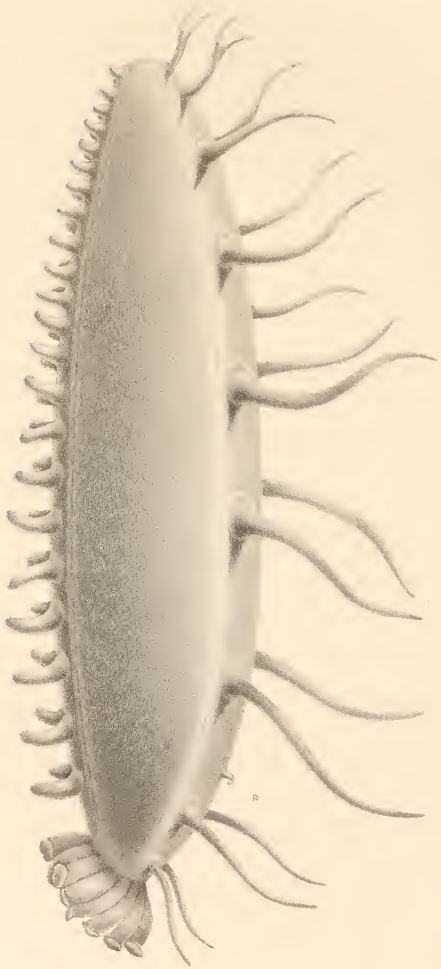
Fig. 2

Fig. 3

Fig. 4

Fig. 5.

1. PENIAGONE LUGUBRIS, n. sp. 2. PENIAGONE HORRIFER, n. sp.
3-4. PENIAGONE WYVILLII, n. sp. 5. PENIAGONE ATROX, n. sp.



LÆTMOGONE WYVILLE-THOMSONI, Thorell

Fig. 1

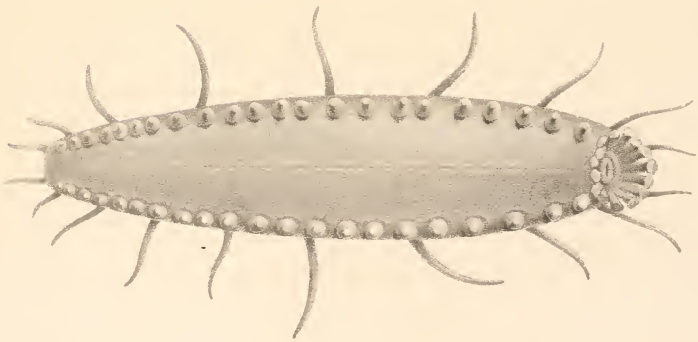


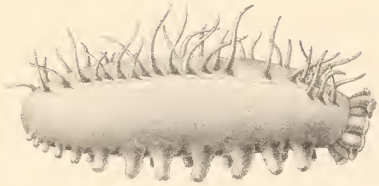
Fig. 2.

LÆTMOGONE WYVILLE-THOMSONI, Theel.

Fig. 2.

Fig. 3.

Fig. 1.

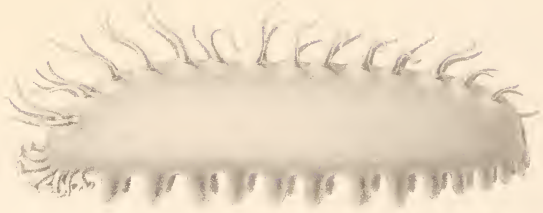


LÆTMOGONE VIOLACEA, Theel.

Fig. 2

Fig. 3

Fig. 1



LÆTMOGONE SPONGIOSA, Thorell.

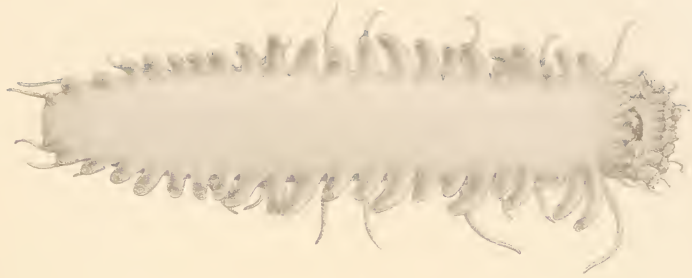


Fig. 1.

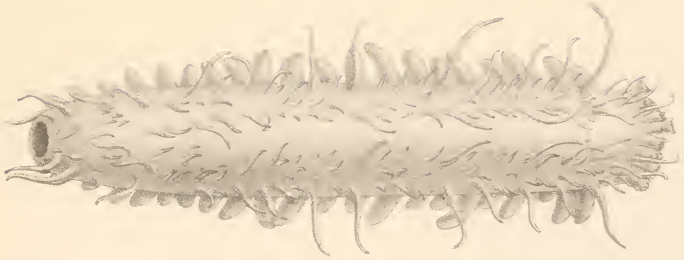


Fig. 2.

ORPHNURGUS ASPER, Theel.

Fig 2.

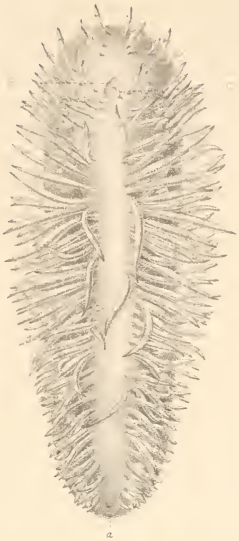


Fig 3.

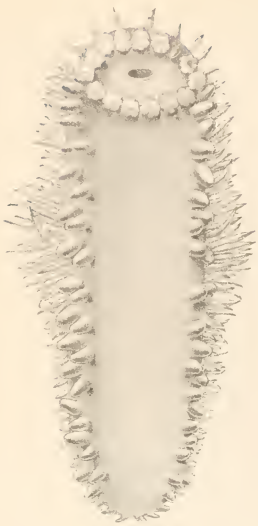
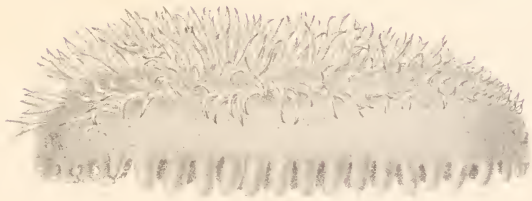


Fig. 1.

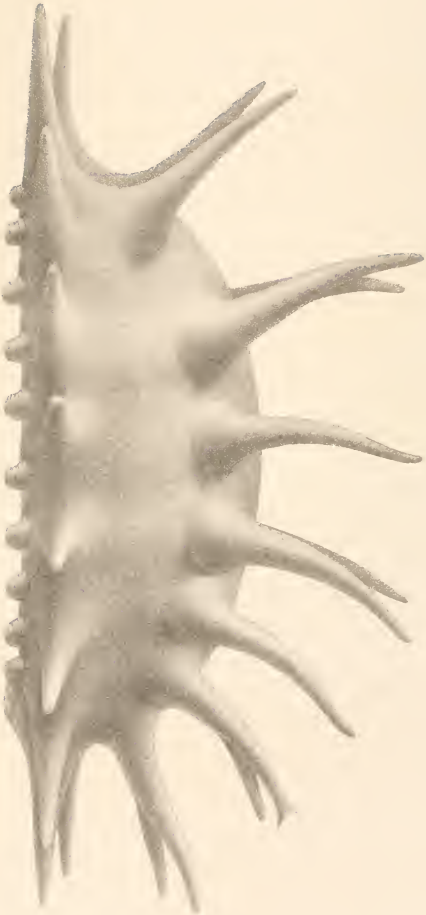


ILYODÆMON MACULATUS,

Fig. 1.

Fig. 2.

PANNYCHIA MOSELEYI.



DEIMA VALIDUM. Theel

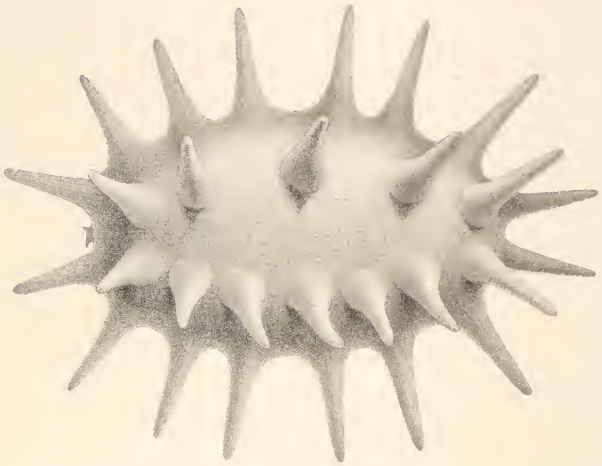


Fig. 1.

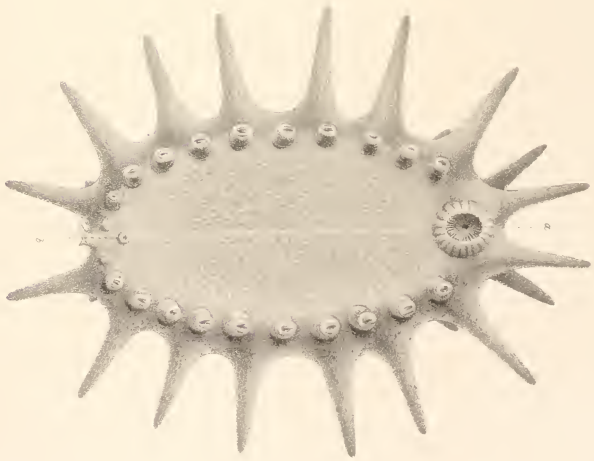


Fig. 2.

DEIMA VALIDUM, Theel

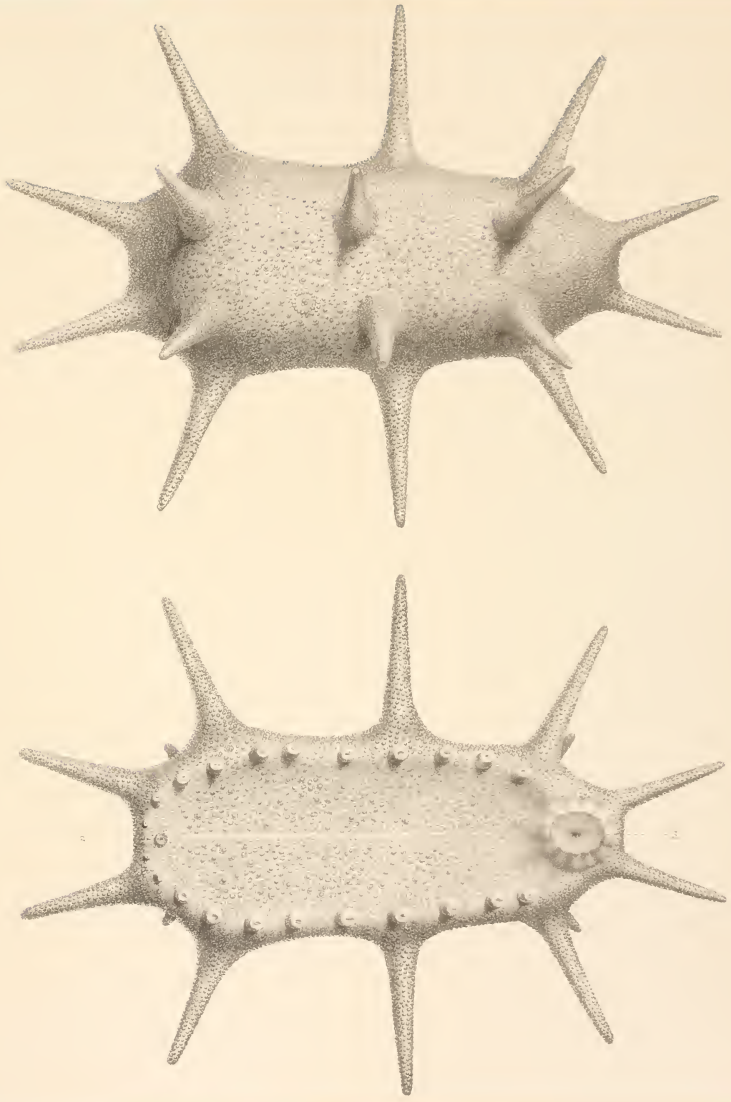


Fig. 1

Fig. 2

DEIMA FASTOSUM, Théel

Fig. 1

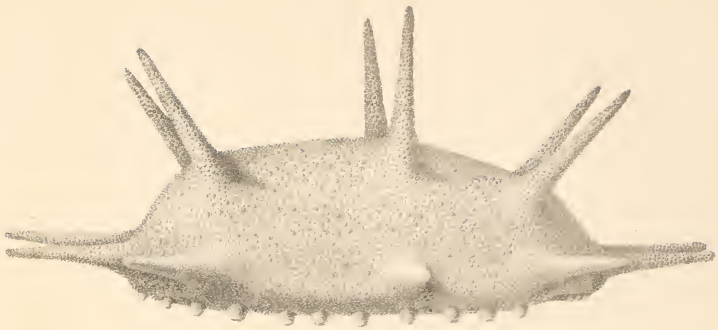


Fig. 2

1. DEIMA FASTOSUM. Trail. 2 ONEIROPHANTA MUTABILIS Trail.

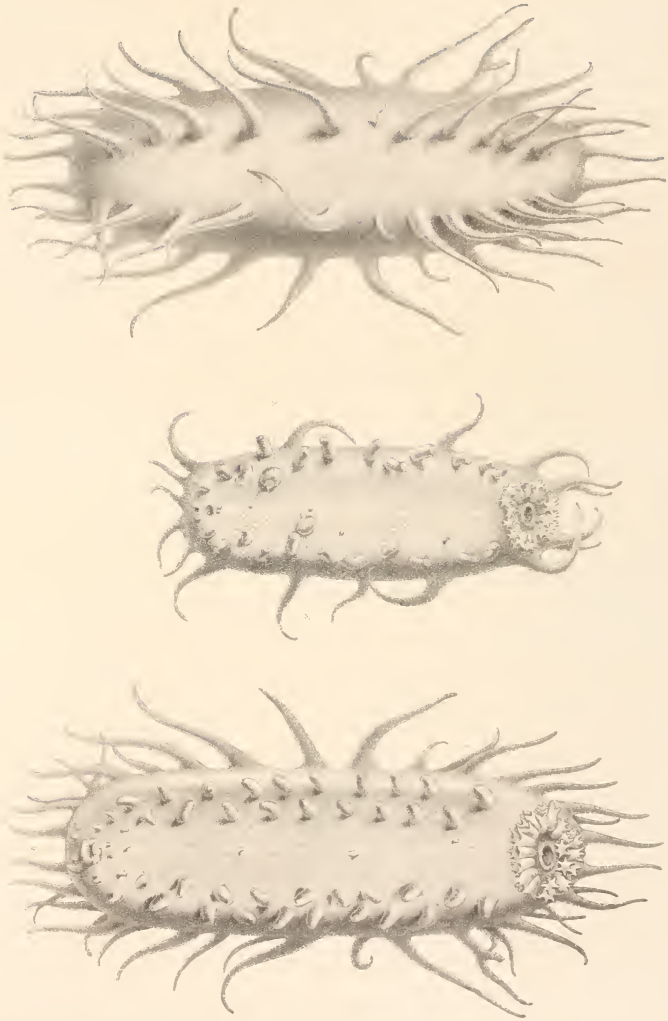


Fig. 1

Fig. 3

Fig. 2

ONEIROPHANTA MUTABILIS, Théel

BENTHODYTES SANGUINOLENTA.

Fig. 1

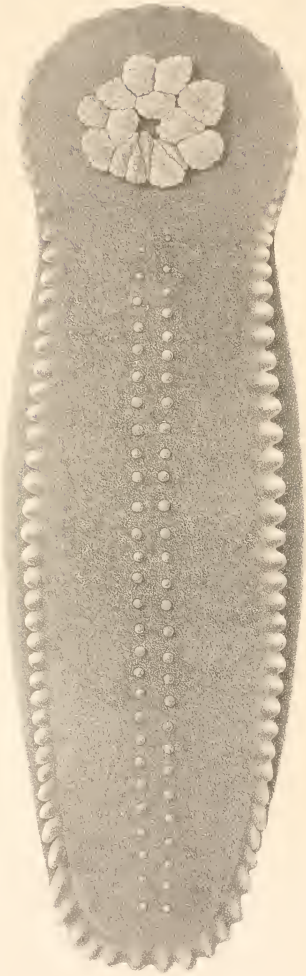
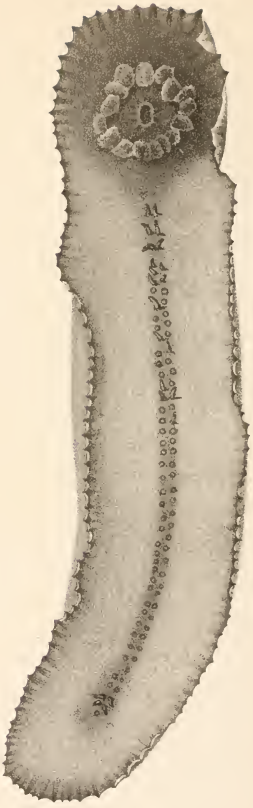


Fig. 2

BENTHODYTES SORDIDA,

Fig. 1.

Fig. 2.



1. BENTHODYTES MAMILLIFERA, n. sp. 2. BENTHODYTES SANGUINOLENTA, var. MARGINATA n.

Fig. 2

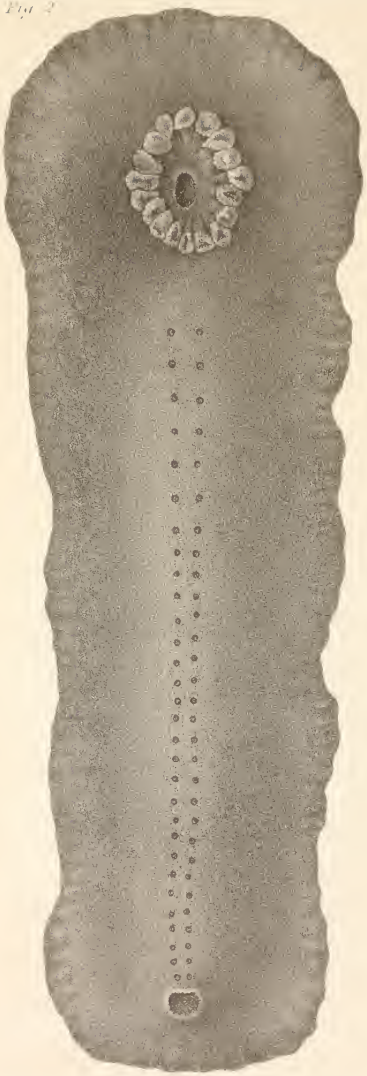
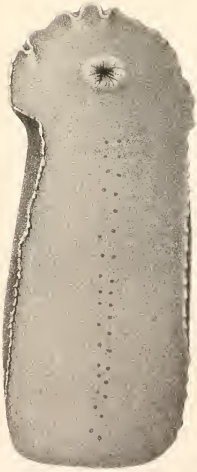
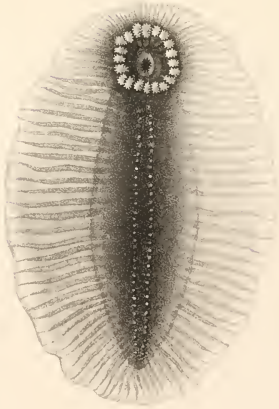


Fig. 1.

EUPHRONIDES DEPRESSA.





M. Thiél. del.

1 PSYCHROPOTES LONGICAUDA, n. sp. 2-4 PSYCHROPOTES LOVENI, n. sp.
5-6 BENTHODYTES SELENKIANA, n. sp. 7 BENTHODYTES TYPICA, n. sp.

Fig. 1

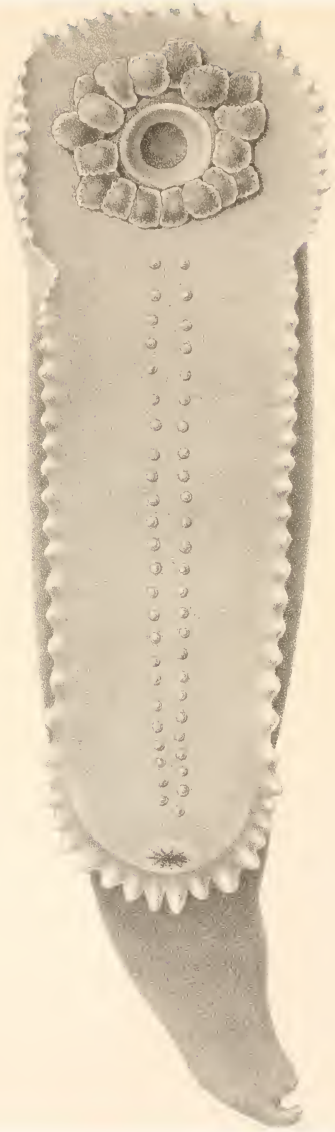
Fig. 2

PSYCHROPOTES LONGICAUDA, n. sp.

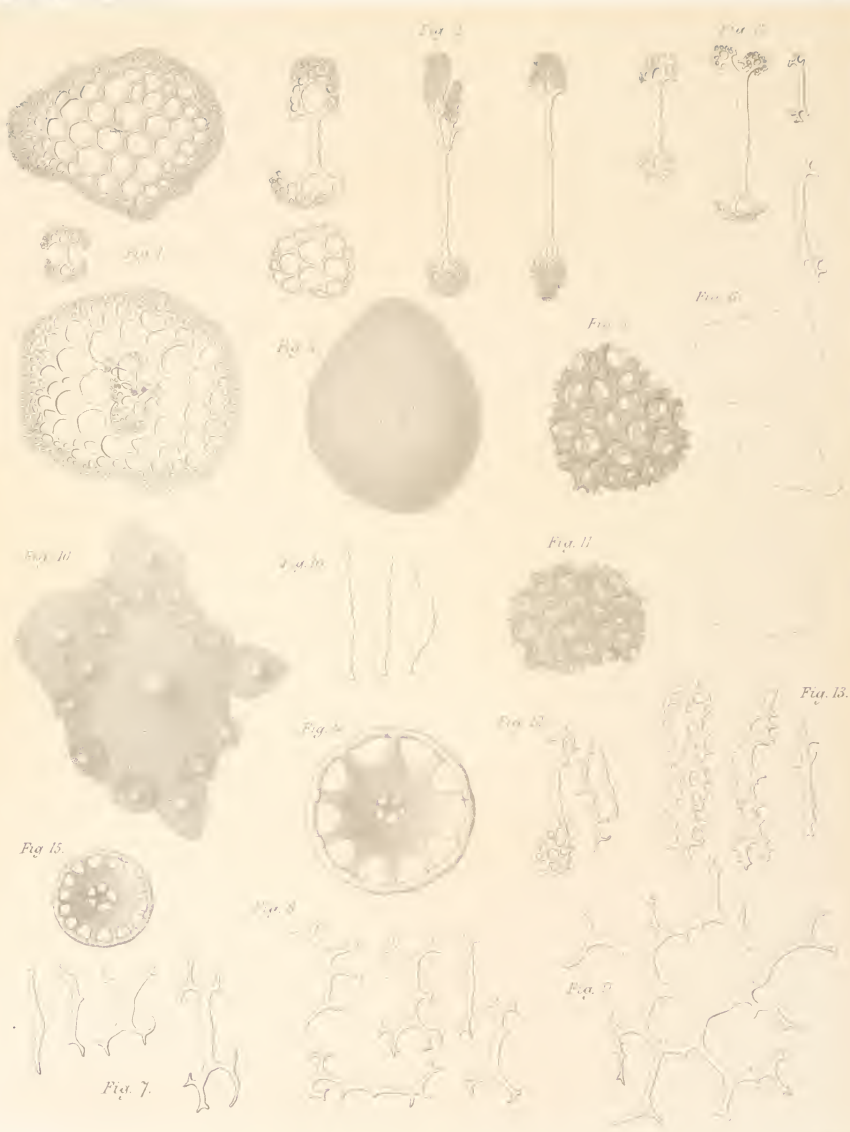
Fig 2

Fig 1

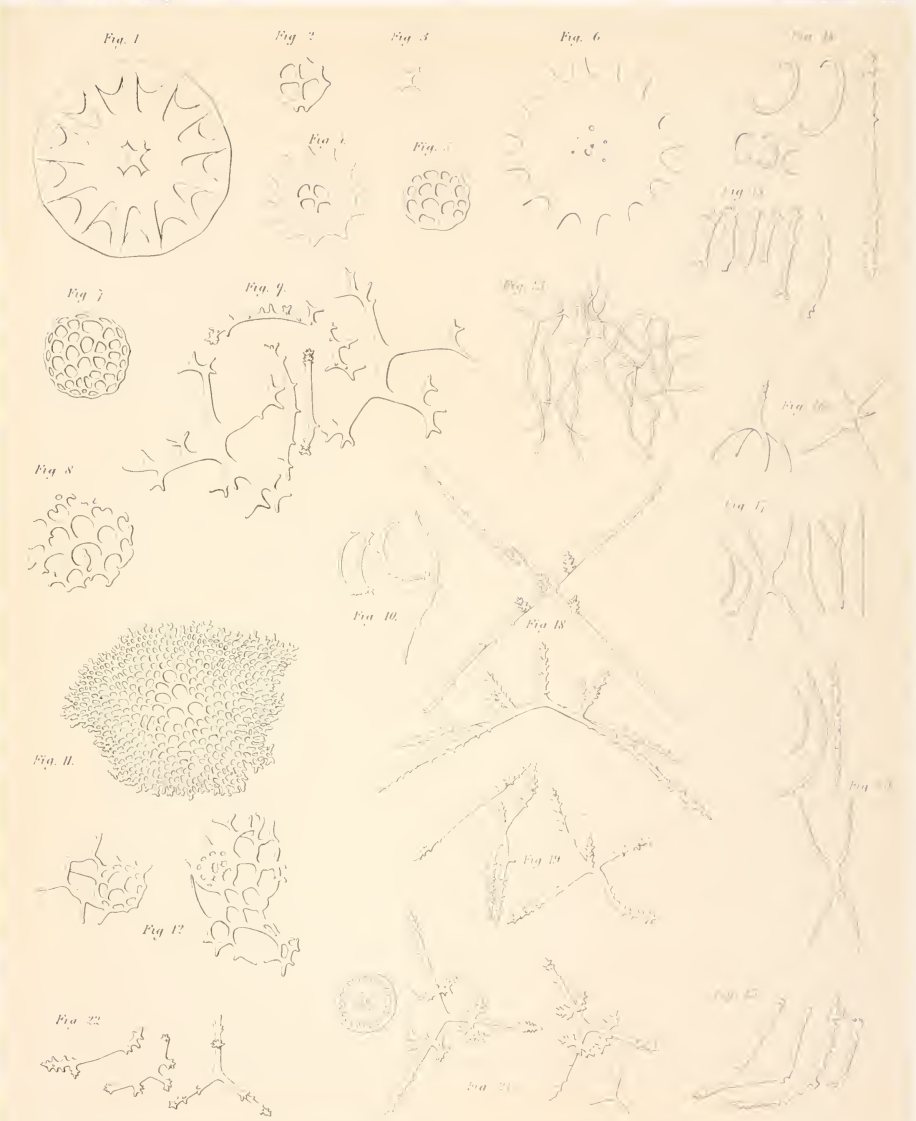
1. PSYCHROPOTES LONGICAUDA, var. FUSCO PURPUREA. 2. PSYCHROPOTES LONGICAUDA, var. MONSTROSA.



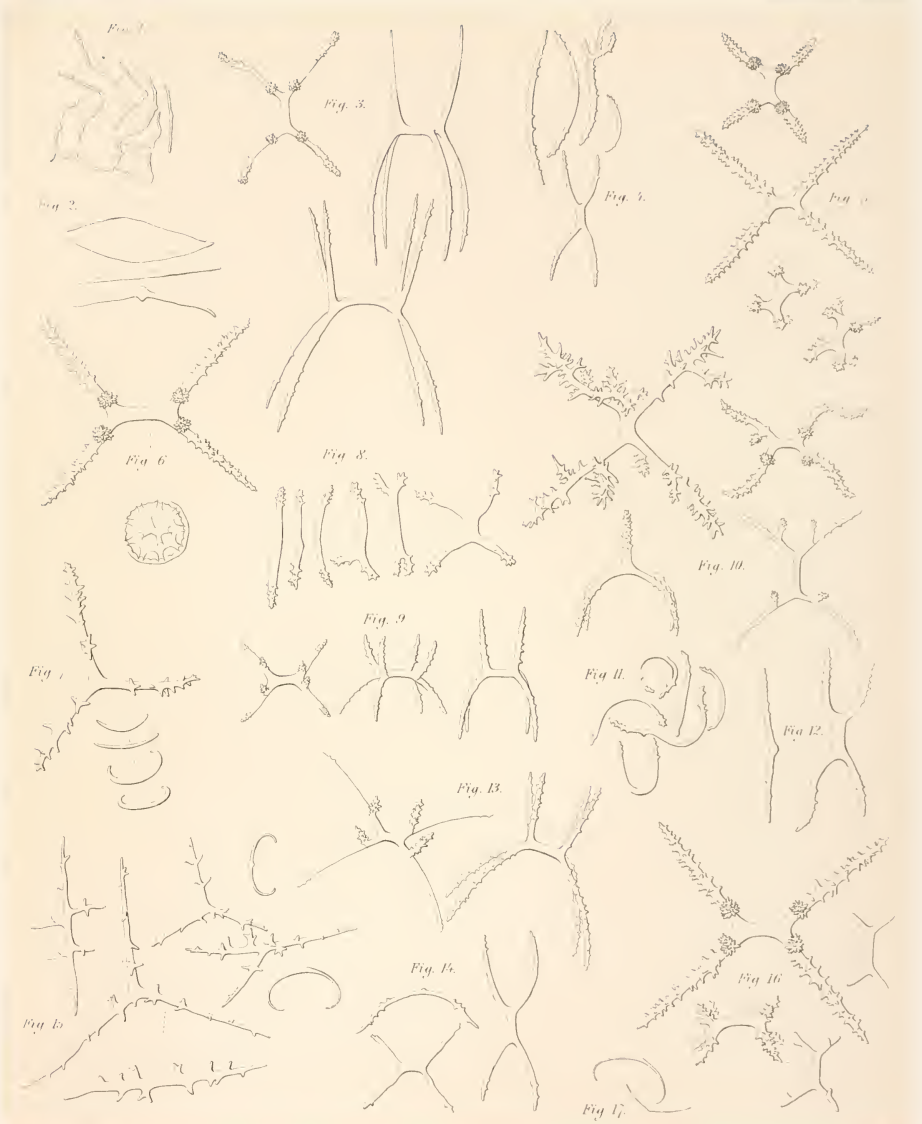
PSYCHROPOTES LONGICAUDA, var. MONSTROSA, n.



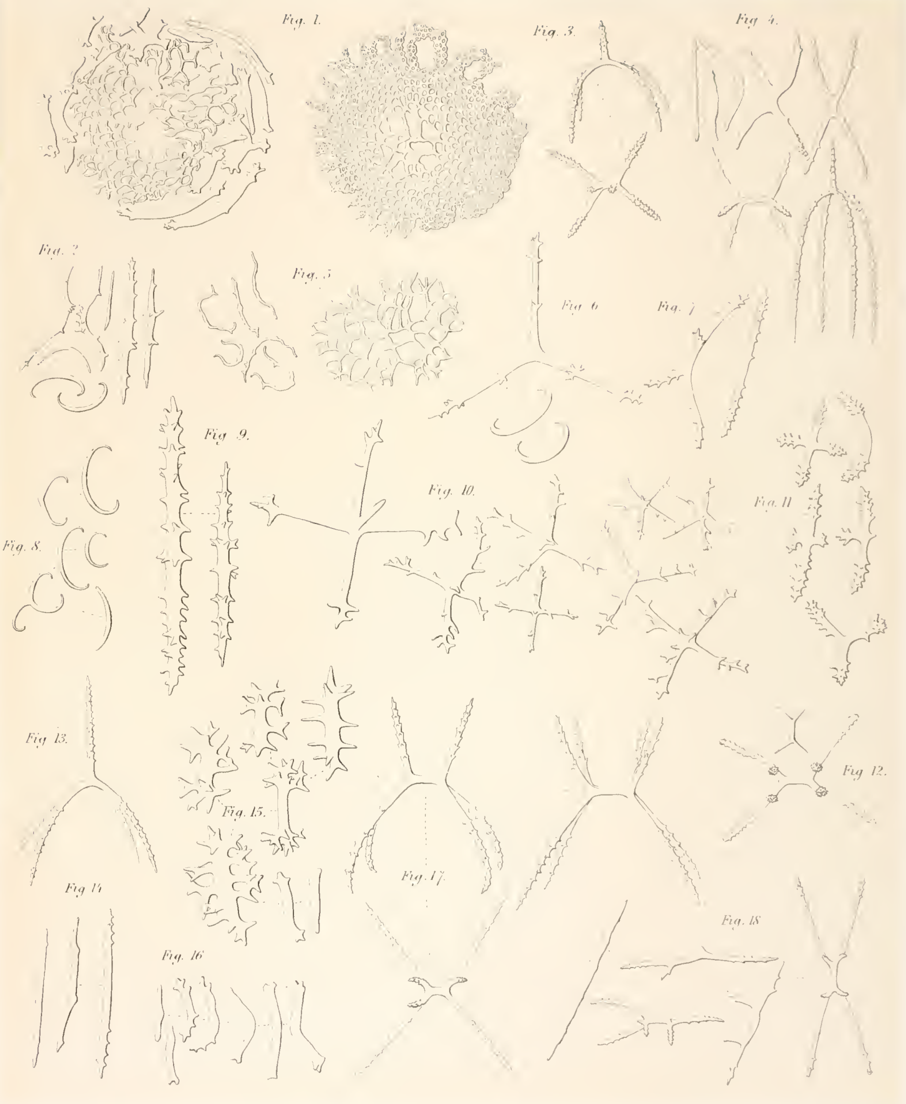
1-3 ONEIROPHANTA MUTABILIS, Theel. 4-9 DEIMA VALIDUM, Theel.
10-13 DEIMA FASTOSUM, Theel. 14-15 LÆTMOGONE WYVILLE-THOMSONI, Theel.



1-13 PANNYCHIA MOSELEY [illegible] 14-15 SCOTOPLANES ALBIDA, [illegible]
16-17 PARELPIDIA ELONGATA, [illegible] 18-20 ELPIDIA RIGIDA, [illegible]
21-23 ACHLYONICE LACTEA, [illegible]

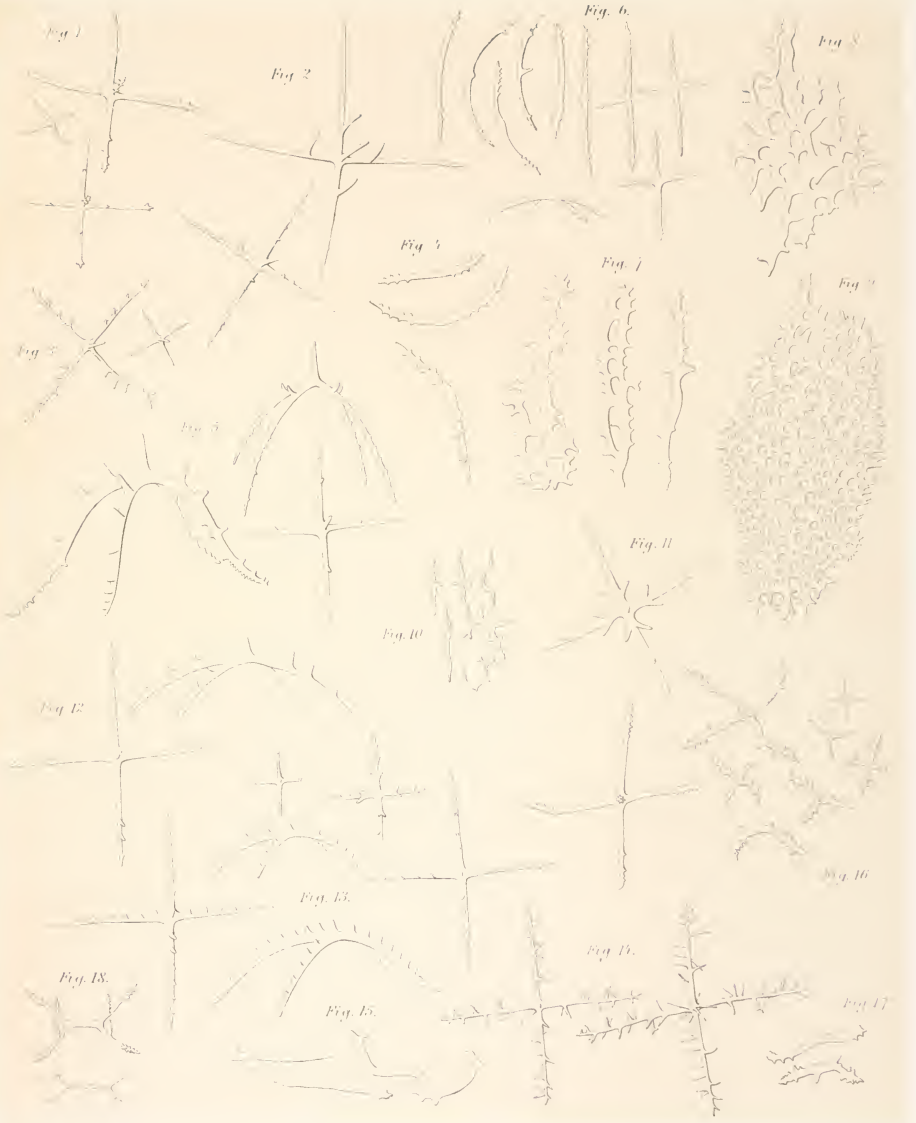


1-2 KOLGA NANA, Theel. 3-4 ELPIDIA INCERTA, n. sp. 5 PENIAGONE ATROX, n. sp. 6 ELPIDIA AMBIGUA, n. sp.
7 SCOTOPLANES INSIGNIS, n. sp. 8-9 PENIAGONE HORRIFER, n. sp. 10-12 ELPIDIA WILLEMOËSI, n. sp.
13-14 ELPIDIA PURPUREA, n. sp. 15 PENIAGONE NARESI, n. sp. 16 PENIAGONE CHALLENGERI, n. sp.
17 SCOTOPLANES MOLLIS, Theel.

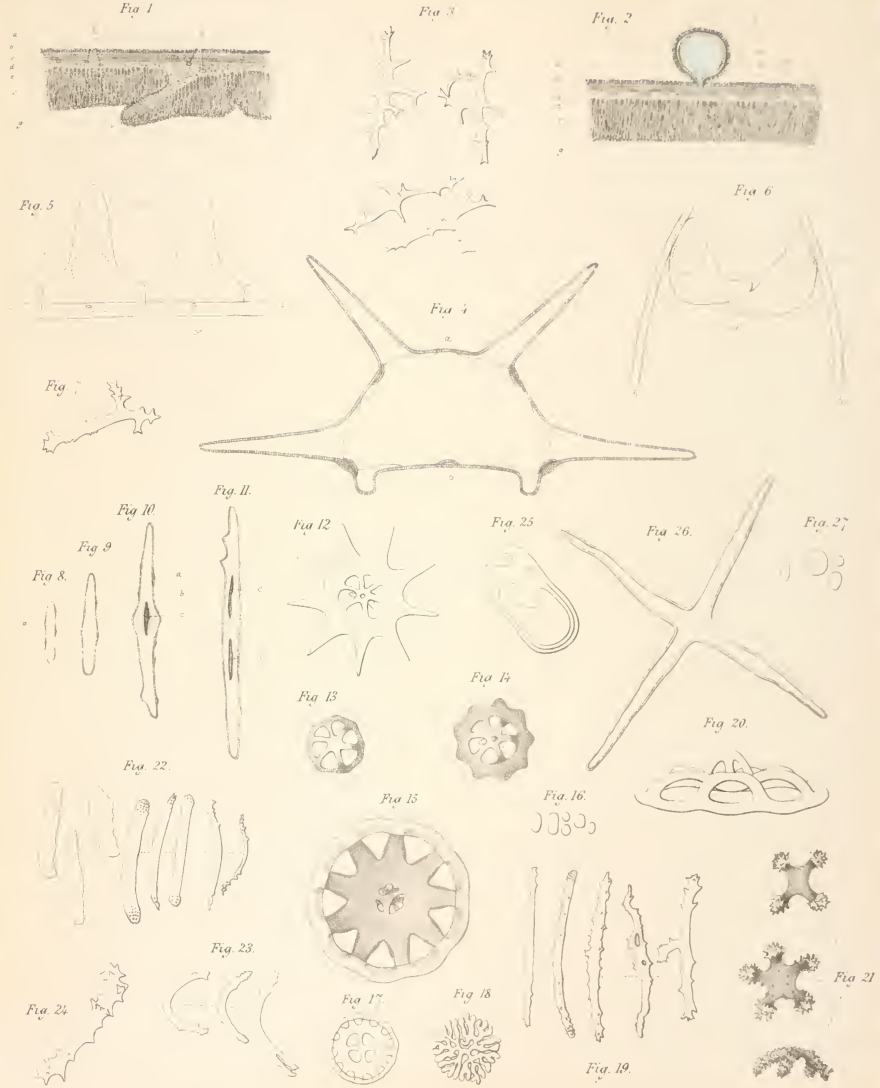


H. Théel del.

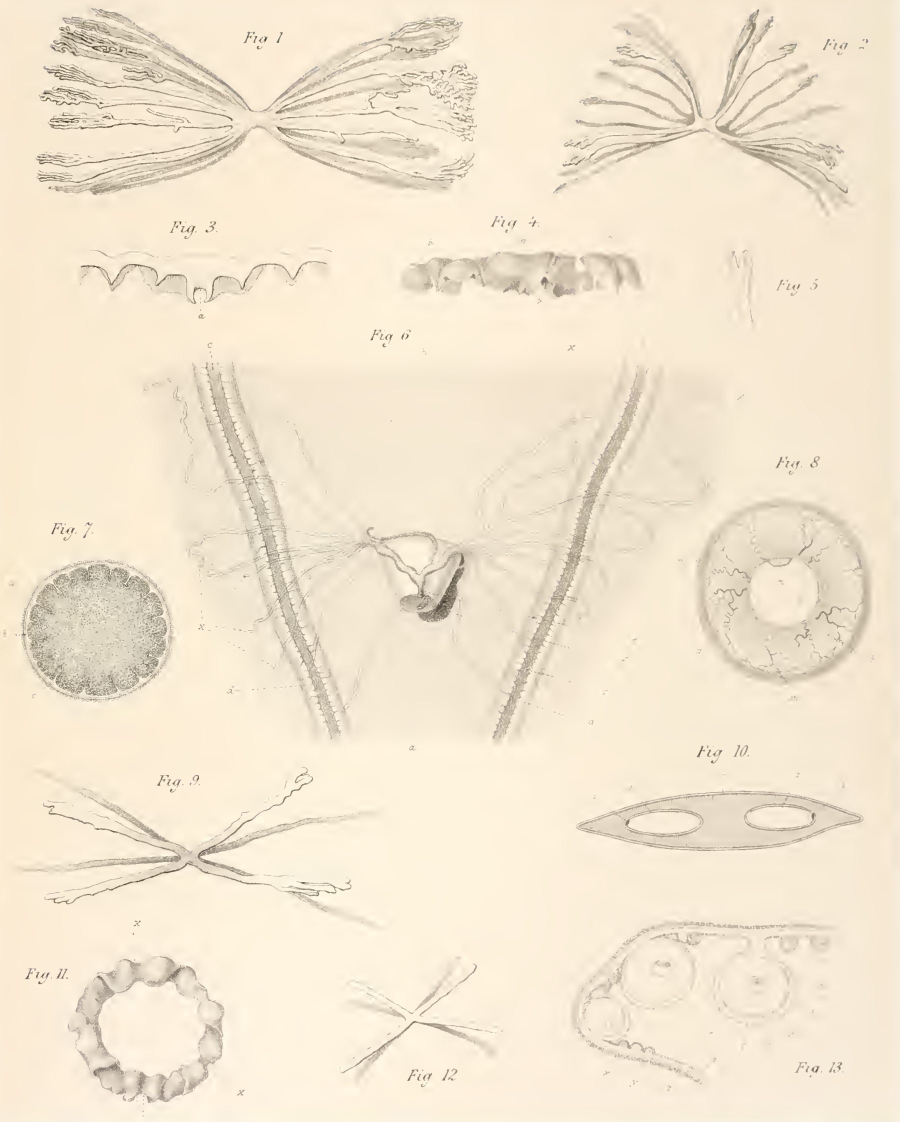
1 LÆTMOGONE WYVILLE-THOMSONI, Théel. 2 SCOTOPLANES MURRAYI, Théel. 3-4 ELPIDIA VERRUCOSA, Théel.
5 KOLGA NANA, Théel. 6-7 SCOTOPLANES ROBUSTA, n. sp. 8-9 SCOTOPLANES GLOBOSA, Théel.
10-11 PSYCHROPOTES SEMPERIANA, n. sp. 12-13 PENIAGONE AFFINIS, n. sp. 14 BENTHODYTES PAPILLIFERA, n. sp.
15-16 ORPHNURGUS ASPER, Théel. 17-18 PENIAGONE VITREA, n. sp.



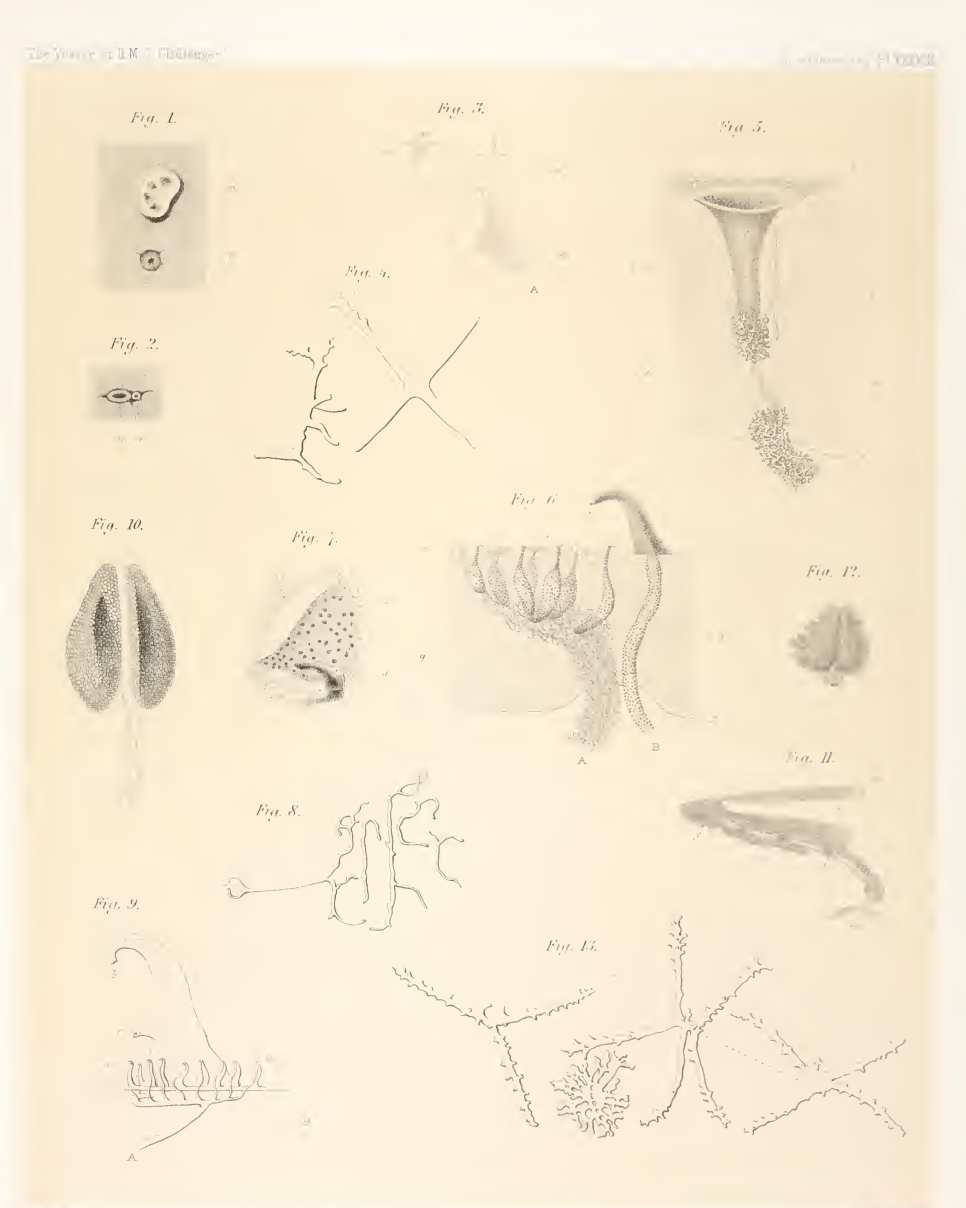
1-3. PSYCHROPOTES LOVÉNI, n. sp. 4 BENTHODYTES TYPICA n. sp. 5-6 EUPHRONIDES DEPRESSA, n. sp.
7-10 DEIMA FASTOSUM, Faxon. 11 PSYCHROPOTES LONGICAUDA, var FUSCO-PURPUREA, n. sp.
12. NOTOPHOTREPHOS EXIGUA, n. sp. 13-17 PSYCHROPOTES LONGICAUDA n. sp. 18 SCOTOANASSA DIAPHANA, n. sp.



1-2, ONEIROPHANTA MUTABILIS, Theel 3, LÆTMOGONE WYVILLE-THOMSONI, Theel 4, DEIMA VALIDUM, Theel
5-6, SCOTOPLANES GLOBOSA, Theel 7 DEIMA FASTOSUM, Théel 8-11, ONEIROPHANTA MUTABILIS Theel
12-19, ILYODÆMON MACULATUS, Theel 20-24 LÆTMOGONE VIOLACEA, Theel 25 KOLGA NANA, Theel
26-27, BENTHODYTES ABYSSICOLA Theel



1 ELPIDIA WILLEMOËSI, n sp 2 PARELPIDIA ELONGATA, Théel 3 DEIMA FASTOSUM, Théel 4 ONEIROPHANTA MUTABILIS Théel
5 LÆTMOGONE WYVILLE-THOMSONI, Theel 6 PENIAGONE WYVILLII n sp 7 LÆTMOGONE WYVILLE-THOMSONI, Theel.
8 DEIMA VALIDUM, Théel 9 SCOTOPLANES ROBUSTA, n sp 10 PSYCHROPOTES LONGICAUDA, n.sp
11 LÆTMOGONE WYVILLE-THOMSONI, Theel 12 SCOTOPLANES PAPILLOSA, Théel 13 ONEIROPHANTA MUTABILIS, Theel



1-4 BENTHODYTES ABYSSICOLA, n. sp. 5 BENTHODYTES TYPICA, n. sp. 6-8 ILYODÆMON MACULATUS, Thiele.
9 LÆTMOGONE WYVILLE-THOMSONI, Thiele. 10 ORPHNURGUS ASPER, Thiele. 11-12 ONEIROPHANTA MUTABILIS, Thiele.
13 BENTHODYTES SORDIDA, n. sp.

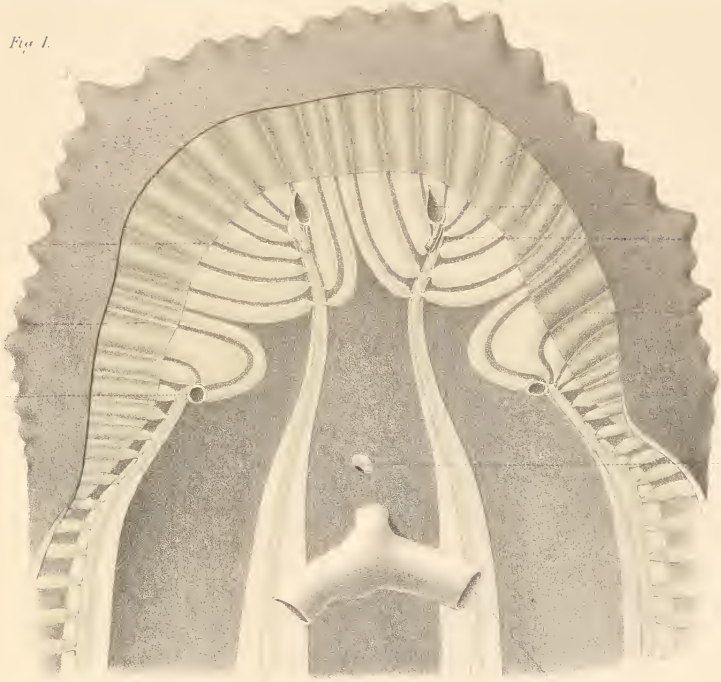


Fig. 1.

Fig. 2.

Fig. 3.

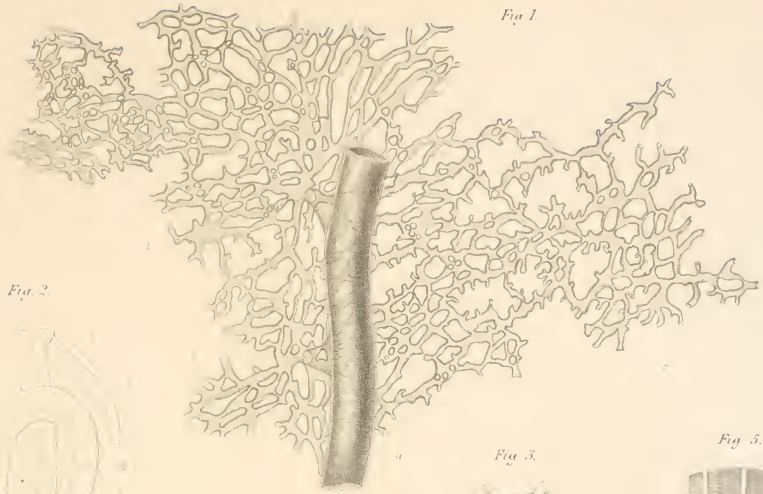
Fig. 5.

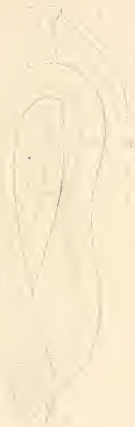
Fig. 6.

Fig. 7.

Fig. 4.

1, PSYCHROPOTES LONGICAUDA, var. MONSTROSA, n. 2, ELPIDIA VERRUCOSA, Theel.
3, ACHLYONICE PARADOXA, Théel. 4, LÆTMOGONE WYVILLE-THOMSONI, Théel.
5-6, LÆTMOGONE SPONGIOSA, Théel. 7, ACHLYONICE PARADOXA, Théel.





1, 3. ONEIROPHANTA MUTABILIS, Iam. 4-5, BENTHODYTES SANGUINOLENTA, n. sp.
6. BENTHODYTES SANGUINOLENTA, var. MARGINATA n. 7, EUPHRONIDES DEPRESSA, n. sp.
8, BENTHODYTES SANGUINOLENTA, var. MARGINATA, n.

Fig. 1.

Fig. 2.

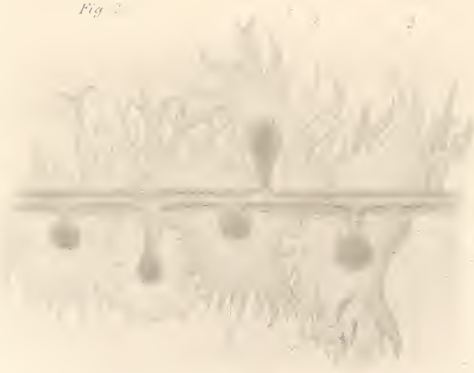


Fig. 3.

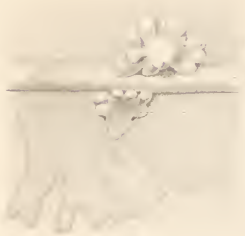


Fig. 4.

Fig. 5

1-2 ONEIROPHANTA MUTABILIS, Théel
3 ORPHNURGUS ASPER, Théel
4 ONEIROPHANTA MUTABILIS, Théel
5 ACHLYONICE PARADOXA, Théel

Fig. 1

Fig. 2

Fig. 3.

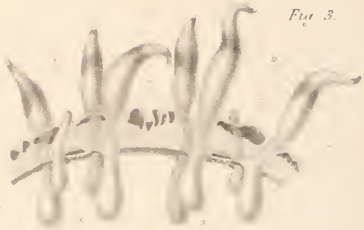


Fig. 5

Fig. 6

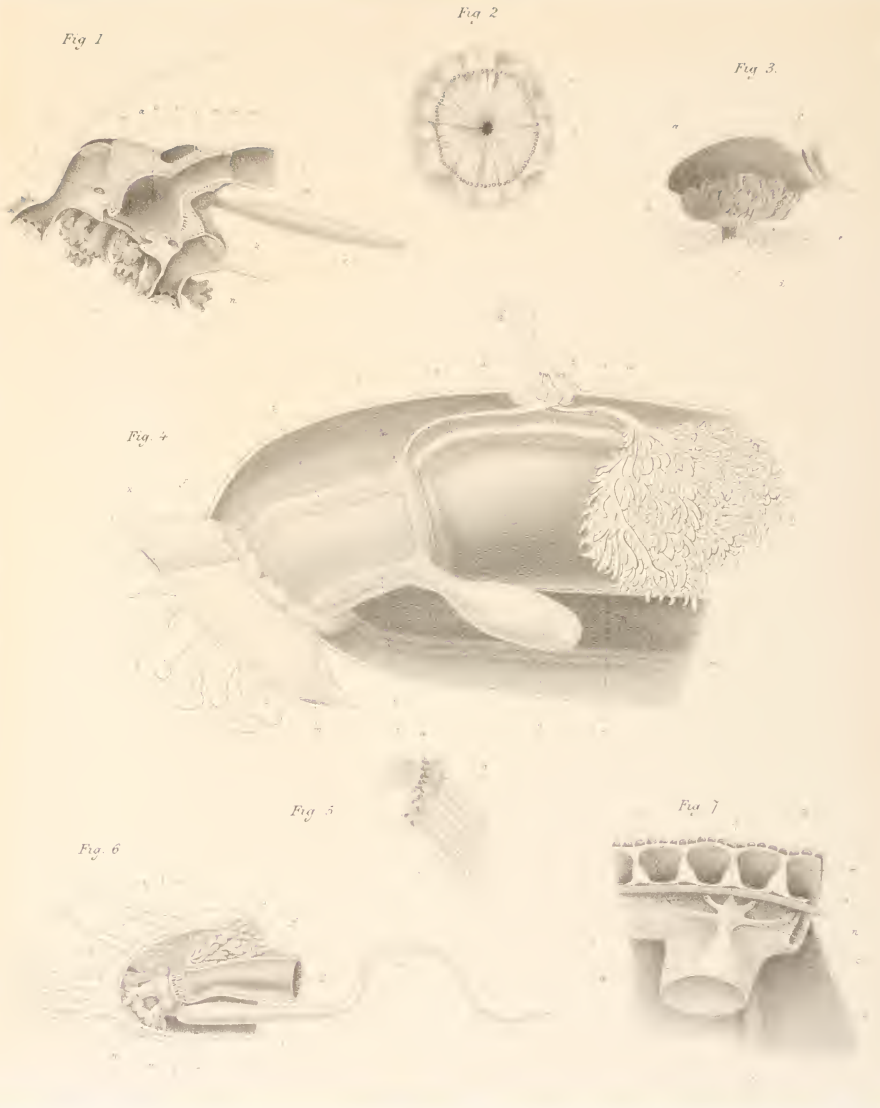
Fig. 4

Fig. 8.

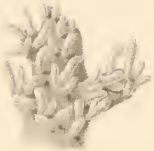
Fig. 7

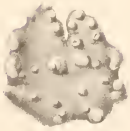
Fig. 9

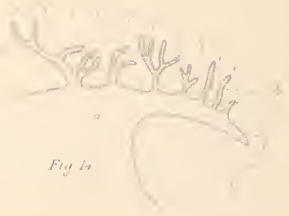
1, 2 LÆTMOGONE WYVILLE-THOMSONI, Theel. 3-4 ILYODÆMON MACULATUS, Theel. 5 KOLGA NANA, Théel.
6 BENTHODYTES SANGUINOLENTA, n. sp. 7 LÆTMOGONE WYVILLE-THOMSONI, Theel. 8 KOLGA NANA, Théel.
9 ONEIROPHANTA MUTABILIS, Theel.



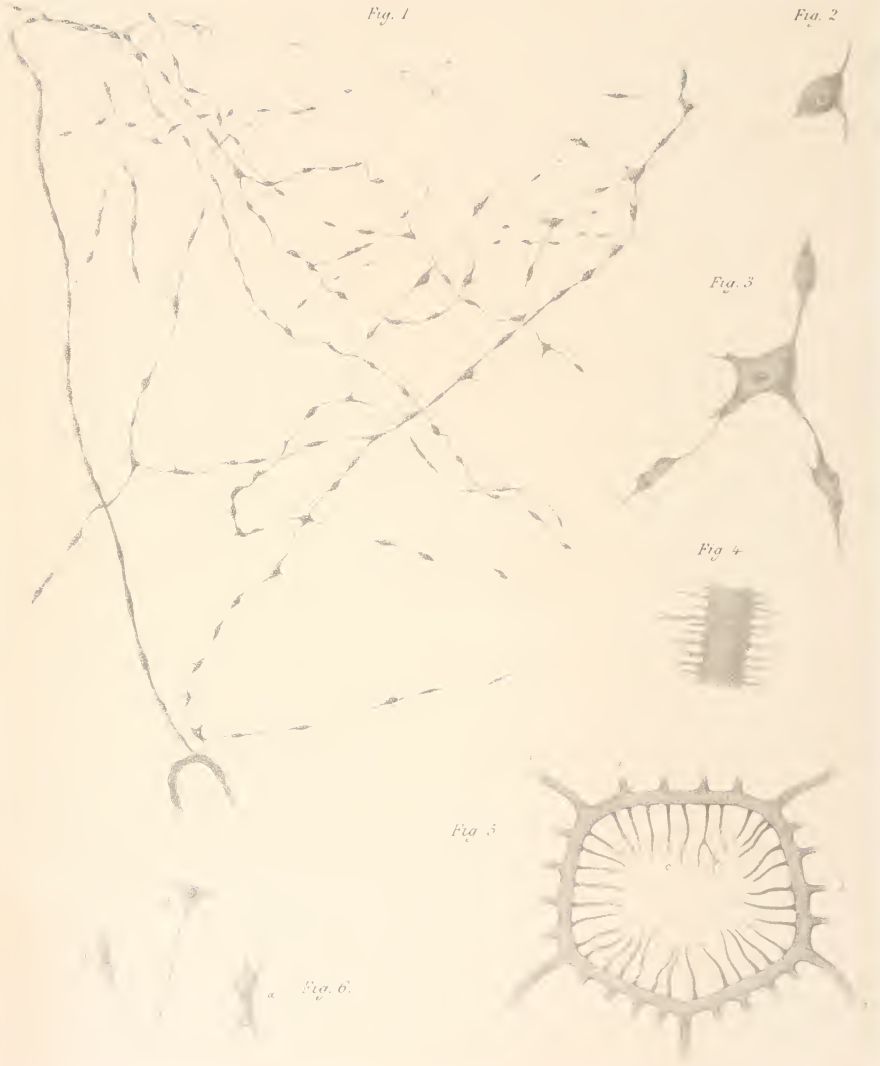
1 ONEIROPHANTA MUTABILIS, Thesl. 2-3 DEIMA FASTOSUM, Thesl.
4 LÆTMOGONE WYVILLE-THOMSONI, Thesl. 5 DEIMA FASTOSUM, Thesl.
6 ONEIROPHANTA MUTABILIS, Thesl. 7 DEIMA VALIDUM, Thesl.



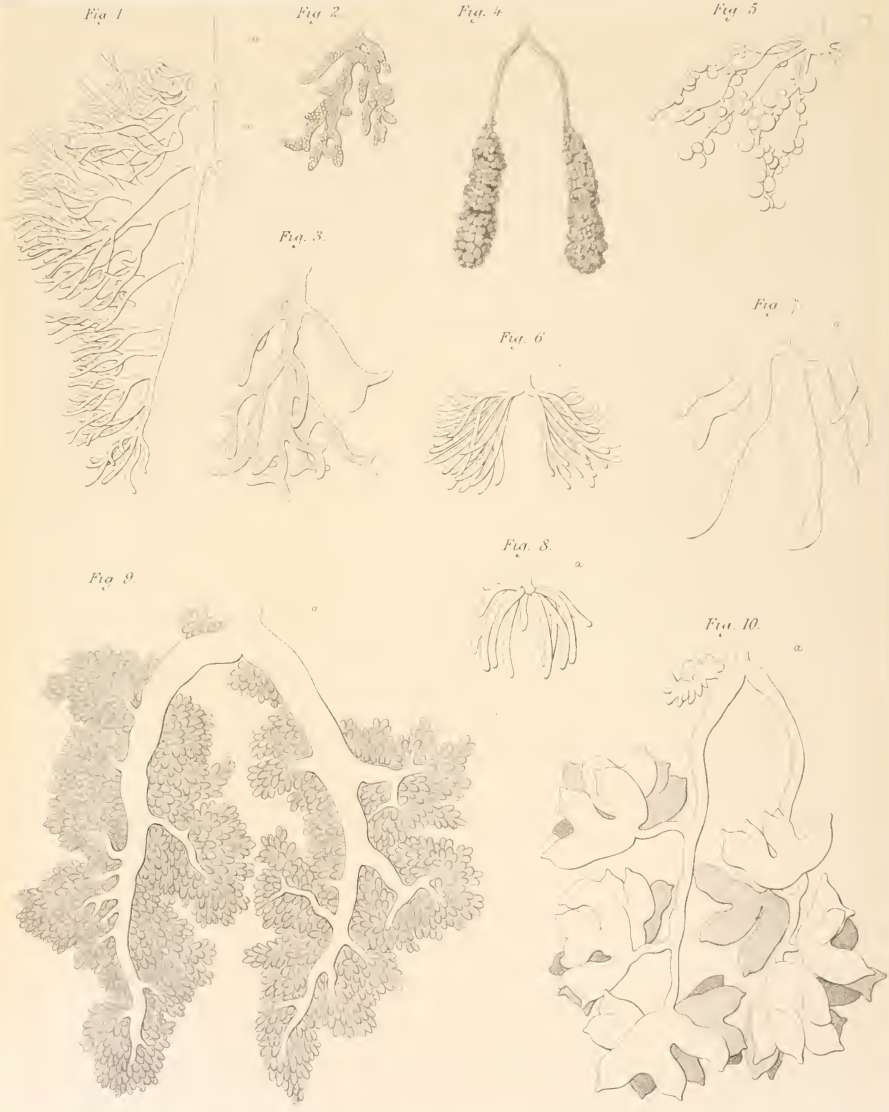




1 PSYCHOTREPHOS EXIGUA, n sp 2 SCOTOPLANES MOLLIS, Théel 3 ORPHNURGUS ASPER, Theel
4 SCOTOPLANES MURRAYI, Théel 5 PENIAGONE WYVILLII, n sp 6 ELPIDIA PURPUREA, n sp
7 PENIAGONE WYVILLII, n sp 8 BENTHODYTES TYPICA, n sp 9 SCOTOANASSA DIAPHANA, n sp
10 PENIAGONE VITREA, n sp 11 LYODÆMON MACULATUS, Théel 12 SCOTOPLANES GLOBOSA, Theel
13 DEIMA VALIDUM, Théel 14 LÆTMOGONE WYVILLE-THOMSONI, Théel



ONEIROPHANTA MUTABILIS. Théel.



1 ILYODÆMON MACULATUS, Théel 2-3 LÆTMOGONE WYVILLE-THOMSONI, Théel. 4 EUPHRONIDES DEPRESSA, n sp
5 DEIMA VALIDUM, Théel. 6-7 ONEIROPHANTA MUTABILIS, Théel. 8 DEIMA FASTOSUM, Théel
9-10 BENTHODYTES ABYSSICOLA, n. sp.