Synoptic Keys to the Genera of Ophiuroidea

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Abstract

Systematic keys, synonymy and a selected bibliography are presented for the extant genera of Ophiuroidea.

Introduction

When the last monographic treatment of the Ophiuroidea was published by Lyman in 1882, 103 genera were recorded. Since then a further 205 genera have been proposed (many of them evident synonyms), yet no comprehensive revision of the group has been attempted. As a result the whole literature of the subject has become extremely scattered and systematic studies are now very laborious. The synopsis of existing genera here presented is an attempt to give a preliminary analysis of the generic characters in a form suitable for use by those engaged on regional faunal studies. Of the 308 genera which have been recorded, some 53 genera are provisionally rejected as synonyms, leaving about 255 valid genera which embrace some 1,900 species. The characters have been keyed in a numerical system which should be followed consecutively. At every point the contrasted character is cited by its serial number in parentheses. It is hoped that in this way practical identification and cross-checking will be simplified, at the same time retaining a reasonably natural sequence. The key avoids the use of characters which require the destruction of the specimen for their demonstration. Wherever feasible, external characters are employed, so that unique specimens may be subjected to the minimum of damage in the process of identifying them. For this reason Matsumoto’s classification has been largely abandoned, as it is impracticable. The arrangement here adopted is an arbitrary development of various proposals already current in the literature. The nominotypical rule has been applied throughout to the family-group taxa. Thus, in the case of the type genus Ophiura Lmk., Ophiuridae Lyman replaces Ophiolepididae as the familial name, Ophiurinae Lyman replaces Ophiolepidinae as the familial name, Ophiurinae Lyman replaces Ophiomastinae as the subfamilial name; in accordance with the rule, both are attributed to 1865, the original date of publication by Lyman of the familial name, which in any case has priority. For other groups of ophiuroids the original names for the families and subfamilies have been restored if valid. Where a genus appeared to me to be unsatisfactorily defined, the type species has been used as the basis of the generic diagnosis. Thus, it has been felt preferable to indicate that the type species of a genus has “3 erect arm-spines”, rather than “arm-spines present, few”. Where possible, expressions such as “broad”, “long”, etc., have been replaced by more quantitative values—e.g., “as broad as a basal arm-joint”, “longer than two arm-joints”, etc. In many cases, unfortunately, these details cannot be ascertained from the literature. The original diagnosis and authority and the name of the type species is cited for each genus. The type-species is indicated by a prefixed asterisk; it gives the name as originally published, but the trivial name alone is cited in those
cases where the species is still placed in the genus to which it was originally referred. For each type species there is also given some indication of the origin or distribution, if known, and an approximate bathymetric datum. Thus, a type species from "Albatross Station 4781 in 482 fathoms" is cited as "N. Pacific, 500 fms". Utilizing the cross-reference provided by the key itself, the bibliography, and the index, the original source for each genus can be found. Where the source of a type species differs from that of the genus of which it is now the type, in the more important cases it will be found included in the bibliography; otherwise, reference should be made to H. L. Clark's "Catalogue of Recent Ophiurians" (1915), or the Zoological Record in the case of species published since 1915.

This guide to the genera is necessarily derived from the original work of others, and represents a digest of the very scattered literature. Most of the genera are known to me only through the literature. It seems inevitable that errors will have crept in during the long process of abstracting and rearranging, and I shall be grateful for corrections and for information on any genera which have been omitted, in order that a supplement may be prepared if it seems desirable. A new monograph is urgently required, but could only be undertaken by someone with access to the great collections held in museums of the northern hemisphere.

**Historical Review**

The bizarre form and tree-like branching arms of Gorgonocephalids attracted the attention of several pre-Linnean naturalists. The earliest reference seems to be the "Stella arborescens" of Rondelet (1554). Winthrop, a New England naturalist of Stuart times, made two communications to the Royal Society on "The Basket Fish" (Phil. Trans for 1670 and 1671). "Astrophyton" was illustrated and described by Linck in 1733; the species concerned, or one allied to it, now carries the name *Gorgonocephalus linckii* (M. & T.).

All star-shaped echinoderms known to Linné in 1758 were included in his genus *Asterias*. Certain species of ophiuroids were among the assemblage. Three of them are notable as becoming the types of genera subsequently erected:—*Asterias capitmedusea*, *Asterias ophiura*, and *Asterias aculeata*. Pennant (1777) added *Asterias pentaphylla*; Retzius (1783) *Asterias euryale*; Pallas (1788) *Asterias oligactes*; and Abildgaard (1789) *Asterias nigra*. These species are now placed in widely differing families of ophiuroids, and their incongruous association with *Asterias* serves to point the transitory character of taxonomic assemblages.

Realizing that *Asterias* comprised at least two main types of radiate animals, Lamarck in 1801 limited the content of the genus to asteroids and euryalids; the simple-armed ophiuroids were referred to a second genus *Ophiura*. The latter was, of course, based upon the Linnean species of that name, which is thus the type species and genus for all ophiuroids. However, Montagu (1804), Retzius (1805) and others continued to refer new species of ophiuroids to *Asterias* L., including some species which later became types of ophiuroid genera.

Fragmentation of the unmanageable genus *Asterias* was resumed in 1815 when, independently, Oken proposed *Euryale*, and Leach *Gorgonocephalus*—to include the forms with branching arms. These genera were originally synonymous but, thanks to restricted definitions proposed by Lyman in 1882, both names have survived as independent genera, as well as the pre-Linnean *Astrophyton*, revived by Mueller and Troschel in 1842. Meantime, Lamarck in 1816 further restricted *Asterias*, referring the forms with branching arms to *Euryale*, as Oken had proposed the previous year. *Asterias* thus ceased to have any connection with ophiuroids.

Three new genera were added by Louis Agassiz in 1835: *Ophiocoma*, *Trichaster* and *Ophiurella*. The first was based on *Ophiura echinata* Lmk., the second on *Euryale palmiferum* Lmk., but the identity of the third is not now clear.
A landmark was the publication of Mueller and Troschel's paper on the genera of ophiuroids (1840), followed two years later by their "System der Asteriden". In the 1840 paper seven new genera were proposed—Ophiothrix, Ophiolepis, Ophionyx, Ophioderma, Ophiomyxa, Ophiopholis and Ophiocnemis. Six further genera were proposed by them in 1842, and Forbes (1843) added three more (including the well-known Amphiura and Pectinura). By the mid-century a total of 22 recognisable genera had been established.

During the next twenty years Lütken added thirteen more genera, every one beginning with either Ophi(o)- or Ast(e)ro-. Unfortunately this convention has been followed too faithfully by later naturalists, with the result that about 200 of the generic names are so tediously uniform as to make them extremely difficult to remember. Through slips of the pen variant spellings continually arise to confound the synonymy.

During the second half of the nineteenth century some 125 new genera were proposed, as follows: Lyman (45, 18 of which stem from the Challenger), Verrill (26), Lütken (13), Liitken (10), Koehler (5)—the remainder by less prolific authors. During this period the Challenger report by Lyman (1882) provided the first (and so far, only) monograph on ophiuroids.

The first half of the twentieth century saw the publication of notable descriptive works, especially those of Koehler, including his Siboga Reports (1904-5). Important systematic contributions have been those of Matsumoto (1915-17) and Doederlein (1911, 1927, 1930). Regional faunal surveys have been carried out by Mortensen (in Indonesia, South Africa, New Zealand, Australia, Europe, Arctic and Antarctic); by H. L. Clark (in Australia, South Africa, Indonesia); Koehler (in Antarctica, Indonesia, Indian Ocean, India). H. L. Clark (1915) issued a Catalogue of genera and species, a work which remains a standard reference. During these fifty years a further 150 genera have been proposed. Over the last decade or so, although expeditions continue to be active, the number of genera recognized as valid has fallen, as various synonyms have been recognized.

Class ASTEROZOA
Subclass OPHIUROIDEA

Asterozoa in which the alimentary organs are essentially confined to a central disc from which the arms are distinctly demarcated and capable of performing the locomotor movements, the tube-feet serving as non-suctorial, sensory tentacles.

In all existing genera the ambulacral plates fuse in pairs early in life to form median articulating joints, termed vertebrae, and the ambulacral groove is converted into an internal epineural canal. These characters sharply distinguish extant ophiuroids from other Asterozoa, but they are lacking from the more generalized Palaeozoic ophiuroids.

Key to the Orders of OPHIUROIDEA

1 (4) An open ambulacral groove traverses the lower surface of the arm.
2 (3) Ambulacral plates persist as discrete elements in the adult stage, not fusing together in pairs to form vertebrae; the arm is therefore capable of only limited movements. . . Order STENURIDA Spencer.
   (An exclusively Palaeozoic group of 9 genera arranged in 5 families. See Spencer (1951)).
3 (2) Ambulacral plates fuse in pairs to form vertebrae which permit snake-like arm-movements. . . Order OEGOPHIURIDA Matsumoto.
   (Exclusively Palaeozoic, 7 families; see Spencer (1951)).
Ambulacral groove closed over and purely internal, forming the epineural canal; ambulacral plates fused in pairs to form articulating vertebrae which permit snake-like arm-movements. Order OPHIURIDA Mueller & Troschel.

(The largest order, comprising all living species and all known fossils from the Triassic onwards, as well as one Palaeozoic family, the Agasteridae.)

**Fossil Genera**

As a review of these is in preparation for Moore's forthcoming *Treatise of Invertebrate Paleontology*, they are omitted from the synopsis given here.

**Order OPHIURIDA Mueller & Troschel, 1840**

(syn. Myophiuroidea Matsumoto, 1915.)

**Key to the Suborders, Families and Subfamilies**

1 (8) Disc and arms covered by thick skin which may contain a mosaic of granules but does not overlie a layer of plates or scales. Arm-spines point downwards. Arms roll into vertical coils. Vertebrae articulate by broad, hourglass-shaped surfaces. . . (Suborder EURYALAE M. & T. p. 7.)

2 (7) Vertebrae with a ventral furrow, so that the radial canal and nerve are not imbedded in stereom; distal arm-joints not long and slender.

3 (4) Hooks on dorsal side of arms; the hooks have no lamina and lack regularly arranged perforations; gonads restricted to disc. . . (Family GORGONOCEPHALIDAE Ljungman, 1867, emend. Mortensen, 1933. p. 7.)

4 (3) No hooks on dorsal side of arms; but at distal end of arm the lateral arm-spines are transformed into hooks which lack a lamina and lack perforations.

5 (6) Gonads restricted to disc. (Fam. ASTERONYCHIDAE Verrill, 1899, emend. Mortensen, 1933. p. 11.)

6 (5) Gonads extending to at least midway along the arms. . . (Fam. ASTEROSCHEMATIDAE Verrill, 1899, restr. Mrtsn., 1933; non Matsumoto, 1915. p. 11.)

7 (2) Vertebrae with ventral furrow closed over, so that radial canal and nerve lie within the vertebrae; distal arm-joints long and slender; no hooks on dorsal side of arms, but at distal end of arm the lateral arm-spines are transformed into hooklets with a lamina perforated by serially arranged holes. (Fam. EURYALIDAE Gray, 1840, emend. Mortensen, 1933, p. 10.)

8 (1) Disc and arms covered by scales or plates (sometimes invested by skin or granules). Arm-spines placed laterally on arms. Arms usually move horizontally (but in Fam. Hemiureyalidae they roll vertically). . . . (Suborder OPHIURAE Mueller & Troschel, p. 12.)

9 (10) Arms rolling vertically into tight coils. Vertebrae with broad, saddle-shaped articulations, like those of the Order Euryalae. Usually epizoic upon gorgonian corals. . . . (Fam. HEMIEURYALIDAE Verrill, 1899. p. 12.)

10 (9) Arms bending only sideways, in the horizontal plane. Vertebrae with ball-and-socket joints, or with interlocking processes. Usually free-living, only very rarely epizoic.
Representative ophiuroids illustrating characters of systematic significance. 1, ventral aspect and, 2, dorsal aspect, of *Ophiura* (Fam. Ophiuridae). 3, ventral aspect of *Ctenamphiura* (Fam. Amphiuridae). 4, dorsal aspect of arm-joint in *Ophiacantha* (Fam. Ophiacanthidae). 5, distal arm-hooklet with flattened lamina which is perforated and bears a secondary (i.e., lateral) tooth, in *Astroceras* (Fam. Euryalidae). 6, similar arm-hooklet but lacking the flattened lamina and perforations, in *Astrothorax* (Fam. Gorgonocephalidae).
11 (12) Disc without ventral interradial areas. Gonads arranged serially along the arms on either side, bulging visibly below the skin. Stomach sending a dorsal radial diverticulum into each arm. . . (Fam. OPHIOCANO-PIDAE Mortensen, 1933. p. 15.)

12 (11) Disc with conspicuous ventral interradial areas. Gonads and stomach confined to disc.

13 (16) Thick soft skin covers the plates of disc and arms, but the underlying plates and scales become visible after drying. Arm-spines erect. . . . (Fam. OPHIOMYXIDAE Ljungman, 1866. p. 13.)

14 (15) Oral shields small. Adoral plates long and slender, lying between the oral shield and the first lateral arm-plates. Vertebrae long and slender, the articular peg well-developed. . . . (Subfam. OPHIOBYRSINAE Matsumoto, 1915, p. 13.)

15 (14) Oral shields and adoral plates fused together, massive. Adoral plates proximal to oral shield. Vertebrae short, thick, the articular peg rudimentary or lacking. . . . (Subfam. OPHIOBYRSINAE Matsumoto, 1915. p. 15.)

16 (13) Disc and arms not covered by thick skin. Scales and plates easily visible, though they may carry spines or granules more or less concealing them on the disc.

17 (20) Spiniform tooth-papillae forming a cluster at the apex of each jaw.

18 (19) Oral papillae border each jaw. (Fam. OPHIOCOMIDAE Ljungman, 1867. p. 25.)

19 (18) No oral papillae. (Fam. OPHIOTHRICIDAE Ljungman, 1867. p. 23.)

20 (17) No tooth-papillae.

21 (22) Paired infradental papillae at the apex of each jaw. . . . (Fam. AMPHIURIDAE Ljungman, 1867, p. 20.)

22 (21) An unpaired infradental papilla at the apex of each jaw.

23 (28) Arms inserted laterally into the disc and firmly fused to it.

24 (25) Granulation covers over the disc-scales of both upper and lower surfaces, often also covering the jaws. . . . (Fam. OPHIODERMATIDAE Ljungman, 1867. p. 26.)

25 (24) No granulation. . . . (Fam. OPHIURIDAE Lyman, 1865. p. 28.)

26 (27) Second oral tentacle-pore opens more or less entirely outside the oral slits. . . . (Subfam. OPHIUРИNІAЕ Lyman, 1865, restr. Matsumoto, 1915, p. 28.)

27 (26) Second oral tentacle-pore opens entirely within the oral slit. (Subfam. OPHIOLEPIDINAE Matsumoto, 1915, p. 32.)

28 (23) Arms inserted ventrally below the disc and partly overlain by the disc, the arms and disc not firmly fused together.

29 (36) Free margins of jaw bear a continuous series of uniform oral papillae.

30 (33) No granulation or spinules on disc.

31 (32) Arms robust, not constricted at the nodes. A ventral keel on the midline of each ventral arm-plate, often also a similar keel on the dorsal arm-plates. Disc large, flat. . . . (Fam. OPHIOCHITONIDAE Matsumoto, 1915, p. 26.)

32 (31) Arms slender, elongate, with no ventral or dorsal keels. Vertebrae long, slender, often divided longitudinally by a series of pores. . . . (Fam. AMPHILEPIDIDAE Matsumoto, 1915. p. 23.)
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33 (30) Granules or spinules present on disc. Arms slender, often constricted at the nodes. Mainly abyssal forms.

34 (35) Arm-spines numerous, long, conspicuous, erect. . . . (Fam. OPHIACANTHIDAE Perrier, 1891. p. 15.)

35 (34) Arm-spines few, small, inconspicuous, adpressed. . . . (Fam. OPHIOLEUCIDAE Matsumoto, 1915. p. 19.)

36 (29) Free margins of jaw do not bear a continuous series of uniform papillae; instead, there is a diastema separating the lateral oral papillae from the dissimilar infradental papillae at the apex of the jaw. . . . (Fam. OPHIACTIDAE Matsumoto, 1915. p. 23.)

Suborder EURYALAE Mueller & Troschel, 1840

Family GORGONOCEPHALIDAE Ljungman, 1867, emend. Mortensen, 1933

1 (39) Arms forked.

2 (3) Seven arms, bifurcating once about halfway out: girdle hooklets minute, without secondary teeth: reproducing by transverse fission. . . .

Schizostella A. H. Clark, 1952.*


3 (2) Five arms.

4 (7) More than 30 arm-joints before the first fork.

5 (6) Disc and arms with transverse ridges. . . . Astrocnida Lyman, 1872.*

*Trichaster isidis Duchassaing, 1850. Caribbean. 100 fms.

6 (5) Disc and arms without transverse ridges. . . . Astroclon Lyman, 1879.*

*propugnatoris Lyman, 1879. Indonesia. 100 fms.

7 (4) Less than 20 arm-joints before the first fork.

8 (38) Primary plates inconspicuous: radial shields elongate, bar-like.

9 (17) Five madreporites of similar size.

9a (10) Hooklets with a secondary tooth. . . .

Astroglymma Doederlein, 1927.*

Syn.: Astrodactylus Doederlein, 1911 (preoccupied).*

*Astrophyton sculptum Doed., 1896. Indonesia.

10 (9a) Hooklets with no secondary teeth.

11 (14) Arm-spines occurring below the disc before the first or second fork.

12 (13) Radial shields without transverse ridges: arm-spines occurring before the first fork. . . .

Astrogordius Doederlein, 1911.*

*Astrophyton cacaoticum Lyman, 1874. Caribbean. Littoral.

13 (12) Radial shields with transverse ridges. . . . Astrocyclus Doederlein, 1911.*

*Astrophyton caecilia Ltk., 1856. Caribbean. 100 fms.

14 (11) Arm-spines lacking before the fourth fork.

15 (16) Disc and arms with transverse rows of spines. . . . Astrocanecum Doederlein, 1911.

(Synonym Astrocynodus A. H. Clark, 1918.)*

*Astrophyton spinosum Lym., 1875. Panama, Pearl Is. Littoral.

16 (15) Disc and arms without spines. . . .

Astrodictyum Doederlein, 1927.*

*Astrophyton panamense Verrr., 1867. Panama, Pearl Is. Littoral.

17 (9) One madreporite (exceptionally 2 or 3 of different sizes).

18 (27) Arm-spines present before the first fork.

19 (20) Madreporite placed at the proximal border of the soft interbrachium.

21 (24) Disc and arms covered with large tubercles or spines.


24 (21) Disc and arms bearing only small spinules or granules, or else naked.

25 (26) Disc with a zone of calcareous plates at the margin. . . Gorgonocephalus Leach, 1815

This genus, originally intended to embrace all ophiuroids with branching arms, has successively been restricted by Lyman, 1882, and Doederlein, 1911. *Asterias caputmedusae L., 1758. N. Europe. Littoral.


27 (18) Arm-spines absent before the first fork.

28 (33) Arm-spines beginning at the edge of the disc, after the first or second fork.

29 (30) Madreporite at the inner border of the soft interbrachium; warts or tubercles usually present on disc. . . . Astrocudus Verrill, 1899. *Asterias euryale Retzius, 1783. S. Africa. Littoral.

30 (29) Madreporite separated from the soft interbrachium by accessory plates.


33 (28) Arm-spines beginning at some distance from the disc, not before the fourth fork.

34 (35) The arms near the disc nearly as high as broad, with a narrow ventral side.


36 (37) Radial shields with a longitudinal series of tubercles or spines: hooklets without any secondary teeth. . . . Astrophyton Mueller & Troschel, 1842.

As originally proposed *Astrophyton* was an absolute synonym of *Gorgonocephalus*: the current usage is derived from Lyman, 1882. *Euryale muricatum Lmk., 1816. Caribbean. 200 fms.

37 (36) Radial shields without tubercles or spines: hooklets with a secondary tooth. . . . Astroboa Doederlein, 1911.


38 (8) Primary plates conspicuous, covering much of disc surface: radial shields ovate. . . . Ophiocrene Bell, 1894.

Bell, 1894, himself points out that the type specimen of *O. oenigma* Bell may be a juvenile form. Should it prove to be the young stage of a genus described since 1894, *Ophiocrene* will take priority. H. L. Clark, 1915, has suggested it may be a young *Astrochalcis.* *oenigma* Bell, 1894. Indian Ocean. Littoral.
39 (1) Arms simple.

40 (58) Disc covered by granulation, sometimes including small spinules or shallow scales, but without coarse projecting spikes or tubercles.

41 (42) Arms annulated by alternating belts of granules and hooklets, and with the belts continued on to the disc, so that concentric ridges and furrows mark the dorsal surface: seen from above the animal looks "as if composed only of 5 arms, whose bases were thickened and wedged together" (Lyman, 1882). Hooklets with 1 secondary tooth.

*annulata* Lütken, 1856. Caribbean. 100 fms.

42 (41) No concentric furrows and ridges on disc.

43 (46) Granulation of disc more or less covered, and partly obscured, by a soft skin.

44 (45) About two arm-joints included within the disc: genital clefts shorter than 1 arm-joint: ventral arm-plates fragmented: 4 arm-spines.

*annulata* Liitken, 1856. Caribbean. 100 fms.

45 (44) About six arm-joints included within the disc: genital clefts as long as 3 arm-segments: 4-5 arm-spines: girdle hooklets with 2 or 3 secondary teeth.

*Astrochlamys* Koehler, 1911.

*bruneus* K., 1911. W. Antarctica. 100 fms.

46 (43) Granulation not invested in skin.

47 (48) A peripheral zone of stumpy granules demarcates the ventral margin of the disc, which is otherwise covered by a fine granulation: a zone of spinules surrounds the mouth: 3 or 4 conspicuous arm-spines, each about as long as an arm-joint.

*Astrochele* Verrill, 1878.

*lymani* Verr., 1878. N. Atlantic. 300-1,000 fms.

48 (47) No peripheral zone of specialized granules.

49 (50) A continuous mosaic of small platelets covers the ventral side of the arms and disc: the genital clefts small and restricted to the peripheral region, outside the mosaic: 6 arm-spines.

*Astrostephanus* Doederlein, 1930.

*Astrotoma vecors* Koeh., 1904. Indonesia. 100 fms.

50 (49) Not so.

51 (52) Girdle-hooklets without secondary teeth: about 5 arm-spines.

*Astrotoma* Lyman, 1875.

*agassizii* Lyman, 1875. Antarctic. 100 fms.

52 (51) Girdle-hooklets with secondary teeth.

53 (54) Girdle-hooklets with 1 secondary tooth: 5 to 10 arm-spines.

*Astrothorax* Doederlein, 1911.


54 (53) Girdle-hooklets with 2 to 6 secondary teeth.

54a (55) Five arm-spines: disc uniformly covered by granules, and excavated interradially, so that radial lobes occur at the arm-bases: genital clefts short: hooklets with 2 secondary teeth.

*Astrohelix* Doederlein, 1930.

*Astrotoma bellator* Koehler, 1904. Indonesia. 150 fms.

55 (54a) Two or three arm-spines.
56 (57) Two or three secondary teeth: disc covered by larger rounded and smaller angular granules. . . .  
  *rugosus* H. L. C., 1909. E. Australia. 50 fms.

57 (56) Three to six secondary teeth: thorny granules occur among the disc granules. . . .  

58 (40) Disc carrying coarse spikes or prominent tubercles.

59 (64) Disc carrying coarse prominent tubercles, but no spikes.

60 (63) Three or four arm-spines.

61 (62) Scattered large tubercles on dorsal side of disc, and clusters of platelets on the ventral arm-bases around the mouth: arms annulated by bands of coarser granules, in 4 transverse rows, which alternate with bands of much more numerous and finer granules, in many transverse rows: girdle-hooklets with 1 or 2 secondary teeth. . . .  
  *Astrocrius* Doederlein, 1927.

62 (61) Disc covered above and below by coarse granules and tubercles: arms annulated by double rows of granules, alternating with rows of hooklets which have one feeble secondary tooth. . . .  
  *Astrotoma sobrinus* Matsumoto, 1912.

63 (60) Disc covered above and below by coarse granules: arms annulated by double rows of granules, alternating with rows of hooklets which have one feeble secondary tooth. . . .  
  *Astrohamma* Doederlein, 1930.

64 (59) One flat, scale-like arm-spine, some large tubercles on the dorsal side of disc resembling a cluster of pearls: hooklets of arm with 3 or 4 secondary teeth. . . .  
  *Astrogomphus* Lyman, 1869.

Family EURYALIDAE Gray, 1840
(Syn. Trichasteridae *sensu* Mortensen, 1933)

1 (6) Arms simple.

2 (5) Arms with a prominent dorso-lateral ridge of spines or granules on either side: arm-spines short, of equal size.

3 (4) Dorso-lateral ridges carrying numerous, very prominent tubercles: additional interradial plates lying distal to the adoral shields. . . .  
  *Asterostegus* Mortensen, 1933.

4 (3) Dorso-lateral ridges with scattered tubercles or spines: no additional interradial plates distal to the adoral shields, interradius naked ventrally. . . .  
  *Astrocerae* Lyman, 1879.

For a review of this genus see Mortensen, 1933a.

5 (2) Arms rounded above, without dorso-lateral ridges: inner arm-spine usually longer than the outer. . . .  
  *Asteromorpha* Lütken, 1869.

Synonym *Ophiogelas* Koehler.

6 (1) Arms forking several times: arm-spines short, both of equal size.

7 (10) More than 18 arm-joints occurring before the first fork.
10 (7) Less than 10 arm-joints before the first fork: arms forking repeatedly over most of their length: gonads entering the arms. . . . Euryale Oken, 1815.

Euryale is usually attributed to Lamarck, 1816; however, Oken’s usage appears to have priority. The current employment of Euryale stems from Lyman, 1882; previously it was an absolute synonym of Gorgonocephalus: for discussion, see Verrill, 1899.


8 (9) Arms with dorso-lateral ridges, often set with spines or granules: lateral plates widely separated on ventral surface of arm: arms branching only in their distal halves: gonads entering arms. . . . Trichaster Agassiz, 1836.

*Euryale palmiferum* Lmk., 1816. Indian O. 100 fms.

9 (8) Arms symmetrically rounded above, without dorso-lateral ridges: lateral plates meeting on ventral midline of arm: gonads confined to disc. . . . Sthenocephalus Koehler, 1898.

*indicus* Koehler, 1898. Indonesia. 30 fms.

Family ASTERONYCHIDAE Verrill, 1899

(Emend. Mortensen, 1933)

1 (2) More than 3 arm-spines which (except for the 3 inner ones) are modified as simple hooklets. Disc and arms covered above by naked skin. . . . Asteronyx Mueller & Troschel, 1842.

*loveni* M. & T., 1842. North circum-polar. 100 fms.

2 (1) Three (rarely 2) arm-spines, never hooked; disc covered above and below by thin, imbricating scales, especially well-developed at the margin. . . . Astrodia Verrill, 1899.

*tenuispina* Verrill, 1899. N. Atlantic. 2,000 fms.

Family ASTEROSCHEMATIDAE Verrill, 1899

(Restr. Mortensen, 1933)

1 (2) Radial shields small, naked, glassy, without spines: disc and arms plated or granulated, arm-spines very small and irregular: proximal part of arm usually dilated, contracting abruptly at the disc. . . . Astrocharis Koehler, 1904.

*virgo* Koehler, 1904. Indonesia. 300 fms.

2 (1) Radial shields covered by skin or granules: proximal part of arm not dilated.

3 (8) Ventral arm-plate separating lateral plates.


*lymani* Studer, 1884. S. W. Africa. 60 fms.

5 (4) Arms long, many times disc-diameter.

6 (7) Large buccal shield. . . . Astrobrachion Doederlein, 1927 (as restricted by Mrtsn. 1933a).

*Ophiocreas constrictus* Farquhar, 1900. New Zealand. Littoral in fiords and archibenthic.

7 (6) No buccal shield. . . . Astroscolex Mortensen, 1933a.

*Ophiocreas adhaerens* Studer, 1884. Australia. 50 fms.

8 (3) Lateral arm-plates fused together on the ventral midline, not separated by ventral plate.
9 (10) Disc covered by granulated skin. . . . *Asteroschema Oersted & Lütken, 1856.
   Syn.: *Laspalia* Ljungman.
   *Asterias oligactes* Pallas, 1788. Caribbean. 100 fms.

10 (9) Disc covered by naked skin. . . . Ophiocreas Lyman, 1879.
   *Lumbricus* Lyman, 1879. Caribbean. 100 fms.

**Suborder OPHIURAE Mueller & Troschel**

**Family HEMIEURYALIDAE Verrill, 1899**

1 (8) Dorsal arm-plates partly or completely subdivided into smaller plates: 3 short, flat arm-spines and 1 short, flat tentacle-scale (Subfamily Hemieuryalinae Matsumoto, 1915).

2 (3) Dorsal arm-plates completely fragmented, forming a mosaic. . . . *Hemieuryale* von Martens, 1867.
   *Pustulata* v. Mart., 1867. West Indies. 100 fms.

3 (2) Dorsal arm-plates subdivided into a larger medium portion, plus some other plates or platelets.

4 (7) A large supplementary plate on either side of each dorsal plate.

   *Johnsoni* A. H. C., 1934. West Indies. Littoral.

6 (5) Two genital clefts in each interradius. . . . Sigsbeia Lyman, 1878.
   *Murrhina* Lyman, 1878. Cuba. 175 fms.

7 (4) Dorsal arm-plates of adjacent segments separated by an intervening transverse row of small platelets. . . . *Ohioplus* Verrill, 1899.
   *Hemieuryale tuberculosa* Lyman, 1883. West Indies. 100 fms.

8 (1) Dorsal arm-plates entire; without supplementary plates: 5–8 conical arm-spines: no tentacle-scale, but lowest arm-spine may serve as one (Subfamily Ophiochondrinae Verrill, 1899, emend. Matsu. 1915).

9 (10) Disc-plates covered by a thick granulated skin. . . . Ophioclinodrus Lyman, 1869.
   (Mortensen, 1927, 1936, has referred this genus to the Ophiacanthidae, without discussion.)
   *Convolutus* Lyman, 1869. Cuba. 270 fms.

10 (9) Disc-plates naked.

11 (18) Ventral arm-plates developed normally throughout arm.


13 (12) Interradii of normal form, without interradial sacs.

14 (17) Disc circular in outline: uppermost arm-spines longer than others.

   *Perplexa* Niels., 1933. Panama. Littoral.

   *Ophioceramis clausa* Lyman, 1878. Kermadec Is. 600 fms.
   (It seems doubtful whether this genus is distinct from *Amphigyptis*, of which it may be a developmental stage.)
17 (14) Disc distinctly 5-lobed owing to the larger radial shields and contracted interradii. ... Ophiomoeosis Koehler, 1904.
Syn: Ophiurases H. L. Clark, 1911.
18 (11) Ventral arm-plates beyond the three basal arm-segments either lacking or fragmented.
19 (20) Ventral arm-plates lacking beyond the third basal segment, and replaced by a ventral furrow. ... Ophioholcus H. L. Clark, 1915.
*Sigsbeia sexradiata Koehler, 1914. West Indies. 350 fms.
20 (19) Ventral arm-plates beyond the third basal segment are fragmented into small platelets. ... Ophiogyptis Koehler, 1905.
*nodosa K., 1905. Indonesia. 50 fms.

Family OPHIOMYXIDAE Ljungman, 1866
1 (36) Oral shields small; adoral plates long and slender, lying between the oral shield and the first lateral arm-plate. Vertebrae long and slender, their articular peg well developed (i.e., zygospondylous).

Subfamily OPHIOMYXINAE
2 (19) Second oral tentacle-pores opening partly or entirely outside mouth-angles.
3 (16) Teeth present, in a single vertical row.
4 (7) Radial shields present.
5 (6) Radial shields large, each with a conspicuous spine at the proximal end. ... Ophiostyracium H. L. Clark, 1911.
6 (5) Radial shields small, and only their distal ends visible at arm-base. ... Astrogeron Verrill, 1899.
H. L. Clark regards this as a synonym of Ophiogerger.
*Ophiogerger supinus Lym., 1883. West Indies. 200–400 fms.
7 (4) No radial shields.
8 (9) No ventral arm-plates, except on the first arm-segment. ... Ophiocanops Koehler, 1922a.
Ophiocanops is keyed here as a practical convenience, as the characters of the gonads and stomach may escape notice. See Family Ophiocanopidae, p. 15.
9 (8) Ventral arm-plates present.
10 (11) Disc delicately scaled above. Oral papillae, teeth spiniform. Spines on outer segments are replaced by minute umbrella-shaped spinules. ... Ophiohelus Lyman, 1880.
*umbella Lyman, 1880. West Indies. 100 fms.
11 (10) Disc without scales.
12 (15) Oral angles devoid of oral papillae.
13 (14) Disc covered by naked skin. ... Ophiogerger Lyman, 1878.
*edentulus Lyman, 1878. Fiji. 1,350 fms.
14 (13) Disc covered by finely granulated skin. ... Ophiosciasma Lyman, 1878.
*attenuatum Lyman, 1878. E. Brazil. 350 fms.
15 (12) Oral angles bearing spiniform oral papillae, which resemble the teeth and tooth papillae. ... Ophioscolelex (s.s.) Mueller & Troschel, 1842. The genus was restricted by Mortensen (1933); synonym Ophiocyodus H. L. Clark, 1911.
*glacialis M. & T., 1842. Arctic. 100 fms.
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16 (3) Teeth vestigial; resembling spinules.

17 (18) Uppermost arm-spines of successive segments united to one another by a horizontal membrane running longitudinally along the arm. No dorsal arm-plates. . . . *Ophiodyssygus H. L. Clark, 1911. *disacanthus H. L. C., 1911. Japan. 100 fms.


19 (2) Second oral tentacle opening entirely within the mouth-angles.

20 (29) Teeth and oral papillae acutely pointed.

21 (22) Conspicuous radial shields, disc scaled above and below; dorsal arm-plates present: 1 tentacle scale: distal part of arm, the upper 2 arm-spines are modified into double hooklets. . . . Ophiolyxus Mortensen, 1933c. *inermis Mrtsn., 1933c. S. Africa. 200 fms.

22 (21) Radial shields not distinguishable from other plates, or lacking altogether. No dorsal arm-plates.


24 (23) Platelets or granules form a conspicuous marginal border round the disc, which is otherwise covered by skin.

25 (28) Genital cleft shorter than an arm-segment.


29 (20) Teeth and oral papillae broadly expanded with denticulate free margins.

30 (33) Disc plates present around the margin, disc otherwise covered by skin.


33 (30) No marginal disc-plates.


H. L. Clark (1915) refers the type to *Ophiomyza. Mortensen (1927) synonymizes *Ophiodyera with *Ophiomyza.
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**rudimentary or absent** (i.e., streptospondylous). . . .

**Subfamily OPHIOBYSINAE**

37 (38) Only 1 genital cleft in each interradius: oral shield present in only 1 interradius. . . .


38 (37) Genital clefts paired: 5 oral shields.

39 (44) Radial shields conspicuous, elongate, bearing spinules.

40 (41) No dorsal arm-plates: arm-spines very long and serrated. . . .

*acanthinus* H. L. C., 1911. Japan. 100 fms.

41 (40) Fragmented dorsal arm-platelets occur: arm-spines not long, nor serrated.

42 (43) Oral papillae forming a regular lateral row along the sides of the oral angle: ca. 5 spiniform teeth at jaw-apex, as well as dental papillae. . . .

*serpen* Lyman, 1883. Caribbean. 70 fms.

43 (42) Only 1 oral papilla, and no teeth: a few spiniform dental papillae at the jaw-apex. . . .

*rudis* Lyman, 1878. Australia. Littoral.

44 (39) Radial shields inconspicuous or absent.

45 (46) Only lateral arm-plates on arm: 1 oval tentacle-scale. . . .

*uncinatus* Lyman, 1883. Cuba. 250 fms.

46 (45) Ventral arm-plates as well as lateral arm-plates.

47 (48) Disc bearing spinules: oral and dental papillae spiniform. . . .

*uncinatus* Koehler, 1922a. Philippine Is. 20 fms.

48 (47) Disc free from spinules: oral and dental papillae, and teeth, all alike, stout, stumpy, blunt and thorny at the tip. . . .

**Family OPHIOCANOPIDAE** Mortensen, 1933

No ventral arm-plate, except on the first arm-joint: uppermost spine embedded in skin of the arm, holding it in an arch to accommodate the stomach and gonads within. . . .

*uncinatus* Koehler, 1922a. Philippine Is. 20 fms.

**Family OPHIACANTHIDAE** Perrier, 1891

1 (30) Tentacle-pores large and conspicuous.

2 (3) Radial shields large. Lateral plates carrying a row of ca. 5 spines, and also a parallel row of ca. 5 hyaline hooklets: dorsal interradii deeply furrowed. . . .

*inani* Koehler, 1922a. Antarctic. 120 fms.

3 (2) Radial shields small or lacking.

4 (21) Disc covered by naked skin or fine scales.

5 (8) Disc higher than wide, arms capable of standing vertically over the disc,
and assuming this position in preserved material: several rows of flat oral papillae.

This assemblage includes *Ophiotholia* and *Ophiomyces*, which Verrill (1899) treated as a distinct family, the Ophiomycetidae; of subsequent writers, Koehler alone adopts Verrill's proposed family. Fell (1941) described a similar arm-posture in juvenile stages of "Kirk's ophiuroid", a species which is now believed to be referable to *Ophiomyxa*. If Verrill's *Ophiomycetidae* is valid, it would also include *Ophioura* H. L. Clark, 1938.

5a (5b) Seven arms. . . . *Ophioura* H. L. Clark, 1938.

5b (5a) Five arms.

6 (7) About 3 arm-spines, plus, on the distal arm-segments, some hyaline umbrella-shaped hooklets. . . . *Ophiotholia* Lyman, 1880.

7 (6) About 10–12 arm-spines: no accessory hooklets. . . . *Ophiomyces* Lyman, 1869

8 (5) Disc not high: arms normal.

9 (10) Disc covered by naked skin, not containing plates: 6 or 7 flat, pointed, hyaline arm-spines. . . . *Ophioblenta* Lütken, 1859.

10 (9) Disc covered by scales above and below, or by thick skin in which embedded plates are visible when dried.

11 (18) Disc completely scaled above and below.

12 (13) No evident genital clefts, the disc continuing unbroken across the dorsal surface of arms: no evident radial shields: no tentacle-scales. . . . *Ophiocymbium* Lyman, 1880.

13 (12) Genital clefts in usual position: tentacle-scales spiniform


15 (14) Radial shields not evident.


17 (16) Oral papillae of 2 types: the inner ones scale-like, the outer ones elongate and spiniform. . . . *Ophiophrura* H. L. Clark, 1911.

Koehler (1922) points out that *Ophiophrura* is closely comparable with *Ophiomede*, and could well be included in the latter: they are kept separate here because of the practical convenience of using the disc-clothing as a key-character.

18 (11) Disc covered by a rather thick skin, which contains embedded plates, visible when dried.

19 (20) Embedded disc-plates imbricating: oral papillae all spiniform: four or five slender, cylindrical tapering smooth arm-spines: tentacle-pores large, 1 small tentacle scale at base of arm, none thereafter. . . . *Ophiotoma* Lyman, 1883.

Syn.: *Ophiopora* Verrill, 1899.

20 (19) The soft thick skin of the disc contains rounded small plates which do not imbricate, and small radial shields: internal oral papillae spiniform,
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21 (4) Disc bearing granules or spines.

22 (29) Dorsal arm-plates visible, not obscured by granules or spinules.

23 (28) Tentacle scales elongate, spiniform.


25 (24) Arms many times longer than disc diameter: radial shields mainly or completely concealed.

26 (27) Eight or 9 spiniform oral papillae which are confluent with 6 or so papillae of the oral tentacle pore: 3 or 4 small spiniform tentacle-scales. . . . Ophiotrema Koehler, 1896.

*alberti Koehler, 1896. Azores.

27 (26) Three or 4 oral papillae confluent with 3 or 4 larger and flatter papillae of the oral tentacle pore: 2 or 3 spiniform tentacle-scales. . . . Ophioprium H. L. Clark, 1915.

*Ophiacantha cervicornis Lym., 1883. Atlantic O. 500 fms.

28 (23) Tentacle scales 2, flattened, oval; outer oral papillae elongate, spiniform. . . . Ophiomedea Koehler, 1906.

Compare also Ophiophysara, paragraph No. 17 above.

*duplicata Koeh., 1906. N. Atlantic. 1,100 fms.

29 (22) Dorsal surface of disc and arms so thickly covered with granules and spinules as to hide the dorsal arm-plates and radial shields: several spiniform, tentacle-scales. . . . Ophiambix Lyman, 1880.

*aculeatus Lym., 1880. Fiji. 1,300 fms.

30 (1) Tentacle-pores small and inconspicuous.

31 (46) Radial shields small and short.

32 (33) No genital plates or scales: an accessory perforated plate between the oral shield and the peristomial plate. . . . Microphiura Mortensen, 1911.

*decipiens Mort., 1911. West Indies. 500 fms.

33 (32) Genital plates present: oral plates without accessory plate.

34 (39) Oral shield separated from the first lateral arm-plate by adoral shield.

35 (36) Disc scales almost naked. . . . Ophiocopa Lyman, 1883.

*spatula Lyman, 1883. Indian Ocean. 150 fms.

36 (35) Disc scales bearing spines on granules.

37 (38) Outermost oral papillae large and operculiform. . . . Ophiolimna Verrill, 1899.

*Ophiacantha bairdi Lyman, 1883. North Circumpolar. 500-1,400 fms. Ophiolimna is not recognized by H. L. Clark (1915).


*Ophiomitrella placida Koehler, 1904. Indonesia. 400 fms.

H. L. Clark (1915) referred the type to Ophiacantha.

39 (34) Oral shields adjoin first lateral arm-plate.

40 (41) Dorsal arm-plates small, widely separated by the lateral plates which meet on the midline. Disc covered above by large plates which are closely granulated save at their margins, which are hyaline. . . . Ophiornipa Koehler, 1922a.
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Compare also Ophiomitrella (No. 61a of this key).

41 (40) Dorsal arm-plates in contact on basal segments, at least, and elsewhere not widely separated by lateral plates.

42 (43) Basal tentacle-pores greatly enlarged: no tentacle-scale.  
Ophientrema Verrill, 1899.

*Ophiacantha scolopendrica Lyman, 1883. Japan. 600 fms.

43 (42) Basal tentacle-pores not enlarged: oval radial shields.

44 (45) Ventral arm-plates visible: single flat tentacle scale.  
Ophiophthalmus Matsumoto, 1917.  


45 (44) Ventral arm-plates obscured by thick skin: 2 tentacle-scales.  
Ophiochondrella Verrill, 1899.

*Ophiocandrus squamosus Lyman, 1883. St. Kitts. 250 fms.  
Referred by H. L. Clark (1915) to Fam. Hemieuryalidae.

46 (31) Radial shields large.

47 (56) Radial shields long and narrow.

48 (49) Radial shields joined in pairs.  
Ophiacanthella Verrill, 1899.  
*Ophiacantha troscheli Lyman, 1878. Atlantic. 100 fms.

49 (48) Radial shields separated.

50 (51) Distal borders of dorsal arm-plates bearing each a row of spines.  
Ophiochondrella Verrill, 1899.

*punctata Koehler, 1922a. Indonesia. 100 fms.

51 (50) Dorsal arm-plates without spines.

52 (53) Disc scales not covered by skin: dorsal arm-plates mostly in contact: 1 large tentacle scale.  
Ophialcaea Verrill, 1899.  
*Ophiacantha tuberculosa Lyman, 1878. Philippine Is. 400 fms.

53 (52) Disc and arms covered by skin.

54 (55) Disc covered by thin skin bearing granules and stumps: the underlying scales can be seen when dried: arm-spines hollow.  

*Asterias bidentata Retzius, 1805. N. Atlantic. Littoral. 1,300 fms.  
Enlarged operculiform outer oral papillae and adoral plates with an enlarged distal lobe are characters which occur in Ophiotreta Verrill (type Ophiacantha lineolata Lyman, 1883, Caribbean, 200 fms.). Ophiotreta is recognised as a valid genus by Koehler and by H. L. Clark (who synonymizes Ophiotrotia Matsumoto with it).

55 (54) Disc covered by thick skin, bearing granules and stumps: arm-spines short, blunt, and invested in thick skin.  
Ophiolebes Lyman, 1878.  
*scorteus Lym., 1878. Antarctica. 300 fms.

56 (47) Radial shields broad: disc plates very distinct, not hidden by skin.

57 (64) Oral papillae arranged in a regular series.

58 (61) Outermost oral papilla large and operculiform: dorsal arm-plates small, widely separated from each other by lateral plates.

59 (60) Disc five-lobed, radial shields contiguous, at least distally: oral shield small, and separated from first lateral arm-plate by adoral shield: jaws somewhat sunken, so that the oral and adoral shields form a conspicuous elevated
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ring: no genital plates. . . . Ophiothamnus Lyman, 1869.
Syn. Ophiola Koehler, 1906, according to Matsumoto (1917).
*vicarius Lyman, 1869. Caribbean. 20 fms.

60 (59) Disc not five-lobed: radial shields contiguous along most of their length:
oral shield large, adjoining lateral plate: genital bursae well developed.
Ophiurothamnus Matsumoto, 1917.

*Ophiomitra dicycla H. L. C., 1911. N. Pacific. 400 fms.

61 (58) Outermost oral papilla not enlarged.

61a(61b) Disc not five-lobed—i.e., lacking a notch in the edge of each interradius.
Disc set with short stumps or glassy granules which do not conceal the
scales. 1 tentacle-scale. Dorsal arm-plates not contiguous.

62 (63) Marginal disc-scales differentiated and well developed.

63 (62) Marginal scales not specially developed: disc scales very robust, comprising
mainly radial shields plus some intercalary plates. . . . Ophiomytis
Koehler, 1904.

64 (57) Oral papillae not in a single series, but forming clusters at the ends of the
oral angles. Disc more or less five-lobed.

65 (66) Marginal scales not specially differentiated: radial shields contiguous along
their whole length: 3 tentacle-scales, shaping a ring about the pore.

*vitrea Lyman, 1878. Indian O. 150 fms.

Family OPHIOLEUCIDAE Matsumoto, 1915

1 (4) Single tentacle scale throughout arm.

2 (3) Dorsal arm-plates rudimentary. . . . Ophiotrechus Lyman, 1878.
*panniculus Lyman, 1878. New Guinea. 1,000 fms.

3 (2) Dorsal arm-plates well developed and broadly contiguous: disc granulated:
ventral arm-plates large and entire. . . . Ophiopallas Koehler, 1904.
*paradoxa Koehler, 1904. Indonesia. 200 fms.

4 (1) More than 1 tentacle scale, at least in basal part of arm.

5 (8) Two tentacle scales throughout arm.

6 (7) Disc granulated.

7 (6) Central part of disc covered by skin, with scales and radial shields forming
the periphery.

*Ophiopyren Lyman, 1878.
*longispinus Lyman, 1878. Caribbean. 100-600 fms.

*Ophiopallas Koehler, 1904. Indonesia. 200 fms.

4 (1) More than 1 tentacle scale, at least in basal part of arm.

5 (8) Two tentacle scales throughout arm.

6 (7) Disc granulated.

7 (6) Central part of disc covered by skin, with scales and radial shields forming
the periphery.

*Ophiopyren Lyman, 1878.
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8 (5) Basal tentacle-pores with several scales.  
8a (11) Basal (first to third) tentacle-pores with several marginal scales, but succeeding pores with only 1 scale to each. Disc granulated.  
9 (10) Peripheral granules of disc modified into papillae which continue round the borders of the radial shields, and some other plates . . . . Ophioleuce Koehler, 1904.  
*seminudum Koehler, 1904. Indonesia. 800 fms.  
10 (9) Granules of disc not specialized and not arranged in rows around the borders of disc plates . . . . Ophiocirce Koehler, 1904.  
*inutilis Koehler, 1904. Indonesia. 60 fms.  
11 (8a) Tentacle-pores with 6 scales, dwindling to 3 or 4 scales at the distal extremity of the arm . . . . Ophioperla Koehler, 1912.  
*Ophiura koehleri Bell, 1908 = Ophioperla ludwigi Koehler, 1912. Antarctica, 40–250 fms.  

See Mortensen (1936, p. 311) for discussion of type and nomenclature.  

Family AMPHIURIDAE Ljungman, 1867  

1 (18) Oral papillae, not forming a continuous row along the side of the jaw, but instead there is a gap between the infradental papillae and the outer papillae: the mouth angle is therefore permanently gaping: outermost papillae arise from adoral shield: an additional papilla occurs dorsal to the infradental papilla (Amphiura group).  
2 (7) Disc bearing spines, or spiny processes.  
3 (4) No true (articulating) spines on disc, but scales of ventral side and margin of dorsal side end each in a small spiniform tubercle . . . . Acrocnida Gislén, 1926.  

(Compare Paracrocnida Mortensen)  
*Asterias brachiata Montagu, 1804. N. Europe. Littoral.  
4 (3) True (articulating) spines occur on some of the disc-scales.  
4a (4b) One infradental papilla . . . . Amphiocnida Verrill, 1899.  
*Ophiocnida putnami Lyman, 1871. N. Pacific, littoral.  
4b (4a) Two infradental papillae.  
5 (6) Two infradental papillae and 3 outer papillae on the adoral shield: radial shields contiguous: large primary plates: spines are carried by the lesser disc scales: tentacle-papillae 2–3 at base of arm, 1 elsewhere: 5–6 arm-spines. . . . Anamphiura H. L. Clark, 1939.  
*valida H. L. C., 1939. Indian Ocean. 150 fms.  
6 (5) Two infradental and 2 outer oral papillae, the latter spiniform: radial shields contiguous distally but widely separated proximally: numerous disc-spines: usually no tentacle-scales: 5–10 arm-spines. . . . Ophiocentrus Ljungman, 1867.  
7 (2) Disc free from spines.  
8 (9) A supplementary plate present between the oral plate and adoral shield, on either side . . . . Paramphiura Koehler, 1895.  
*Ophiocoma punctata Forbes, 1841. N. Europe. Littoral.  
9 (8) No supplementary plate between oral plate and adoral shield.  
11 (10) Disc covered by scales, at least on dorsal side.
12 (13) Two tentacle-scales, the outer one spiniform and bearing barbs: two outer oral papillae, the outermost rounded and flat, the inner one acutely pointed.

*platydicus* H. L. Clark, 1939. Aden. 100 fms.

13 (12) No spiniform tentacle-scales.


15 (14) Arm-spines not hooked on distal joints of arm.


17 (16) Disc-scales coarse, chunky, arranged in an irregular mosaic: outermost oral papilla spiniform, the other two papillae rounded: ten to twelve arm-spines arranged in an erect, lateral comb. . . . *Ctenamphiura* Verrill, 1899.

*Amphiura maxima* Lyman, 1879. Torres Strait. 30 fms.

18 (1) Three or more oral papillae, forming a continuous row along the side of the jaw, and so closing over the mouth angle.

18a (18b) Second oral tentacle-pore opening outside the oral slits.

*Ophiomonas* Djakonov, 1952.

18b (18a) Second oral tentacle-pore opening within the oral slit.

19 (28) Four or five oral papillae, the outermost carried on the adoral shield; an additional papilla occurs just dorsal to the infradental one (*Amphioplus* group).

20 (23) Disc free from spines.

21 (22) Outermost oral papilla larger than others, and operculiform: radial shields contiguous. . . . *Amphichilus* Matsumoto, 1917.

*trichoides* Matsumoto, 1917. N. Pacific.

22 (21) Outermost oral papillae small, not operculiform: radial shields divergent. *Amphioplus* Verrill, 1899.


23 (20) Disc bearing spines, or some spiniform processes.

24 (25) No true (articulating) spines on disc, but scales of the ventral side and margin of the dorsal side end each in a small spiniform tubercle. . . . *Paracrocnida* Mortensen, 1940.

Compare *Acrocnida* Gislén.


25 (24) True (articulating) spines occur on some of the disc-scales.

26 (27) Two spiniform tentacle-scales, the adradial one being long and slender: 6–10 arm-spines: conical, spaced, oral papillae, the outermost long and spiniform: radial shields contiguous. . . . *Amphilimna* Verrill, 1899.

*Ophiocnida olivacea* Lyman, 1869. N. Atlantic. 120 fms.


*Amphioplus acanthinus* H. L. C., 1911. Japan. 100 fms.
28 (19) Three or four oral papillae, the outermost carried on the oral plate: no papillae on the adoral shield, and no additional papilla just dorsal to the infradental one.

29 (36) Three oral papillae, the outermost much larger than the others and meeting its fellow of the other side, so as to seal the distal half of the mouth angle (Amphipholis group).

30 (31) Some disc-scales bearing spines. . . . Ophiostigma Lütken, 1856. (To this genus I refer provisionally Amphistigma H. L. Clark, 1938; it was founded on a single specimen of a juvenile stage.) *tenue Luetken, 1856. Caribbean. Littoral.

31 (30) Disc-scales without spines.

32 (33) One tentacle-scale: arm-spines of distal arm-joints transformed into hooklets: male dwarfed, and carried on the ventral side of the female, which is epizoic on the echinoid Echinodiscus. . . . Amphilycus Mortensen, 1933. *androphorus Mortensen, 1933. E. Africa. Littoral.

33 (32) Two tentacle-scales.


36 (29) Three or four subequal oral papillae (Amphiodia group).


38 (37) Disc without spines (though some peripheral scales may have a spine-like process).


40 (39) Disc partly or wholly scaled.

41 (42) Disc with dorsal scales, but densely granulated on ventral side: genital scales broad with several parallel furrows: 2 tentacle-scales. . . . Amphichondrius Nielsen, 1933 *granulosus Nielsen, 1933. California. Littoral.

42 (41) Disc scaled above and below, without granulation.

43 (44) Radial shields contiguous: marginal scales of disc erect, or spiniform, arranged to form a more or less sharply defined “fence” around the rim. Ophiophragmus Lyman, 1865. Mortensen (1940) speaks of “spines along the border of the disc”, but spines are not mentioned in Lyman’s original diagnosis. Nielsen (1932) has also defined Amphispina (as a sub-genus of Amphiodia) having only spiniform marginal scales, not articulated spinules—but Lyman (1865) had already assigned this character to his Ophiophragmus. I therefore regard Amphispina Nielsen, 1933, as a synonym. *Amphiura wurdemanii Lyman, 1860. N. Atlantic.

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Family OPHIACTIDAE Matsumoto, 1915

1 (8) Disc scaled above and below.
2 (3) A circle of small platelets surrounds each dorsal arm-plate: granules or spinules on disc, but primary plates naked and distinct: lower arm-spine hooked on distal part of arm. . . . Ophiopholis Mueller & Troschel, 1840.
3 (2) Dorsal arm-plates contiguous, not surrounded by platelets.
4 (7) No spines on disc: not fissiparous: five arms.
5 (6) Radial shields united in pairs: three oral papillae, of which the outermost is enlarged (but not operculiform), all three papillae partly fused together: genital clefts present: the male dwarfed and carried on the ventral surface of the female. . . . Ophiodaphne Koehler, 1931.
   *materna Koehler, 1931. Indonesia. 100 fms.
   *arcticus Ljung., 1866. Arctic. 600 fms.
7 (4) Spines present on disc, though not so numerous as to conceal the coarse scales: often with six or seven arms, and reproducing by transverse fission of the disc: one or two oral papillae. . . . Ophiactis Lütken, 1856. Syn.: Amphiactis Matsumoto, 1915 (non Verrill, 1869).
8 (1) Disc scaled above but naked below: a single (outer) oral papilla: adoral shields all in contact, thus forming a continuous ring around the mouth: radial shields united in pairs. . . . Hemipholis Lyman, 1865.

Family AMPHILEPIDIDAE Matsumoto, 1915

1 (2) Second tentacle-pore opening entirely within the oral angle, so that the latter is closed by oral papillae; genital bursae and genital clefts present. Radial shields small, restricted to edge of disc at base of arm. . . . Ophiochytra Lyman, 1880.
   *epigrus Lym., 1883. C. Pacific. 2,400 fms.
2 (1) Second tentacle-pore opening more or less outside the oral angle, so that the latter gapes; genital bursae and genital clefts absent; radial shields conspicuous, not restricted to edge of disc. . . .

Family OPHIOTHRICIDAE Ljungman, 1866

1 (26) Radial shields low, without a raised crest.
2 (3) Disc covered above and below by naked skin through which only the distal ends of the radial shields project; no tentacle scales or, at most, scales present only on basal arm-joints. . . . Ophiogymna Ljungman, 1866.
   Syn.: Ophiocampsis Duncan, 1887 (see Koehler 1922a, p. 284).
3 (2) Disc not covered by naked skin.
Upper surface of disc bearing granules.

Lower surface of disc covered by skin.

Dorsal surface of arms bearing granules, tubercles or coarse irregular grains, which more or less obscure the plates; dorsal arm-plates reduced in size.

Syn.: *Ophioteresis* Bell, 1892 (juvenile stage).

*mirabilis* Verrill, 1867. Panama. Littoral.

Entire dorsal surface of disc and arms densely coated with uniform granules which completely obscure all plates; tentacles issue from side of arms.

Ophiopsammium Lyman, 1874.

*semperi* Lyman, 1874. Philippine Is. Littoral.

Lower surface of disc covered by fine scales.


Disc covered by primary plates and radial shields; two arm-spines.

Ophiophthirius Doederlein, 1898.

*actinometrae* Doed., 1898. Torres Strait. Littoral.

Arm-spines of all arm-joints free, not united by webs.

Macrophiothrix H. L. Clark, 1938.

Species of this genus may occur as epizoic forms on various comatulids.

Disc plates bear spines or thorns.

Arm-spines of the proximal arm-joints united by a membranous web into vertical fin-like fans.

*Ophiopteron* Ludwig, 1888.

Mortensen (1932) has shown that some spp. of *Ophiothrix* pass through an “Ophiopteron” stage.

Arm-spines of ali arm-joints free, not united by webs.

Macrophiothrix H. L. Clark, 1938.


Disc plates without spines or thorns.

Dorsal arm-plates short and wide; arm-spines smooth and opaque.

Ophiomaza Lyman, 1871.

Species of this genus may occur as epizoic forms on various comatulids.

Dorsal arm-plates not short and wide; arm-spines thorny.

Ophiotrichoides Ludwig, 1882.


The genus is strongly represented in the Indo-Pacific, and at least one species has an “Ophiopteron” stage; see H. L. Clark (1946, p. 230).

Radial shields small or partly concealed by spinules.

Dorsal arm-plates bearing minute spinelets.

Amphiophiothrix H. L. Clark, 1946.

*Ophiothrix demessa* Lyman, 1861. Tropical Indo-Pacific. Littoral.

Dorsal arm-plates smooth.

Spines or thorns on disc plates; tentacle-scales present.

Ophiothrix Mueller & Troschel, 1840.
Synoptic Keys to the Genera of Ophiuroidea

Syn.: *Ophionyx* M. & T., 1840.
*Asterias pentaphylla* Pennant, 1777. Britain. Littoral.

23 (22) Disc plates with no spines or thorns.

24 (25) Arm-spines not longer than width of arm; radial shields contiguous along their whole length; androphorous, epizoic on *Diadema* and *Toxopneustes*; distal arm-spines hooked. . . . *Ophiosphaera* Brock, 1888.
25 (24) Arm-spines long and slender, up to four times as long as width of arm; radial shields scarcely contiguous. . . . *Lissophiothrix* H. L. Clark, 1938.

26 (1) Radial shields each carry a raised vertical crest. Disc naked above and below, or with only a few small scattered scales imbedded in skin.

27 (28) Some proximal dorsal arm-plates carry a high median keel; beyond disc ventral arm-plates become rounded and widely separated. . . . *Ophiolophus* Marktanner-Turneretscher, 1887.


28 (27) Dorsal arm-plates without keels.

29 (30) Disc and arms minutely granulated. . . . *Gymnolophus* Brock, 1888.
30 (29) Disc and arms naked. . . . *Ophioaethiops* Brock, 1888.

Syn.: *Ophiohelix* Koehler, 1895.


Family OPHIOCOMIDAE Ljungman, 1867.

1 (2) Two tentacle-scales, the inner one being greatly elongated and lanceolate. *Ophiopsila* Forbes, 1843.

Syn.: *Ophianoplus* M. Sars, 1857.

2 (1) Tentacle-scales, short, leaf-like.

3 (4) Disc covered by naked skin. . . . *Ophiarthrum* Peters, 1851.
3 (5) Disc bearing spines, or granules.

4 (3) Disc bearing granules only.

7 (6) No supplementary scales.

8 (10) Arm-spines solid. . . . *Ophiocoma* Agassiz, 1836.

9 (8) Disc bearing spines, or spines and granules.

10 (5) Disc bearing spines, or spines and granules.


Syn.: *Acantharachna* E. A. Smith.


H. L. Clark (1946) regards this genus as wholly made up of juvenile stages of *Ophiocoma* which are supposedly 5 or 7 armed as young, 5 armed as adult. This has not been proved.

Family **OPHIOCHITONIDAE** Matsumoto, 1915

1 (4) Accessory dorsal arm-plates present.

2 (3) Disc-scaling coarse and compacted so that some scales are largely obscured by their neighbours: supplementary plates, short, mainly confined to sides of arm and not conspicuous from above. . . . *Ophiodesmus* Ziesenhenne, 1940.

*amphilogus* Ziesen., 1940. L. Calif. Littoral.

(A. M. Clark (1953) considers the second of these characters more distinctive.)

3 (2) Disc-scaling relatively fine, the scales not especially compacted: supplementary plates conspicuous from above. . . . *Ophionereis* Lütken, 1859.


For discussion of *Ophionereis* see A. M. Clark (1953). The following probably do not rank higher than subgenera of *Ophionereis*:—*Ophiotriton* Doederlein, 1896, lacking obvious scales on the disc; *Ophiocrasis* H. L. Clark, 1911, with 2 or more supplementary plates (as opposed to *Ophionereis* s.s., which supposedly has only 1 supplementary plate).

4 (1) No accessory dorsal arm-plates.

5 (8) In addition to the large tentacle-scale, one or two much smaller scales may occur, at least on the basal arm-segments.

6 (7) Spines on disc, both above and below, and across the dorsal arm-base.

*Ophiodoris* Koehler, 1904.

*malignus* Koehler, 1904. Indonesia. 250 fms.

7 (6) No spines on disc, but granules present on ventral interradii, and sometimes also above. . . . *Ophioplax* Lyman, 1875.

*ljungmani* Lyman, 1875. Caribbean. 100 fms.

8 (5) Only the large tentacle-scale present: Disc entirely free from spines or granules: arms keeled above and below. . . . *Ophiochiton* Lyman, 1878.

*fastigiatus* Lyman, 1878. Japan. 100 fms.

Family **OPHIODERMATIDAE** Ljungman, 1867

1 (8) Arm spines erect, not adpressed to arm.

2 (5) Oral shields entirely covered by granules: arm-plates usually concentrically striated: 6 or more hyaline arm-spines.


*Ophiocoronis grandisquama* Koehler, 1904. Indonesia. 250 fms.

4 (3) Ventral arm-plates wider than long, contiguous only on basal joints: 1 or 2 tentacle-scales: teeth pointed at free end. . . . *Ophiuroconis* Matsumoto, 1915.

*monolepis* Matsumoto, 1915. Japan. 100 fms.

5 (2) Oral shields naked.

5a (5b) Arm-plates concentrically striated; one large tentacle-scale. . . . *Toporkovia* Djakonov, 1954.


5b (5a) Arm-plates not concentrically striated: arm-spines opaque: 2 tentacle-scales.


*Ophiochaeta mixta* Lyman, 1878. Caribbean. 100 fms.

See note under *Ophiacantha*, p. 18.

8 (1) Arm spines short, adpressed to arm, or partly imbedded in granulation.

9 (16) Single tentacle-scale.

10 (13) Oral shields entirely covered by granules.


13 (10) Oral shields naked: 2-4 arm-spines.


13b (13a) Ventral arm-plate of each joint subdivided into a narrow proximal plate and a broad distal plate: radial shields not exposed.


15 (14) Dorsal arm-plates fragmented to form a mosaic: distal end of genital cleft extending to dorsal margin of disc, so as to be visible from above.

16 (9) Two tentacle-scales.

17 (24) Genital clefts divided into two subsidiary apertures, so that 4 genital apertures lie in each interradius.

18 (19) Proximal cleft lies on ventral side, close to oval shield, but distal cleft lies on dorsal side of disc, beside radial shield. . . . *Ophiura daniana Verrill, 1867. San Salvador. Littoral.

19 (18) All genital clefts lie on ventral side of disc.

20 (21) Arms densely clothed in granules, with only the arm-spines and 2 tentacle-scales emergent. . . . *Ophiocryptus H. L. Clark, 1915b.

21 (20) Arms not granulated, arm-plates visible.

22 (23) Proximal cleft long and narrow, the distal one circular and smaller. . . . *Ophiura granulosus* Ives, 1889. Loc. and depth not stated, presumably Eastern N. America.

23 (22) Distal cleft larger than proximal one. . . . Ophioderma Mueller & Troschel, 1840.

24 (17) Genital clefts entire, 2 genital apertures in each interradius.


26 (25) Only granules on disc.
27 (36) Radial shields concealed by disc granulation.

28 (29) Marginal scales at periphery of disc enlarged and conspicuous: disc not notched at insertions of the arms. . . . Ophiopezella Ljungman, 1872.

29 (28) Disc without enlarged marginal scales.


Syn.: *Ophiostegastus* Murakami, 1944.

Ophiocorum was stated by H. L. Clark to have only one tentacle scale, and was therefore referred to *Ophiocorion* by Matsumoto (1917). This is an error, however. Dr. Elizabeth Deichmann, who kindly examined the holotype at Harvard on my behalf, informs me that there are 2 tentacle-scales.


31 (30) Arms without granulation, disc more or less notched at the arm-insertions.

31a (31b) One supplementary dorsal arm-plate on either side of dorsal arm-plate.
*Ophioclastus* Murakami, 1943

*hataii* Caroline Island.

31b (31a) No dorsal supplementary arm-plate.

32 (33) Oral shield entire, without a supplementary plate at the distal margin.
*Ophiopsea* Peters, 1851.

Syn.: *Ophiopsammus* Lütken, 1869.

*fallax* Peters, 1851. Mozambique.

33 (32) Oral shield with a distal supplementary plate.

34 (35) Having an inner row of six or seven small aciculate arm-spines, more or less covered by an outer row of seven or eight larger spines: two tentacle-scales on the first six to eight segments, the inner one the longer. . . .
*Distichophis* Ely, 1942.


36 (27) Radial shields not covered by granules.

37 (38) Interradial spaces between adjacent radial shields much wider than adradial spaces between pairs of shields. . . . *Ophiarachnella* Ljungman, 1872.


38 (37) Interradial and adradial spaces between adjacent radial shields about equal: the radial shields large, forming a conspicuous ring around the disc.
*Ophiochasma* Grube, 1868.

Syn.: *Ophiopinax* Bell, 1884.


Family **OPHIURIDAE** Lyman, 1865
(Syn. Ophiolepididae auctt.)

Subfamily **Ophiurinae** Lyman, 1865
(Syn. Ophiomastinae Matsu., 1915)

1 (12) One or more basal lateral arm-plates greatly enlarged: genital clefts inconspicuous or altogether lacking, as a result of the encroachment of the lateral plates upon the ventral interradii: disc covered mainly by primaries or radial shields.

2 (5) Only the first lateral arm-plate enlarged.


4 (3) Radial shields inconspicuous: the structures which Clark calls the "radial shields" in his description of the holotype are evidently enlarged first lateral arm-plates. Each enlarged lateral plate extending to meet its fellow of the adjacent arm, so that the whole circular disc is invested by a ring of laterals: disc therefore not sharply demarcated from arms: oral shield small, lying proximal to the contiguous laterals: small dorsal arm-plates present: tentacle-pores close together. . . . Ophiuraster H. L. Clark, 1939.

*perissus* H. L. C., 1939. Aden. 1,100 fms.

5 (2) Two or more basal lateral arm-plates enlarged.

6 (9) First two basal lateral arm-plates enlarged, but both confined to ventral side of disc.

7 (8) The first pair of lateral plates produced into several rounded lobes, which overlie and partly obscure the oral shield: the second pair of lateral plates with similar but smaller lobes overlying the genital cleft: dorsal and ventral arm-plates extending to the arm-tip. . . . Ophiochrysis Koehler, 1904.

*ornata* Koehler, 1904. Indonesia. 700 fms.

8 (7) The first pair of lateral plates meeting distally on the interradial midline, surrounding the small oral shield: small dorsal and ventral arm-plates on the proximal half of arm. . . . Ophiomisidium Koehler, 1914.

*speciosum* Koehl., 1914. Off Brazil. 800 fms.

9 (6) Five or more basal lateral arm-plates enlarged.

10 (11) Lateral plates of the 5 proximal arm-joints widened, carry 2 or 3 broad flattened spines with serrate outer edge: the enlarged lateral plates do not become fused together to form a continuous pentagonal disc. . . . Ophiophycis Koehler, 1901.

*mirabilis* Koehler, 1901. Azores. 600 fms.

11 (10) Lateral plates of the first 9 arm-joints expanded inter-radially and fused to the disc-proper, to make a pentagonal suckorial structure, by which the animal adheres to substrate, with the help of the tube-feet: no oral shield: dorsal shields separated, adjoining the first ventral arm-plate of the corresponding side: no genital clefts. . . . Astrophyiura Sladen, 1879.


12 (1) Basal lateral arm-plates not enlarged.

13 (16) Disc covered above by soft skin, with only the distal ends of the radial shields exposed, though other scales may be revealed if the skin is dried: tentacle-pores bordered by papillae.

14 (15) An arm-comb present: only scattered irregular scales embedded in dorsal skin of disc: 7 or 8 arm-spines.

Gymnophiura Lütken & Mortensen, 1897.

*mollis* L. & M., 1897. Gulf of Panama. 1,300 fms.

15 (14) No arm-comb: a complete covering of scales beneath the skin: 3 small arm-spines.

Ophiopleura Danielssen & Koren, 1877.

Syn.: *Lütkenia* Duncan.

*borealis* D. & K., 1877. Arctic. 200 fms.
Disc covered above by naked plates or scales.

Each dorsal arm-plate fragmented into a central plate, with several lateral mosaic platelets on either side. 

*Ophiionotus* Bell, 1902. *victoriae* Bell, 1902. Antarctica. Littoral.

Dorsal arm-plates not fragmented.

Primary plates in direct contact with arm-bases, there being no radial shields: only 1 large scale-like oral papilla. 

*Ophiotypa* Koehler, 1897. *simplex* Koehler, 1897. Indian O. 2,000 fms.

Primary plates not directly touching arm-plates.

First dorsal arm-plate divided longitudinally, on the midline, into 2 equal plates, each carrying a row of papillae on the outer edge, beside the main arm-comb. 


Not so.

Radial shields contiguous proximally, but separated distally by a conspicuous triangular plate wedged into the disc-margin: the three sides of this plate carry minute papillae: oral shield elongate, occupying most of the interbrachium below: arms flattened, broad at base. 


Radial shields not separated by a triangular plate whose margins carry papillae.

Fine granulation covers upper surface of disc and extends on to part of lower surface. Radial shields short, oval, widely separated by numerous small platelets and by granulation. No arm-comb.


Tentacle-pores restricted to a few basal arm-joints.

Disc distinctly higher than the arms.

Genital clefts bordered on their proximal interradial side by several plates which distally are continuous with a row of papillae, forming a rudimentary arm-comb: dorsal side of disc bearing larger plates with belts of smaller ones around them: arms higher than broad: 2 arm-spines, 2 tentacle-scales.


Genital clefts without proximal interradial plates: well-developed arm-comb of prominent spinules: dorsal side of disc mainly covered by large primary plates: 3 arm-spines, 1 or no tentacle-scales.


Disc low and flat.

No distinct tentacle-scales: first tentacle-pore large, the others very small: disc covered by scales. 

*Ophioplinitus* Lyman, 1878. *medusa* Lyman, 1878. Antarctica. 2,000 fms.

Tentacle-scales distinct: disc covered by tumid plates.
32 (33) Arm-spines minute; primary plates large, circular, with smaller plates between.  
*Ophioglypha inornata* Lyman, 1878. Mid-Atlantic. 1,850 fms.

33 (32) Arm-spines not minute.

34 (35) A large keel-like plate at the base of the arm, more or less obscuring the radial shields: arms compressed, triangular in sections, because the dorsal plates stand high and keel-like, giving a serrated outline to the arm: 5 or more similar arm-spines.  
*Ophiostiera* Bell, 1902.  
Syn.: *Ophiomages* Koehler, 1923.

35 (34) Three arm-spines, whereof the middle one becomes transformed into a hyaline up-turned hooklet on distal arm-joints.  
*Ophiuroglypha lymani* Ljung. W. Antarctica. 100 fms.

36 (25) Tentacle-pores occurring over most of the arm, though the proximal pores are much larger than the distal ones.

37 (48) Disc high, arms not broader than high: primary plates large and conspicuous.

38 (41) Arm-comb present: tentacle-pores large, with numerous scales.

39 (40) Arms cylindrical, gradually tapering, with a blunt extremity: arm-spines arranged in a single row, well-spaced from one another: oral shield large.  
*Amphiophiura* Matsumoto, 1915.  
*Ophioglypha bullata* Wyrille Thomson, 1873. Bermuda. 2,800 fms.

40 (39) Arms higher than broad, wide at the base and tapering rapidly to an acute extremity: arm-spines numerous, often dimorphic and arranged in 2 rows.  
*Stegophiura* Matsumoto, 1915.

41 (38) No arm-comb.

42 (43) No tentacle-scales: ventral interbrachium covered with fine granulation: arms short and thick: a few arm-spines.  
*Haplophiura* Matsumoto, 1915.

43 (42) Tentacle-scales present: ventral interbrachium covered by naked scales.

44 (45) Centrodorsal plate small, star-shaped, with five acute interradial rays: dorsal arm-plates restricted to 2 basal arm joints, and ventral arm-plates not extending beyond the 5–7th joint: one spiniform tentacle-scale.  
*Anthophiura* H. L. Clark, 1911.  

45 (44) Centrodorsal plate large, pentagonal or rounded.

46 (47) One to three tentacle-scales on basal pores, one or none beyond the arm-base: adoral shields well-developed: oral papillae more or less fused together.  
*Ophiomastus* Lyman, 1878.

47 (46) Three to six tentacle-scales in basal pores: oral papillae distinct.  
*Ophiopyrgus* Lyman, 1878.  
(H. L. Clark (1939) has proposed *Ophiopyrgoides* (*Ophiopyrgus* trispinosus Koehler) for forms in which the dorsal arm-plates occur over most of the arm, and in which the disc-plates are relatively flatter. However, it seems probable that some species of *Ophiomastus* and *Ophiopyrgus* are growth-stages of other ophiuroids, and the generic distinction of *Ophiopyrgoides*, in order to accommodate these forms, is dubious.)

*Wylllethomsoni* Lyman, 1878. Tonga. 250 fms.
Disc low and flat, arms broader than high.

Upper surface of disc covered by regularly arranged rounded plates in two sizes, the smaller ones each with 1 prominent tubercle and arranged so as to surround the larger ones. Tentacle-pores large, rounded, with 4 spiniform tentacle-scales (fewer distad).

*aspera* Koehler, 1931. Indonesia, 60 fms.

Not so.

Primary plates more or less conspicuous, but not covering much of the disc: edge of disc not emarginated at the arm-base: basal dorsal arm-plates well developed, each one sometimes carrying a transverse row of spinules: arm-comb usually continuous across arm-base.

*Ophiura sericea* Forbes, 1852. Arctic. 100 fms.

Primary plates inconspicuous: no transverse spinules on dorsal arm-plates: tentacle-scales papilliform, on both outer and inner edges of pores, more numerous on basal arm-joints.

No arm-combs. Three small, adpressed arm-spines.

*Ophiotjalfa* Mortensen, 1915.

Arm-comb usually present, but not continuous across arm-base: edge of disc emarginated at arm-base, and the notch so formed is occupied by several rudimentary dorsal arm-plates.

*Ophiura* Lamarck, 1801 (emend. auctt.)


*Asterias ophiura* Linné, 1758. Europe. Littoral.

Subfamily Ophiolepidinae Matsumoto, 1915

Tentacle-pores well developed throughout arm.

No tentacle-scale.

Disc thin and flat covered by scales and large radial shields, and bordered by a row of marginal plates which are erect and movable, being attached only by their proximal margins.

*Ophiophyllum* Lyman, 1878.


Disc and sides of arms covered by fine scales, which are swollen and resemble coarse granules: radial shields inconspicuous or hidden: upper arm-plates separated more or less widely by intervening small platelets: lowermost arm-spine sometimes serving as a tentacle-scale.

*Ophiopenia* H. L. Clark, 1911.

*disacantha* H. L. C., 1911. Bering Sea. 50 fms.

Tentacle-scales present.

Tentacle-scales well-developed throughout the arm.

Dorsal arm-plates entire, not fragmented nor divided into supplementary plates.

A row of papillae skirting the outer borders of the gential scales and radial shields: a pair of plates wedged between the radial shields: arm-spines minute.

*Ophiothyreus* Ljungman, 1872.


No papillae skirting genital scales or radial shields.
10 (11) Adoral shields entirely separated by the oral shield, not meeting within, 1 tentacle scale.

10a (10b) Primary plates and radial shields large and conspicuous and, together with a radial series of plates, covering the entire disc; no granulation. . . .


10b (10a) Primary plates inconspicuous; radial shields the only large plates on dorsal side of disc, all other plates reduced to small scales, with fine granulation between them. . . .

*Ophiocrates* Koehler, 1904.

11 (10) Adoral shields meeting on midline proximad to oral shield, 1 or 2 tentacle scales.

12 (13) First lateral arm-plate conspicuously enlarged: 1 tentacle-scale: radial shields conspicuous, triangular, tumid, at the arm bases. . . .

*alatus* Koehler, 1904. Indonesia. 700 fms.

13 (12) First lateral arm-plate not enlarged.

14 (15) Marginal plates of disc greatly swollen, forming a rampart about the periphery: 2 tentacle scales. . . .

*Ophioteichus* H. L. Clark, 1938.

15 (14) Marginal plates not swollen.

15a (15b) Oral shield divided transversely into 1 proximal plate and 1 distal plate. Aboral side of disc covered by regularly arranged plates which carry tubercles. About 4 short, thick arm-spines. Oral papillae distinct, conspicuous. . . .

*Ophiocypris* Koehler, 1931.

15b (15a) Not so.

16 (17) Disc covered with numerous small plates and scales, the larger ones surrounded by the smaller: radial shields small, widely separated by intervening plates and scales: three conspicuous plates lie between, and distal to, the shields: 4 or 5 short arm-spines: 2 tentacle-scales: dorsal and ventral arm-plates broadly contiguous throughout. . . .

*Ophiozona* Lyman, 1865 (restr. Matsumoto, 1915).

17 (16) Disc covered by a limited number of stout plates, including radial shields, and some smaller plates: 2 to 4 short arm-spines: dorsal and ventral arm-plates contiguous only at arm-base becoming progressively distant on the distal parts of arms.

18 (19) Primary plates very conspicuous, covering the central half of disc: radial shields small, separated by three plates between and distal to them: 1 tentacle scale. . . .

*Ophiozonoida* H. L. Clark, 1915.

19 (18) Primary plates either conspicuous or not so, but not large: radial shields large, either contiguous, or separated by only a single narrow row of plates, not by 3 distal intervening plates: 1 or 2 tentacle scales. . . .

*Ophiozona longispina* H. L. C., 1908. Japan. 50–300 fms.
20 (7) Dorsal arm-plates more or less sub-divided into supplementary plates or mosaic platelets.

21 (24) Dorsal arm-plates quite distinct, but accompanied by a few supplementary plates.

22 (23) Disc covered by irregular plates, not distinctly imbricating; usually small granules at or near the margins of the plates: radial shields small but distinct: primaries not distinct: one dorsal supplementary plate on each arm-joint, or on some arm-joints only. . . . Ophiolebella Mortensen. 1936.

*Ophiolebes biscutifer E. A. Smith, 1879. Antarctic. 100 fms. The type-species was overlooked in H. L. Clark's (1915) Catalogue.

23 (22) Disc covered by scales in two sizes, the larger surrounded by the smaller: radial shields conspicuous: 2 tentacle scales: smaller supplementary dorsal plates on either side of and/or distal to, the dorsal plates. . . .


See H. L. Clark (1915), p. 342, for discussion on name of type-species.

24 (21) Dorsal arm-plates profoundly modified by extensive fragmentation and intercalation of small mosaic platelets: radial shields very small and inconspicuous.

25 (26) Three or four tentacle-scales: dorsal arm-plates subdivided into two widely separated lateral halves, between which lies a mosaic of small platelets.

Ophioplocus Lyman, 1861.


26 (25) One tentacle-scale: dorsal arm-plates subdivided into two lateral halves which are more or less widely separated at the base of the arm by a mosaic; but distally they lie close together, and one or two median plates intervene, or alternate, with them. Genital clefts not extending beyond the first arm-joint.

*incipiens Koehler, 1922. Antarctic. 0-100 fms.

27 (6) A single well-developed tentacle-scale on the basal 3 or 4 joints, but beyond this the tentacle-pores have no scale. Disc covered by a few large plates and scales: radial shields large, contiguous.

Amphipholizona H. L. Clark, 1915.


28 (1) Tentacle-pores restricted to a few joints at the base of the arm.

29 (30) Entire animal covered by thick smooth skin, more or less obscuring the plates: beneath the skin (and visible on its inner surface) are oval radial shields and other plates: dorsal arm-plates fragmented, comprising only thin, irregular fragments.

Ophiolipus Lyman, 1878.

*agassizii Lyman, 1878. Caribbean. 100 fms.

30 (29) Disc and arm-plates distinct, not obscured by skin: disc covered by porcellanous regular plates and radial shields: dorsal and ventral arm-plates minute, and not developed in the outer part of arm: lateral arm-plates meeting in dorsal and ventral midlines.

31 (32) A continuous ridge of fused oral papillae round jaw-edge: two to five tentacle-pores.

Ophiomusium (s.s.) Lyman, 1869.

Ophiomusa *ultima Hertz West Africa, Hertz 1927, established for spp. with only 2 pairs of tentacle-pores, is here regarded as falling within the definition of Ophiomusium.

*eburneum Lyman, 1869. Caribbean. 200 fms.

32 (31) Oral papillae distinct.

Ophisphalma H. L. Clark, 1941.

*Ophiomusium planum Lyman, 1878. Caribbean. 1,000 fms.
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