

XVIII. *On the Radiata of the Eastern Mediterranean. Part I., Ophiuridæ.*
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DURING my late researches in the Ægean Sea I found ten species of Starfishes, of the order *Ophiuridæ*, several of which are undescribed. Of these, and of the other *Echinodermata* met with during my voyage, I propose, should it be the pleasure of the Society, to give a detailed account, and in the present communication I will commence with describing such as belong to the genus *Ophiura* and to an allied genus hitherto uncharacterized. The animal on which I have founded the genus *Pectinura* (from *πέκω pecto*, and *οὐρά cauda*), is a small starfish which came up in the dredge from 100 fathoms water on the coast of Lycia, where it lives among corallines, millepores and brachiopodous mollusca. Its disc is one-tenth of an inch across, flat, and covered with imbricated scales, which, however, are entirely hidden by a clothing of minute granules, these granules being transformed spines. The pair of scales seen on the disc of all *Ophiuræ* are in this species extremely indistinct, or rather are so like their neighbours, that it is with difficulty we can distinguish them. The rays themselves spring from the disc, and some of the scales of the disc overlap their sides. They are short, as compared with the disc; but in consequence of their being broken away towards their extremities in the only specimen I possess, I cannot state their positive length. They are covered above with scales, which are somewhat orbicular in form, and lap slightly over one another. Beneath, the scales are triangular, or rather fan-shaped, and have their sides encroached upon by the lateral ray-plates, which are squamose, and bear on their superior margins seven or eight spines of unequal lengths, but mostly as long as the ray is broad. These spines are smooth. On the under surface of the bodies the ovarian plates, which are seen separating the origins of the rays, are small and transversely oblong. Each bears a small

accessory plate at its upper margin, but neither of the plates encroaches on the parts of the body which form the triangular spaces between the rays. The space between the ovarian plates and the little comb of spines which guards the mouth is covered with granules like those which cover the body. The colour when recent was grayish, in the dried specimen yellowish.

On this specimen alone I should scarcely have ventured to found a genus, remarkable as are its characters, but would rather have referred it for the present to the genus *Ophiocoma*, as an aberrant form approaching *Ophiura*; but I have had an opportunity of examining a large foreign species, which shows that it has rather a closer affinity with *Ophiura* than *Ophiocoma*, and in fact belongs to a distinct and well-marked genus, differing from the former in having the discs clothed with granules, in the absence of the pectinated scales embracing the origin of the rays, and in the ovarian plates (not soldered as in *Ophiura* into one) not encroaching on the body. From *Ophiocoma* it is distinguished by the lateral ray plates lapping over each other and the posterior ray plates, as in *Ophiura*, and instead of bearing the spines on a transverse ridge or keel, having them articulated to their superior margins, so that when the animal is dead they lie close to the rays, and do not bristle out as in *Ophiocoma*. As among the species of *Ophiura*, the twin plates of the disc opposite the origin of each ray, have a generic and not a specific value. The sources of essential specific character, judging from the species before me, are 1st, the form of the superior ray-scales; 2nd, the number of spines on the lateral ray-scales; 3rd, the form of the upper surface of the rays; and 4th, the form of the disc. The habit of the genus is that of *Ophiura*. Judging from analogy, the suckers, when observed, will be found to be simple and not pinnate or dentate. I now add the definition of the genus, and the specific character of the Mediterranean species.

GENUS PECTINURA, Forbes.

Corpus orbiculare, squamosum, granulosum, ad peripheriam radiatum: radiis simplicibus, squamosis, in corporis discum sub-prolongatis; squamis radiorum lateralibus adpressis, in marginibus superioribus spiniferis: ossiculis ovarialibus binis, in corporis lobos non productis.

Sp. *Pectinura vestita*, nov. sp., Forbes. TAB. XIII. fig. 1—7.

P. disco orbiculari, radiis convexiusculis; squamis superioribus rotundatis: lateralibus 8-spiniferis.

Lat. disc. $\frac{1}{8}$ unc.

Of the genus *Ophiura*, three species inhabit the Ægean Sea, *O. texturata*, *O. albida*, and a very interesting species, which I propose to call *O. abyssicola*. The first of these has long been recorded as a native of the Mediterranean. In the Eastern Mediterranean it is exceedingly scarce, and I only met with two examples. The *Ophiura albida*, which was long confounded with it, is much more common, almost as much so as on the coasts of Britain. I dredged it in various depths, from 15 to 50 fathoms, in many localities, between Cerigo and Rhodes. The *Ophiura abyssicola* is remarkable as an inhabitant of deeper water than any recorded Starfish. It lives on a bottom of soft white mud abounding in *Foraminifera*, which animals probably constitute its food, in between 150 and 200 fathoms water. The disc is round and covered with rosulated scales, those in the centre largest, the others very small. Opposite the origin of each ray are two large plates or scales of the same form as those in *O. albida*. The rays are narrow and tapering, and are five and a half times as long as the body is broad: they are inserted into notches in the disc, but by no means so deeply as in the two former species. There are two pairs of pectinated scales clasping the origin of each ray, the upper having five teeth, the lower about nine. The upper arm-plates are quadrangular and carinate, those of the sides quadrangular, and uniting inferiorly, almost obliterating the lenticular inferior ray-plates: each lateral plate bears a tubercle and three spines, which are longer than the plates to which they are articulated. The colour of this pretty Starfish is pinkish-gray.

A comparison of the characters of this new *Ophiura* with those of its described allies enables us to revise the definition of the genus. The main character is the great size of the ovarian plates, which encroach upon the body beneath between the origins of the arms. This arises from the primary and accessory plates being soldered into one, and from the large development of the accessories. In the other genera they are very small, and quite sepa-

rated from the primaries. Another character, which greatly conduces to the peculiar habit of the genus, is the form of the lateral ray-plates which lap over each other and over a part of the superior and inferior ray-plates, and bear spines on their superior margins. This character it shares with *Pectinura*. The pectinated scales clasping the origins of the rays are peculiar to this genus. The sources of specific character are, 1st, the number and disposition of the denticles of the pectinated scales; 2nd, the form of the ovarian plates; 3rd, the form of the rays; 4th, the form of the superior ray-plates; and 5th, the number of spines on the lateral ray-plates. The cirrhi in this genus are simple. The revised characters of *Ophiura* and of the three species inhabiting the Ægean Sea will stand as follows:—

Genus OPHIURA, Lamarck, Agassiz.

Corpus orbiculare, squamosum, læve, ad peripheriam radiatum; radii simplicibus, squamosis in corporis discum prolongatis, ad origines squamis pectinatis adpressis; squamis lateralibus radiorum adpressis, in marginibus superioribus spiniferis: ossiculis ovarialibus marginis simplicibus, in corporis lobos productis.

1. *O. texturata*, Lamarck.

O. squamis pectinatis ad radiorum origines plusquam 20-dentatis, ossiculis ovarialibus lyratis, radiis carinatis; squamis superioribus transversè oblongis: lateralibus 7-spiniferis.

2. *O. albida*, Forbes.

O. squamis pectinatis ad radiorum origines 16-dentatis, ossiculis ovarialibus scutatis, radiis convexis; squamis superioribus triangularibus: lateralibus 4—5-spiniferis.

3. *O. abyssicola*, nov. sp., Forbes. TAB. XIII. fig. 8—14.

O. squamis pectinatis ad radiorum origines binis 5—9-dentatis, ossiculis ovarialibus pentagonis, radiis carinatis; squamis superioribus quadratis: lateralibus 3—4-spiniferis.

Lat. disc. $\frac{2}{10}$ unc.

Genus OPHIODERMA, Müller and Troschel.

Nearly allied to *Pectinura* is the genus *Ophioderma* of Müller and Troschel (Wiegmann's Archiv, 1840), founded on the *Ophiura lacertosa* of Lamarck, a species not uncommon in the Western Mediterranean, though rare in the Ægean, and with which many exotic forms have been confounded. The habit is that of *Ophiura*, the characters those of *Pectinura*, from which it materially differs in having four conspicuous genital pores in the inferior interspaces, two near the mouth, and two towards the margin. The fossil *Ophiura Egertoni* belongs to this genus. The Mediterranean species is prettily variegated with orange, white, black and gray, and has a disc which is sometimes nearly an inch broad, with rays nearly five times as long as the breadth of the disc. It lives in from 10 to 20 fathoms water on various kinds of bottom. The characters of the genus, revised, will stand thus:—

Corpus orbiculare, squamosum, granulosum, ad peripheriam radiatum; radiis simplicibus squamosis; disco in radiorum origines prolongato, infra poris genitalibus viginti; squamis radiorum lateralibus adpressis, in marginibus superioribus spiniferis, spinis simplicibus; ossiculis ovarialibus parvis, oralibus pectinatis.

Sp. *Ophioderma lacertosa*.

O. radiis convexinseulis; squamis superioribus transversè oblongis: lateralibus 8-spiniferis: inferioribus quadratis.

Ophioderma lacertosa, Müll. & Tros.

Ophiura lacertosa, Lamarck.

Ophiura squamata et Rondeletii, Risso.

Asterias ophiura, Delle Chiaje.

Diam. disci $\frac{6}{10}$ unc; long. radiorum 3 unc.

Genus OPHIOMYXA, Müller and Troschel.

This genus was constituted for the reception of an unnamed species in the Paris and Vienna collections. The characters are remarkable. The skin of the discs and arms is smooth, and when recent, slimy, coriaceous, and unprovided with scales. There are but two genital pores in each interspace, and

the papillæ, which form combs for the protection of the mouth, are serrate, or rather ciliate, on their margins, a character not met with in any of the other genera.

The skeleton has several peculiarities. The disc-skeleton consists only of the shields opposite the origins of the rays, which in the species I have taken are linear and nearly parallel. They are connected together and jointed to the framework of the rays by a band of small scales. Each of the disc-shields has a process consisting of four small imbricated scales projecting from its outer margin. Two long divaricating processes spring from each intermediate plate to join the disc-origin of the arms beneath: these may be considered as belonging to the genital-skeleton. The peculiarity of the splanchno-skeleton has already been noticed. The ray- or myo-skeleton differs from that of all other *Ophiuridæ*. The upper ray-scales are each formed of two triangular ossicula, each connected with the lateral ray-plates by two very small ones; the under ray-scales are directly articulated with the lateral ray-plates.

The species which inhabits the Ægean Sea has a pentagonal, flat, coriaceous and smooth disc, having two linear, nearly parallel, separate shields opposite the origin of each ray. The upper ray-scales are very narrow, longitudinally lenticular (each composed of two ossicula), and connected together by the skin of the arm: the lower ones are cordate, larger and closer. The lateral ray-plates bear four spines each, the uppermost spine longest. The spines are smooth towards their bases, but tapering and serrated above. The ridge on which they are placed enables them to lie rather close, but not quite. They are not so long as the ray is broad. The rays are nearly seven times as long as the disc is broad. The ovarian plates are small, and transversely sub-pentagonal. The colour when alive is olive. It lives in between 10 and 20 fathoms water, and several specimens were taken in the sea of the Cyclades.

The genus may be characterized thus:—

Corpus pentagonale, coriaceum, læve, ad peripheriam radiatum; radiis simplicibus interruptè squamosis; disco in radiorum origines prolongatis; squamis radiorum lateralibus spiniferis, spinis serrulatis; ossiculis ovarialibus binis parvis, oralibus spinis serrulatis armatis.

Sp. *O. lubrica*, nov. sp., Forbes. TAB. XIII. fig. 15—22.

Diam. disc. $\frac{3}{4}$ unc.; long. rad. 5 unc.

Note.—I unfortunately neglected to observe the form of the cirrhi in the living animal; but, judging from the formal analogy between those organs and the spines in other genera, I should expect to find them pinnate.

Genus OPHIOPSILA, Forbes. (ὄφις and ψιλός, *nudus*.)

I have thought it necessary to constitute a genus for the reception of a naked-bodied, long-armed *Ophiura*, which is not uncommon in the seas of the Archipelago. It combines some of the characters of *Ophiomyxa* with some of those of the following genus, and has a habit peculiar to itself.

But one species occurs. It has a round disc, sometimes lobed between the rays, flat, coriaceous and smooth. There are two linear nearly parallel separate shields opposite the origin of each ray. The upper ray-scales are square and minutely granulated; the lower ones are quadrangular, with lunate sides. Each lateral ray-plate bears six spathulate spines, the lowest but one of which is longer than the rest, and the lowest smaller. In dead specimens the last laps over the ray-plate, so that its apex meets that of its fellow on the opposite side. The spines can lap close to the rays, except the undermost ones. The longest spines do not quite equal in length the breadth of the ray. The rays are $6\frac{1}{2}$ times as long as the breadth of the disc. The ovarian plates are small and subpentagonal. When alive, the colours are brilliant shades of brown, morone, or orange: when dead, the creature is of a purplish brown. It inhabits various depths above 40 fathoms.

CHAR. GEN. Corpus orbiculare, coriaceum, læve, ad peripheriam radiatum; radiis simplicibus squamosis, infra discum insertis; squamis lateralibus subcarinatis, spiniferis, spinis simplicibus; ossiculis ovarialibus parvis, oralibus ad latera nudis.

Sp. *Ophiopsila Aranea*, Forbes. TAB. XIV. fig. 1—7.

Lat. disc. $\frac{3}{10}$ unc.: long. rad. $3\frac{1}{2}$ unc.

Genus AMPHIURA, Forbes. (ἀμφὶ and οὐρά.)

I constitute this genus for the long-rayed scaly and smooth-bodied *Ophiuræ*, with simple tentacula and smooth spines. Müller and Troschel included

them in their genus *Ophiolepis*, synonymous with the *Ophiura* of Agassiz, and in my History of British *Echinodermata* I united them with *Ophiocoma*, with which they have greater affinity. An investigation of many species has induced me to regard them as generically distinct, and to define the group as follows:

Corpus orbiculare, squamosum, læve, ad peripheriam radiatum; radiis simplicibus squamosis, infra discum insertis; squamis lateralibus subcarinatis spiniferis, spinis simplicibus; ossiculis ovarialibus parvis, oralibus ad latera nudis; cirrhis simplicibus.

Three species inhabit the Ægean Sea, one of which is undescribed, viz.:—

1. *Amphiura florifera*, nov. sp., Forbes. TAB. XIV. fig. 8—13.

A. disco squamis centralibus maximis rosulatis, scutellis ovatis disjunctis, squamis radiatorum superioribus quadratis: inferioribus 3-lobatis: lateralibus 3-spiniferis spinis brevissimis linearibus simplicibus.

Diam. disc. $\frac{1}{2}$ unc.; long. rad. $\frac{5}{2}$ unc.

Disc round, flat, scaly, the central scales very large and rosulate, those between the shields small and imbricate. Two ovate shields parallel but not touching superiorly, diverging inferiorly opposite the origin of each ray. Upper ray-scales square, lower ones suddenly narrowed superiorly so as to appear trilobed: lateral ray-plates bearing 3 spines each, which are rather shorter than the breadth of the ray. Ovarian plates small and trilobed. Rays $2\frac{1}{2}$ to 3 times as long as the disc is broad. Colour gray, with a pale spot on the upper part of each shield; arms yellowish-pink.

This pretty little Starfish was dredged in 100 fathoms water, among corals and Terebratulæ, off Ananas Rocks, near the Island of Milo, in August 1842.

2. *Amphiura neglecta*.

A. disco squamis centralibus parvis rosulatis, scutellis oblongis conjunctis, squamis radiatorum superioribus quadratis: inferioribus oblongis: lateralibus 4-5-spiniferis spinis brevibus simplicibus.

Ophiura neglecta, Johnston.

Ophiocoma neglecta, Forbes, *Brit. Starfishes*.

Ophiolepis, Müller.

Ophiura squamata, Delle Chiaje (not of Lamarck).

Diam. disc. $\frac{1}{10}$; long. rad. $\frac{4}{10}$.

Frequent among the islands of the Archipelago, in similar situations to those in which we find it in Britain. Most common among the rocks near the water's edge.

3. *Amphiura Chiajii*, Forbes. TAB. XIV. fig. 14—18.

A. disco squamis minutis rosulatis, scutellis cuneatis divergentibus apicibus approximatis, squamis radiorum superioribus lenticularibus: inferioribus quadratis sulcatis: lateralibus 4-spiniferis spinis longis, simplicibus.

Ophiura filiformis, *Delle Chiaje* (not of Müller).

Diam. disc. $\frac{2}{10}$ unc.; long. rad. $1\frac{3}{4}$ unc.

Disc pentagonal, flat, scaly, the scales very small; two wedge-shaped shields opposite the origin of each ray, superiorly touching, inferiorly diverging. Upper ray-scales lens-shaped, lower ones square and longitudinally sulcated: lateral ray-plates bearing 4 spines each, which are longer than the breadth of the ray, acute, simple, and all of one form, therein differing from those of *Amphiura filiformis*, to which species it bears a great resemblance and was very naturally referred by Delle Chiaje. The ovarian plates are subpentagonal and small. The rays are generally 7 or 8 times as long as the disc is broad, but their length varies in different specimens. The rays are yellowish, with an orange line down their centres; the disc is of a dull purplish-brown, with a bright yellow spot on each shield and a yellow margin. The cirrhi are long, simple and white.

It lives in soft mud, in various depths from 10 to 120 fathoms, throughout the Archipelago and on the coast of Asia Minor.

GENUS OPHIOTHRIX, Müller and Troschel.

This genus was constituted for the reception of *Ophiura rosula* and its allies, referred by Agassiz, and afterwards by myself, to *Ophiocoma*, which Müller and Troschel restrict to *Ophiura granulata* and some allied species. With this arrangement I entirely concur, and propose the following revised character for *Ophiothrix*:

Corpus orbiculare, spinosum, ad peripheriam radiatum; radiis simplicibus squamosis; squamis superioribus imbricatis; lateralibus carinatis spiniferis, spinis serrulatis; ossiculis ovarialibus parvis, oralibus ad latera nudis; cirrhis pinnatis.

Ophiothrix rosula.

Ophiura rosula and *Ophiocoma rosula* of authors.

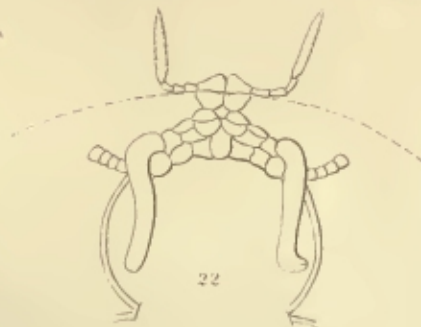
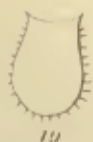
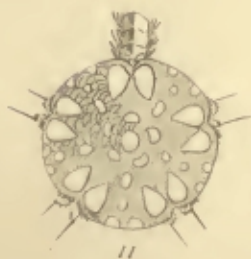
The Mediterranean specimens are somewhat smaller than the British, but do not appear to differ in any essential point. *O. tricolor*, *pentagona*, *Ferussaci*, *Cuvieri*, and *quinquemaculata* of Delle Chiaje seem to be all varieties of this very variable species.

Common in the Ægean, and on the coast of Asia Minor, among rocks near sea-mark; not frequent in deep water.

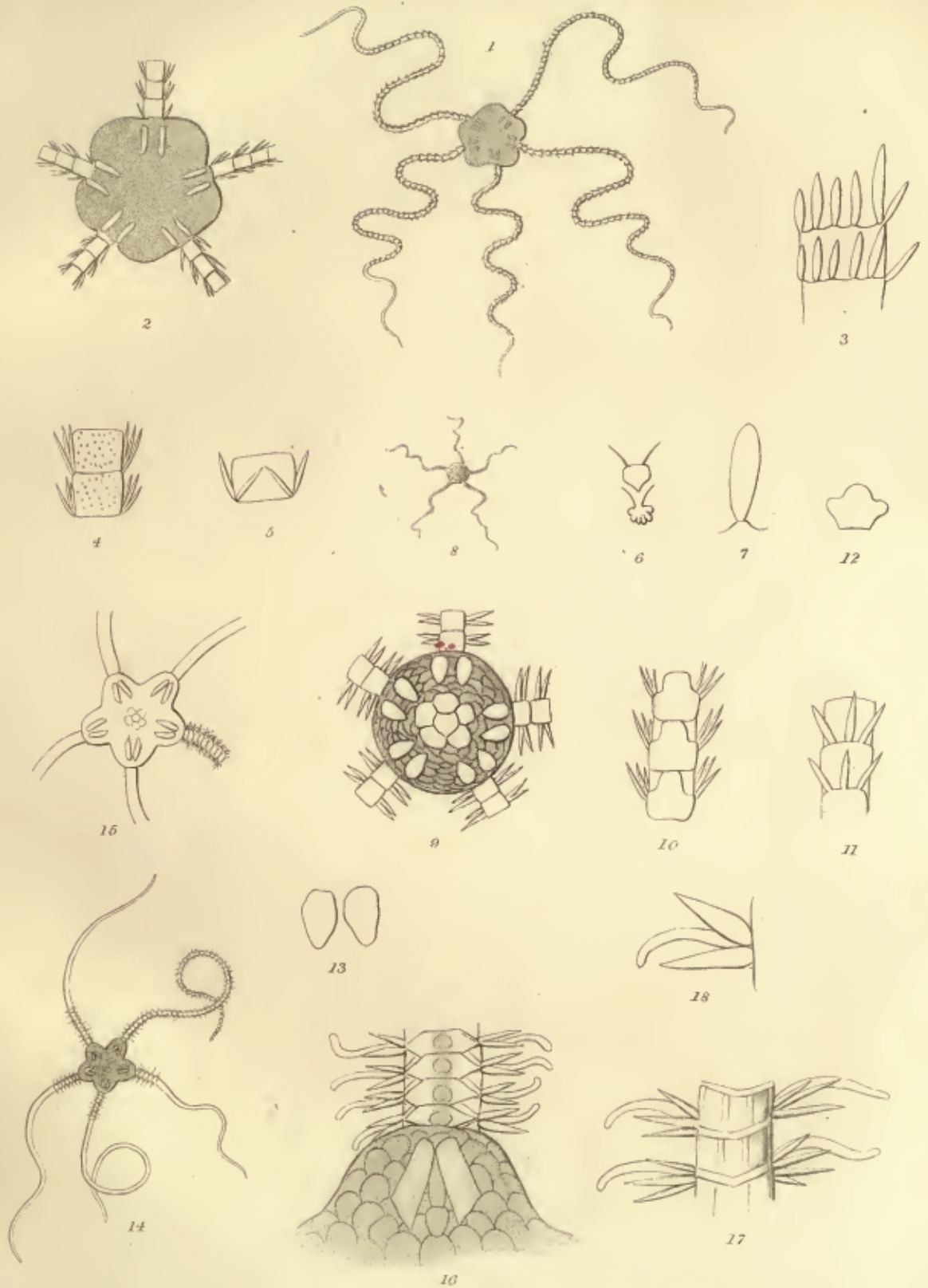
EXPLANATION OF THE PLATES.

TAB. XIII.

- Fig. 1. *Pectinura vestita*, of the natural size.
 2. Diagram of the upper surface of the body.
 3. Diagram of the lower surface of the body.
 4. Ovarial plates.
 5. Superior arm-scales.
 6. Inferior arm-scales.
 7. Lateral arm-scales, with spines.
 8. *Ophiura abyssicola*, of the natural size.
 9. Upper arm-scales and pectinated scales of the base of the arm.
 10. Lower arm-scales.
 11. Diagram of the upper surface of the body.
 12. Diagram of the lower surface of the body.
 13. Lateral arm-scales, with spines.
 14. Ovarial plate.
 15. *Ophiomyxa lubrica*; upper surface of the disc.
 16. Under side of ray.
 17. Upper side of ray.
 18. Ovarial plates and mouth-defence.
 19. A mouth-spine.
 20. A ray-spine.
 21. Lateral view of ray-spines.
 22. The disc-shields and their articulations.









TAB. XIV.

- Fig. 1. *Ophiopsila Aranea*, of the natural size.
2. Disc, seen from above.
 3. Lateral ray-plates and spines.
 4. Upper plates of ray.
 5. Under plates of ray.
 6. Genital plate and mouth-defence.
 7. A ray-spine.
 8. *Amphiura florifera*, of the natural size.
 9. Disc magnified.
 10. Under side of ray.
 11. Lateral ray-plates and spines.
 12. Genital plate.
 13. Disc-shields.
 14. *Amphiura Chiajii*, of the natural size.
 15. Disc, seen from above.
 16. Portion of disc and base of ray, seen from above.
 17. Under ray-plates.
 18. Lateral ray-plates and spines.

