

# 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 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 caput-medusae*, *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* comprized 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*, *Ophiolepsis*, *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), Ljungman (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)).



- 4 (1) 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 Aganasteridae.)

#### 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.

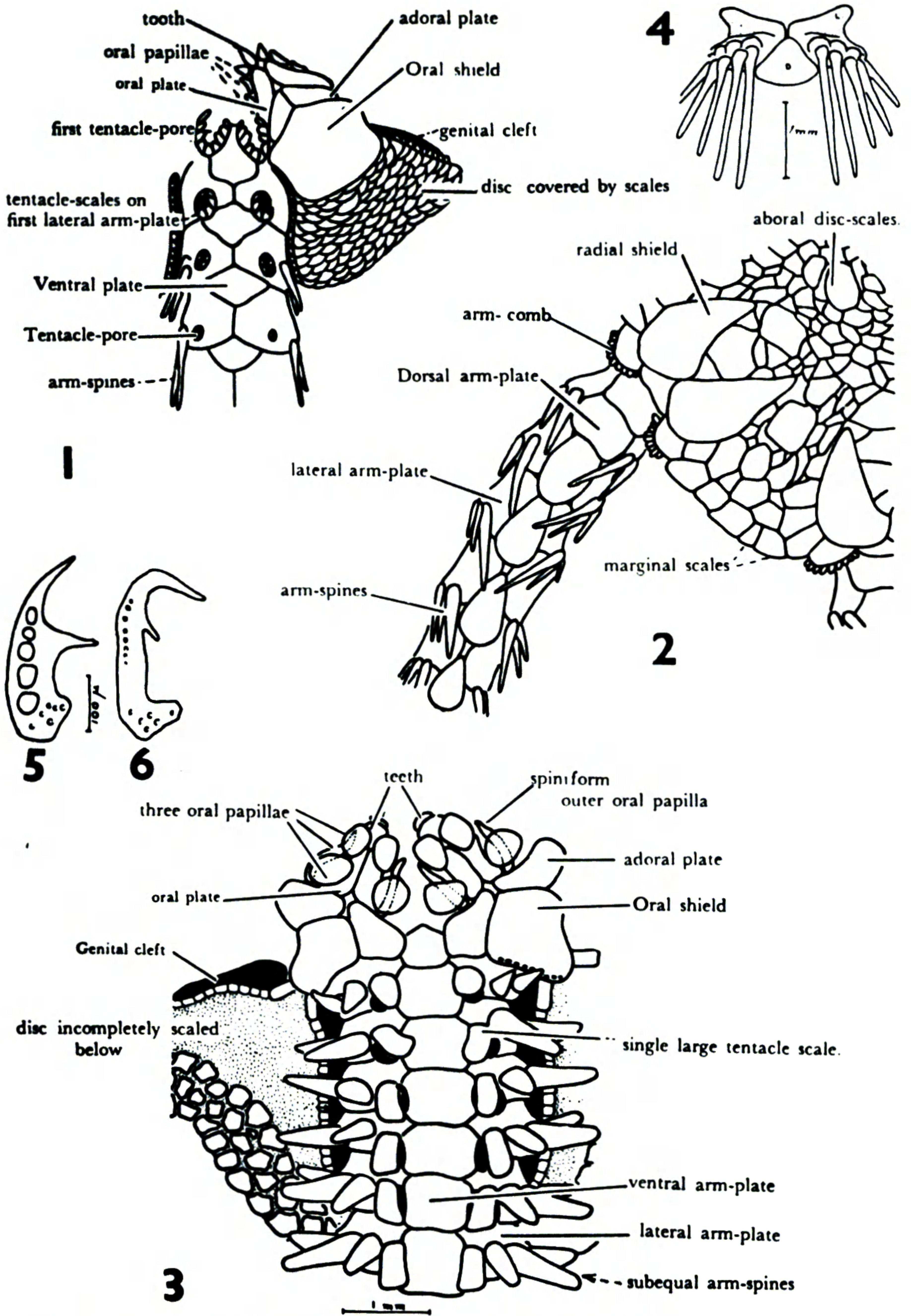
### Order **OPHIURIDA** Mueller & Troschel, 1840

(syn. Myophiuroida 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. Hemieuryalidae 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 interradiar 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. **OPHIOCANOPIDAE** Mortensen, 1933. p. 15.)
- 12 (11) Disc with conspicuous ventral interradiar 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. **OPHIOMYXINAE** Ljungman, 1866, restr. 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. **OPHIURINAE** 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.)



- 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.  
*\*bifurcata* A. H. C., 1952. Caribbean. Littoral.
- 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. . . . *Astrocaneum* 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* Verr., 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.



- 20 (19) Madreporite separated by accessory plates on the soft interbrachium: mouth in a crater-like depression. . . . **Astracme** Doederlein, 1927.  
\**Astrophyton mucronatum* Lyman, 1869. Caribbean. 100 fms.
- 21 (24) Disc and arms covered with large tubercles or spines.
- 22 (23) Radial shields conspicuously separated. . . . **Astroconus** Doederlein, 1911.  
\**Astrophyton australe* Verrill, 1876. Tasmania. Littoral.
- 23 (22) Radial shields scarcely separated. . . . **Conocladus** H. L. Clark, 1909.  
\**oxyconus* H. L. C., 1909. E. Australia. 50 fms.
- 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.
- 26 (25) Disc-margin without calcareous plates. . . . **Astrodendrum** Doederlein, 1911.  
\**Gorgonocephalus sagraminus* Doed., 1902. Japan. 100 fms.
- 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. . . . **Astrocladus** Verrill, 1899.  
\**Asterias euryale* Retzius, 1783. S. Africa. Littoral.
- 30 (29) Madreporite separated from the soft interbrachium by accessory plates.
- 31 (32) Disc and arms smooth. . . . **Astrospartus** Doederlein, 1911.  
\**Euryale mediterraneus* Risso, 1826. Mediterranean. Littoral.
- 32 (31) Disc and arms with warts. . . . **Astroplegma** Doederlein, 1928.  
\**expansum* Doed., 1928. Indonesia. 100 fms.
- 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.
- 35 (34) Free arms near the disc conspicuously broader than high, with flat, broad ventral surfaces. . . . **Astrochalcis** Koehler, 1905.  
\**tuberculosis* Koehler, 1905. Indonesia. Littoral.
- 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.  
Syn.: *Astorhaphis* Doederlein, 1911.  
\**Astrophyton clavatum* Lyman, 1861. Indian O. Littoral.
- 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. . . .  
*Astroporpa* Oersted & Lütken, 1856.  
 \**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. . . .  
*Astrochlamys* Koehler, 1911.  
 (The type species, *A. bruneus* Koehler, is viviparous, and the females carry a dwarf-male clinging to the dorsal side of the disc: a second species, *A. sol* Mortensen, has 10 arms.)  
 \**bruneus* K., 1911. W. Antarctica. 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. . . .  
*Astrochele* Verrill, 1878.  
 \**lymani* Verr., 1878. N. Atlantic. 300-1,000 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. . . .  
*Astrostephanus* Doederlein, 1930.  
 \**Astrotoma vecors* Koeh., 1904. Indonesia. 100 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. . . .  
*Astrozona* Doederlein, 1930.  
 \**Astrogomphus munitus* Koehler, 1904. Indonesia. 600 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.  
 \**misakiensis* Doed., 1911. Japan. Litt.
- 54 (53) Girdle-hooklets with 2 to 6 secondary teeth.
- 54a(55) Five arm-spines: disc uniformly covered by granules, and excavated inter-radially, 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. . . . *Astrothrombus* H. L. Clark, 1909.  
\**rugosus* H. L. C., 1909. E. Australia. 50 fms.
- 57 (56) Three to six secondary teeth: thorny granules occur among the disc granules. . . . *Astrothamnus* Matsumoto, 1915.  
\**echinacea* Matsumoto, 1912. Japan. Littoral.
- 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.  
\**Astrotoma sobrinus* Matsumoto, 1912. Japan.
- 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. . . . *Astrohamma* Doederlein, 1930.  
\**Astrothamnus tuberculatus* Koehler, 1923. Antarctica. 70 fms.
- 63 (60) 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. . . . *Ophiozeta* Koehler, 1931.  
\**turgida* Koehler, 1931. Indonesia. 200 fms.
- 64 (59) Disc with irregularly disposed conical spikes on dorsal surface, a mosaic of minute granules occupying the spaces between: oral papillae spiniform, similar to teeth: lateral plates meeting ventrally, and continued upward as double rows of nodules and hooks. . . . *Astrogomphus* Lyman, 1869.  
\**vallatus* Lym., 1869. N. Atlantic. 300 fms.

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 interradiial plates lying distal to the adoral shields. . . .  
*Asterostegus* Mortensen, 1933.  
\**tuberculatus* Mrtsn., 1933. S. Africa. 200 fms.
- 4 (3) Dorso-lateral ridges with scattered tubercles or spines: no additional interradiial plates distal to the adoral shields, interradius naked ventrally. . . .  
*Astroceras* Lyman, 1879.  
For a review of this genus see Mortensen, 1933a.  
\**pergamena* Lyman, 1879. Japan. 100 fms.
- 5 (2) Arms rounded above, without dorsolateral ridges: inner arm-spine usually longer than the outer. . . .  
*Asteromorpha* Lütken, 1869.

Synonym *Ophiogelas* Koehler.

\**Asteroschema rousseaui* Michelin, 1862. Indian O. 100 fms.

- 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.

\**asperum* Lmk., 1816. Indonesia. Littoral.

- 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.

- 4 (5) Arms short, 2-5 times disc-diameter (possibly juvenile stages of other genera). . . . **Ophiuropsis** Studer, 1884.

\**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.: *Lasपालia* 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 Hemiuryalinae 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.
- 5 (6) One genital cleft in each interradius. . . . *Quironia* A. H. Clark, 1934.  
\**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. . . . *Ophioplus* 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. . . . *Ophiochondrus* 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.
- 12 (13) Paired interradiial sacs between the oral shields and radial shields. . . .  
*Ophiocila* A. H. Clark, 1949.  
\**elegans* A. H. C., 1949. Hawaii. 600 fms.
- 13 (12) Interradii of normal form, without interradiial sacs.
- 14 (17) Disc circular in outline: uppermost arm-spines longer than others.
- 15 (16) Genital clefts pore-like, placed beside the small oral shield. Ventral interradius covered by several polygonal plates. Primary plates inconspicuous. . . . *Amphigyptis* Nielsen, 1933.  
\**perplexa* Niel., 1933. Panama. Littoral.
- 16 (15) Genital clefts elongate. Single large plate covers the ventral interradius. Primary plates conspicuous. . . . *Ophiocyclus* H. L. Clark, 1939.  
\**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 interradia. . . . . **Ophiomoeris** Koehler, 1904.  
 Syn: *Ophiurases* H. L. Clark, 1911.  
 \**spinosa* Koehler, 1904. Kei Is. 160 fms.
- 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.  
 \**trachyacanthum* H. L. C., 1911. North Pacific. 400 fms.
- 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 *Ophiogeron*.  
 \**Ophiogeron 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. . . . . **Ophiogeron** 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. . . . . **Ophioscolex** (s.s.) Mueller & Trochel, 1842. The genus was restricted by Mortensen (1933); synonym *Ophiocynodus* H. L. Clark, 1911.  
 \**glacialis* M. & T., 1842. Arctic. 100 fms.



- 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. . . . *Ophiosyzygus* H. L. Clark, 1911.  
\**disacanthus* H. L. C., 1911. Japan. 100 fms.
- 18 (17) No membrane uniting arm-spines: thin hyaline dorsal arm-plates. . . .  
*Ophioleptoplax* H. L. Clark, 1911.  
\**megapora* H. L. C., 1911. North Pacific. 70 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. . . . *Ophiolycus* 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.
- 23 (24) A conspicuous coating of large granules covers the dorsal surface of the disc and arms. . . . *Ophiovesta* Koehler, 1931.  
\**granulata* Koehler, 1931. Indonesia. Littoral.
- 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.
- 26 (27) No tentacle scale: arm-spines hyaline with several hooklets. . . .  
*Ophiostiba* Matsumoto, 1915.  
\**hidekii* Matsumoto, 1915. Japan. 300 fms.
- 27 (26) Single tentacle-scale: arm-spines not hooked. . . . *Ophiomora* Koehler, 1907.  
\**elegans* Koehler, 1907. East Africa.
- 28 (25) Genital cleft as long as 4 arm-segments: 6 or 7 short, blunt arm-spines.  
*Neoplax* Bell, 1884.  
\**ophiodes* Bell, 1884. Indian O. Littoral.
- 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.
- 31 (32) Dorsal arm-plates entire: radial shields rudimentary: arm-spines modified as compound hooks. . . . *Ophiobyalus* Matsumoto, 1915.  
\**gotoi* Matsumoto, 1915. Japan.
- 32 (31) Dorsal arm-plates fragmented; radial shields conspicuous: arm-spines not hooked, save at tip of arm. . . . *Ophiomyxa* Mueller & Troschel, 1840.  
\**Ophiura pentagona* Lmk., 1816. Mediterranean.
- 33 (30) No marginal disc-plates.
- 34 (35) No radial shields: arm-spines webbed. . . . *Ophiohymen* H. L. Clark, 1911.  
\**gymnodiscus* H. L. C., 1911. North Pacific. 100 fms.
- 35 (34) Radial shields present: arm-spines free. . . . *Ophiodera* Verrill, 1899.  
\**serpentaria* Lyman, 1883. N. Atlantic. 350 fms.  
H. L. Clark (1915) refers the type to *Ophiomyxa*. Mortensen (1927) synonymizes *Ophiodera* with *Ophiomyxa*.
- 36 (1) Oral shields and adoral plates fused together and very thick: adoral plates lying proximal to the oral shields. Vertebrae short, thick, their articular peg



rudimentary or absent (i.e., streptospondylous). . . .

Subfamily OPHIOBYRSINAE

- 37 (38) Only 1 genital cleft in each interradius: oral shield present in only 1 interradius. . . . **Ophioschiza** H. L. Clark, 1911.  
*\*monacantha* H. L. C., 1911. Bering Sea. 300 fms.
- 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. . . .  
**Ophiophrixus** H. L. Clark, 1911.  
*\*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. . . .  
**Ophiobyrseella** Verrill, 1899.  
*\*serpens* Lyman, 1883. Caribbean. 70 fms.  
 H. L. Clark (1915) refers the type to *Ophiobyrsa*.
- 43 (42) Only 1 oral papilla, and no teeth: a few spiniform dental papillae at the jaw-apex. . . .  
**Ophiobyrsa** Lyman, 1878.  
*\*rudis* Lyman, 1878. Australia. Littoral.
- 44 (39) Radial shields inconspicuous or absent.
- 45 (46) Only lateral arm-plates on arm: 1 oval tentacle-scale. . . .  
**Astrogymnotes** H. L. Clark, 1914.  
 Referred by H. L. Clark and Doederlein to Trichasteridae: but Mortensen states vertebrae are zygospondylous: the solitary genotype is hexamerous, and this character may prove to be generic.  
*\*catasticta* H. L. C., 1914. W. Australia. 100 fms.
- 46 (45) Ventral arm-plates as well as lateral arm-plates.
- 47 (48) Disc bearing spinules: oral and dental papillae spiniform. . . .  
**Ophiobrachion** Lyman, 1883.  
*\*uncinatus* Lyman, 1883. Cuba. 250 fms.
- 48 (47) Disc free from spinules: oral and dental papillae, and teeth, all alike, stout, stumpy, blunt and thorny at the tip. . . . **Ophiosmilax** Matsumoto, 1915.  
*\*mirabilis* Matsumoto, 1915. Japan. 300 fms.

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. . . . **Ophiocanops** Koehler, 1922a.

*\*fugiens* 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. . . .  
**Ophiodictys** Koehler, 1922a.  
 Syn.: *Ophiodaces* Koehler, 1922.  
*\*inanis* 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 *Ophiothauma* H. L. Clark, 1938.

- 5a (5b) Seven arms. . . . . **Ophiothauma** H. L. Clark, 1938.  
\**heptactis* H. L. Clark, 1938. N. Australia. Littoral.
- 5b (5a) Five arms.
- 6 (7) About 3 arm-spines, plus, on the distal arm-segments, some hyaline umbrella-shaped hooklets. . . . . **Ophiotholia** Lyman, 1880.  
\**supplicans* Lym., 1880. Juan Fernandez. 1,800 fms.
- 7 (6) About 10-12 arm-spines: no accessory hooklets. . . . . **Ophiomyces** Lyman, 1869  
\**frutectosus* Lym., 1869. N. Atlantic. 100 fms.
- 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. . . . . **Ophioblenna** Lütken, 1959.  
\**antillensis* Lütk., 1859. West Indies. Littoral.
- 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.  
\**cavernosum* Lym., 1880. Kerguelen. 2,000 fms.
- 13 (12) Genital clefts in usual position: tentacle-scales spiniform
- 14 (15) Evident radial shields. . . . . **Amphipsila** Verrill, 1899.  
H. L. Clark (1915) refers this sp. to *Ophiopsila*.  
\**maculata* Verrill, 1899. Caribbean. 200 fms.
- 15 (14) Radial shields not evident.
- 16 (17) Oral papillae scale-like. . . . . **Ophiologimus** H. L. Clark, 1911.  
\**hexactis* H. L. C., 1911. Japan. 100 fms.
- 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 *Ophiomedeia*, 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.  
\**liodisca* H. L. C., 1911. Japan. 500 fms.
- 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.  
\**coriacea* Lym., 1883. North Atlantic. 1,200 fms.
- 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,



- external ones flat and spatulate. . . . **Ophiosparte** Koehler, 1922.  
*\*gigas* Koehler, 1922. Antarctic Ocean. 100 fms.
- 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.
- 24 (25) Arms barely twice as long as disc-diameter, broad at the base and tapering rapidly: radial shields visible: each disc scale carrying a trifid stumpy spine: 1 tentacle-scale. . . . **Ophiodelas** Koehler, 1931.  
*\*insignis* Koehler, 1931. Indonesia. 150 fms.
- 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. **Ophiomedeia** Koehler, 1906.  
 Compare also *Ophiophrura*, 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).
- 38 (37) Oral papillae all similar, none operculiform. . . . **Ophiomelina** Koehler, 1922a.  
*\*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. . . . **Ophioripa** Koehler, 1922a.



- \**marginata* K., 1922a. N. Pacific. 500 fms.  
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.  
Syn. *Ophiosemmotes* Matsumoto, 1917.  
\**Ophiacantha cataleimoida* H. L. C., 1911. N. Pacific. 300-500 fms.
- 45 (44) Ventral arm-plates obscured by thick skin: 2 tentacle-scales. . . . .  
*Ophiochondrella* Verrill, 1899.  
\**Ophiochondrus 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. . . . .  
*Ophiogema* Koehler, 1922a.  
\**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. . . . . *Ophiacantha* Mueller & Troschel, 1842. Syn. *Ophiotreta*, Verrill, 1899a; *Ophiectodia* Verrill, 1899a: *Ophientodia* Verrill, 1899a: *Ophiodiplax* Koehler, 1911 = *Ophioscalus* Verrill, 1899a; *Ophiopristis* Verrill, 1899a. See *Disc. Rpts.*, Mrtsn. (1936).  
\**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 *Ophiurochaeta* 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



- ring: no genital plates. . . . . **Ophiothamnus** Lyman, 1869.  
 Syn. *Ophioleđa* 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. . . . . **Ophiomitrella** Verrill, 1899.  
 \**Ophiacantha laevipellis* Lyman, 1883. Caribbean. 100 fms.
- 61b(61a) Disc five-lobed, having deep interradiar notches in its edge. Dorsal arm-plates contiguous.
- 62 (63) Marginal disc-scales differentiated and well developed. . . . . **Ophioplinthaca** Verrill, 1899b.  
 \**Ophiomitra dipsacos* Lym., 1878. West Indies. 400 fms.
- 63 (62) Marginal scales not specially developed: disc scales very robust, comprising mainly radial shields plus some intercalary plates. . . . . **Ophiomytis** Koehler, 1904.  
 \**weberi* Koehler, 1904. Indonesia. 300 fms.
- 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 disc-scales differentiated and well developed: radial shields not in contact: 1 tentacle-scale. . . . . **Ophiomitra** Lyman, 1869.  
 Lyman specifically cites the large broad radial shields as characteristic of his genus (see also Lyman, 1882, p. 202). Mortensen (1933, p. 42) refers his species *hamula* to *Ophiomitra*, although the radial shields are "rather small". It seems doubtful whether *hamula*, as also *O. spinea* Verrill, really belong in *Ophiomitra*, but I have no material on which to base a conclusion.  
 \**valida* Lyman, 1869. Caribbean. 120 fms.
- 66 (65) Marginal scales not specially differentiated: radial shields contiguous along their whole length: 3 tentacle-scales, shaping a ring about the pore. . . . . **Ophiocamax** Lyman, 1878.  
 \**vitrea* Lyman, 1878. Indian O. 150 fms.

Family **OPHIOLEUCIDAE** Matsumoto, 1915

- 1 (4) Single tentacle scale throughout arm.
- 2 (3) Dorsal arm-plates rudimentary. . . . . **Ophiotrochus** 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. . . . . **Ophiopyren** Lyman, 1878.  
 \**longispinus* Lyman, 1878. Caribbean. 100–600 fms.
- 7 (6) Central part of disc covered by skin, with scales and radial shields forming the periphery. . . . . **Ophiernus** Lyman, 1878.  
 \**vallincola* Lym., 1878. Crozet Is. 1,400 fms.



- 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.  
\**aculeatus* Ljung., 1867. Indonesia. "Deepwater".
- 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.
- 10 (11) Disc covered by smooth naked skin: radial shields narrow and bar-like. . . . **Ophionema** Lütken, 1869.  
\**intricata* Lütken, 1869. Caribbean. Littoral.
- 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.  
**Amphioncus** H. L. Clark, 1939.  
\**platydiscus* H. L. Clark, 1939. Aden. 100 fms.
- 13 (12) No spiniform tentacle-scales.
- 14 (15) Arm-spines hooked on distal joints of arm. Disc covered by primary plates. Epizoic on echinoid *Laganum*. . . . **Nannophiura** Mortensen, 1933.  
\**lagani* Mortensen, 1933. Indonesia. Littoral.
- 15 (14) Arm-spines not hooked on distal joints of arm.
- 16 (17) Disc-scales fine, flattened, imbricating, not chunky: oral shields not meeting the first lateral arm-plate. . . . **Amphiura** Forbes, 1842.  
Syn: *Ophiopelte* Verrill, 1899; *Ophiopeltis* Dub. & Koren, 1845; *Hemilepis* Ljungman.  
\**chiajii* Forbes, 1842. North Sea. Littoral.
- 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.  
\**bathybia* Djakonov, 1952. N.W. Pacific, 2,000 fms.
- 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 (23) 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.  
\**Amphiura tumida* Lym., 1899. Caribbean. 300 fms.
- 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.  
\**persica* Mrtsn., 1940. Persian Gulf. Littoral.
- 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.
- 27 (26) Tentacle-scales short, flat, leaf-like: 3-5 arm-spines: close-set oral papillae, the outermost short and flat. Radial shields not contiguous, or merely touching at their distal ends. . . . **Amphiacantha** Matsumoto, 1917.  
\**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.)  
\**tenuis* 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.
- 34 (35) Two erect, valve-like tentacle-scales which close together like a clam-shell when the tentacle is retracted. . . . **Amphiomya** H. L. Clark, 1939.  
\**notabilis* H. L. C., 1939. Indian Ocean.
- 35 (34) Two flat, leaf-like tentacle-scales. . . . **Amphipholis** Ljungman, 1866.  
\**Ophiolepis gracillima* Stimpson, 1852. Caribbean. Littoral.
- 36 (29) Three or four subequal oral papillae (*Amphiodia* group).
- 37 (38) Disc with numerous scattered spines. . . . **Ophiocnida** Lyman, 1865.  
Syn.: *Ophiocnidella* Ljungman, 1872.  
\**Ophiolepis hispida* Le Conte, 1851. Panama. Littoral.
- 38 (37) Disc without spines (though some peripheral scales may have a spine-like process).
- 39 (40) Naked skin covering disc above and below, save for the elongate radial shields. . . . **Ophionephthys** Lütken, 1869.  
\**limicola* Lütk., 1869. West Indies. Littoral.
- 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.
- 44 (43) Radial shields divergent: disc without specially distinguished marginal scales. . . . **Amphiodia** Verrill, 1899.  
\**Amphiura pulchella* Lyman, 1869. Caribbean. 40 fms.



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.  
\**Ophiolepis scolopendrica* M. & T. = *Asterias aculeatus* Retzius, 1783. N. Hemisphere. Littoral and deep water.
- 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.
- 6 (5) Radial shields separated: not androphorous. No genital clefts: two or three oral papillae: one tentacle-scale. . . . **Ophiopus** Ljungman, 1866.  
Syn.: *Ophiaregma* Sars, 1872.  
\**arcticus* Ljungman, 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).  
\**krebsii* Lütk. = *Ophiolepis savignyi* M. & T., 1842. Tropics.
- 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.  
\**Ophiura elongata* Say, 1825. Caribbean. Littoral.

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. . . . **Amphilepis** Ljungman, 1866.  
\**Amphiura norvegica* Ljung., 1864. Norway. 200 fms.

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).  
\**elegans* Ljung., 1866. Indonesia. Littoral.
- 3 (2) Disc not covered by naked skin.



- 4 (9) Upper surface of disc bearing granules.
- 5 (8) Lower surface of disc covered by skin.
- 6 (7) Dorsal surface of arms bearing granules, tubercles or coarse irregular grains, which more or less obscure the plates; dorsal arm-plates reduced in size. . . . **Ophiothela** Verrill, 1867.  
Syn.: *Ophiotesis* Bell, 1892 (juvenile stage).  
\**mirabilis* Verrill, 1867. Panama. Littoral.
- 7 (6) 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.
- 8 (5) Lower surface of disc covered by fine scales. . . . **Ophiocnemis** Mueller & Troschel, 1842.  
\**Ophiura marmorata* Lmk., 1816. Indian Ocean. Littoral.
- 9 (4) Upper and lower surfaces of disc covered by plates.
- 10 (11) Disc covered by primary plates and radial shields; two arm-spines. . . . **Ophiophthirus** Doederlein, 1898.  
\**actinometrae* Doed., 1898. Torres Strait. Littoral.  
The type (and only known) species was epizoic on a comatulid, and may be a juvenile stage of some other genus.
- 11 (10) Disc covered by numerous other plates, besides the primaries; four or more arm-spines.
- 12 (19) Radial shields large and conspicuous.
- 13 (16) Disc plates bear spines or thorns.
- 14 (15) Arm-spines of the proximal arm-joints united by a membranous web into vertical fin-like fans. . . . **Ophiopteron** Ludwig, 1888.  
\**elegans* Ludwig, 1888. Amboina. Littoral.  
Mortensen (1932) has shown that some spp. of *Ophiothrix* pass through an "Ophiopteron" stage.
- 15 (14) Arm-spines of all arm-joints free, not united by webs. . . . **Macrophiothrix** H. L. Clark, 1938.  
Syn.: *Placophiothrix* H. L. Clark, 1938.  
\**Ophiura longipeda* Lmk., 1816. Indo-Pacific. Littoral.
- 16 (13) Disc plates without spines or thorns.
- 17 (18) Dorsal arm-plates short and wide; arm-spines smooth and opaque. . . . **Ophiomaza** Lyman, 1871.  
Syn.: *Lütkenia* Brock, 1888.  
\**cacaotica* Lyman, 1871. Indo-West-Pacific. Littoral.  
Species of this genus may occur as epizoic forms on various comatulids.
- 18 (17) Dorsal arm-plates not short and wide; arm-spines thorny. . . . **Ophiotrichoides** Ludwig, 1882.  
\**lymani* Ludwig, 1882. Tropical W. Atlantic. Littoral.  
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).
- 19 (12) Radial shields small or partly concealed by spinules.
- 20 (21) Dorsal arm-plates bearing minute spinelets. . . . **Amphiophiothrix** H. L. Clark, 1946.  
\**Ophiothrix demessa* Lyman, 1861. Tropical Indo-Pacific. Littoral.
- 21 (20) Dorsal arm-plates smooth.
- 22 (23) Spines or thorns on disc plates; tentacle-scales present. . . . **Ophiothrix** Mueller & Troschel, 1840.



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.

\**insignis* Brock, 1888. Amboina. Littoral.

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.

\**delicata* H. L. Clark, 1938. Tropical Australia. Littoral.

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.

\**novarae* M-T, 1887. Nicobar Is. Littoral.

28 (27) Dorsal arm-plates without keels.

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

\**Ophiothela holdsworthii* E. A. Smith, 1878. Ceylon.

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

Syn.: *Ophiohelix* Koehler, 1895.

\**unicolor* Brock, 1888. Amboina. Littoral.

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.

\**aranaea* Forbes, 1843. Mediterranean. Littoral.

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

3 (4) Disc covered by naked skin. . . . **Ophiarthrum** Peters, 1851.

\**elegans* Pet., 1851. Indo-W.-Pacific. Littoral.

4 (3) Disc bearing spines, or granules.

5 (10) Disc bearing granules only.

6 (7) Supplementary scales at base of uppermost arm-spine. . . . **Ophiopteris** E. A. Smith, 1877.

\**antipodum* E. A. S., 1877. New Zealand. Littoral.

7 (6) No supplementary scales.

8 (9) Arm-spines hollow. . . . **Ophiocomina** Koehler, 1920.

\**Asterias nigra* Abildgaard, 1789. N. Atlantic. Littoral.

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

\**Ophiura echinata* Lmk., 1816. West Indies. Littoral.

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

11 (12) Five arms. . . . **Ophiomastix** Mueller & Troschel, 1842.

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

\**Ophiura annulosa* Lmk., 1816. Indonesia. Littoral.

12 (11) Six or 7 arms. . . . **Ophiocomella** A. H. Clark, 1939.

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.

\**caribbaea* A. H. Clark, 1939. Caribbean. Littoral.



## 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* Ziesenne, 1940.  
\**amphilogus* Ziesenh., 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.  
\**Ophiura reticulata* Say., 1825. Caribbean. Littoral.  
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.
- 3 (4) Ventral arm-plates longer than wide, and contiguous: 1 tentacle-scale: teeth widened at free end. . . . *Ophiurodon* Matsumoto, 1915.  
\**Ophioconis 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.  
\**fragilis* Djakonov, 1954. N.W. Pacific, 200 fms.
- 5b (5a) Arm-plates not concentrically striated: arm-spines opaque: 2 tentacle-scales.
- 6 (7) Disc bearing scattered spinules among the granules: no accessory oral shield. . . . *Ophiurochaeta* Matsumoto, 1915.  
\**Ophiochaeta mixta* Lyman, 1878. Caribbean. 100 fms.  
See note under *Ophiacantha*, p. 18.



- 7 (6) Disc without spinules: an accessory oral shield. . . . **Ophiarachna**  
 Mueller & Troschel, 1842.  
 \**Ophiura incrassata* Lmk., 1816. Indonesia. Littoral.
- 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.
- 11 (12) Arm-spines hyaline. . . . **Ophioconis** Luetken, 1869. (s. restr. Matsu-  
 moto, 1917).  
 \**Pectinura forbesi* Heller, 1862. Mediterranean. Littoral.
- 12 (11) Arm-spines 6 to 9, opaque. . . . **Cryptopelta** H. L. Clark, 1909.  
 (*Ophiodyscrita* H. L. Clark, 1938, resembles *Cryptopelta*, but has the arm-  
 plates concealed by granules: it is probably the juvenile form.)  
 \**Ophiopeza aster* Lyman, 1879. S. Africa. 150 fms.
- 13 (10) Oral shields naked: 2-4 arm-spines.
- 13a (13b) Ventral arm-plates entire: radial shields partly exposed. . . .  
**Bathypectinura** H. L. Clark, 1909.  
 \**Pectinura lacertosa* Lyman, 1883. Caribbean. 1,500 fms.
- 13b (13a) Ventral arm-plate of each joint subdivided into a narrow proximal  
 plate and a broad distal plate: radial shields not exposed.
- 14 (15) Dorsal arm-plates entire: distal end of genital cleft not extending to the  
 dorsal margin of disc. . . . **Ophiopaepale** Ljungman, 1872.  
 \**goesiana* Ljungman, 1871. Caribbean. 100 fms.
- 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.  
**Schizoderma** Nielsen, 1932.  
 \**diplax* Nielsen, 1932. Gulf of Panama. Littoral.
- 16 (9) Two tentacle-scales.
- 17 (24) Genital clefts divided into two subsidiary apertures, so that 4 genital aper-  
 tures 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. . . .  
**Diopoderma** H. L. Clark, 1913.  
 \**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.  
 \**maculosus* H. L. Clark, 1915b. California. Littoral.
- 21 (20) Arms not granulated, arm-plates visible.
- 22 (23) Proximal cleft long and narrow, the distal one circular and smaller. . . .  
**Ophioncus** Ives, 1889.  
 \**granulosus* Ives, 1889. Loc. and depth not stated, presumably Eastern  
 N. America.
- 23 (22) Distal cleft larger than proximal one. . . . **Ophioderma** Mueller &  
 Troschel, 1840.  
 The "Stella laevis" of Rondelet (1554) is probably *Ophioderma*.  
 \**Asterias longicauda* Retzius, 1805. N. Atlantic. Littoral.
- 24 (17) Genital clefts entire, 2 genital apertures in each interradius.
- 25 (26) Spines present on disc. . . . **Ophiochaeta** Lütken, 1869.  
 \**hirsuta* Lütken, 1869. Fiji. Littoral.
- 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.  
\**Ophiarachna spinosa* Ljungman, 1867. Indonesia. Littoral.
- 29 (28) Disc without enlarged marginal scales.
- 30 (31) Dorsal side of arms densely granulated, concealing the arm-plates. . . .  
**Ophiocormus** H. L. Clark, 1915.  
Syn.: *Ophiostegastus* Murakami, 1944.  
*Ophiocormus* was stated by H. L. Clark to have only one tentacle scale, and was therefore referred to *Ophioconis* 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.  
\**notabilis* H. L. Clark, 1915. New Zealand. Littoral.
- 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.  
**Ophiopeza** 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.  
\**clarki* Ely, 1942. Hawaii. Littoral.
- 35 (34) Having a single row of arm-spines. . . . **Pectinura** Forbes, 1843.  
\**vestita* Forbes, 1843. Mediterranean. Littoral.
- 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.  
\**Ophiarachna gorgonia* Mueller & Troschel, 1842. Indian O. Littoral.
- 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.  
\**Ophiarachna stellata* Ljungman, 1867. Indonesia. Littoral.

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.



- 3 (4) Radial shields conspicuous: enlarged first lateral plates confined to ventral side of disc, and separated interradially by the oral shield: no dorsal arm-plates: tentacle-pores widely separated. . . . **Ophiochorus** H. L. Clark, 1939.  
*\*granulatus* H. L. C., 1939. Zanzibar. 1,500 fms.
- 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 interradiial 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 suctorial structure, by which the animal adheres to substrate, with the help of the tube-feet: no oral shield: adoral shields separated, adjoining the first ventral arm-plate of the corresponding side: no genital clefts. . . . **Astrophium** Sladen, 1879.  
*\*permira* Sladen, 1879. Madagascar. ? sublittoral.
- 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.



- 16 (13) Disc covered above by naked plates or scales.
- 17 (18) Each dorsal arm-plate fragmented into a central plate, with several lateral mosaic platelets on either side. . . . **Ophionotus** Bell, 1902.  
\**victoriae* Bell, 1902. Antarctica. Littoral.
- 18 (17) Dorsal arm-plates not fragmented.
- 19 (20) 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.
- 20 (19) Primary plates not directly touching arm-plates.
- 21 (22) 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. . . . **Dictenophiura** H. L. Clark, 1923.  
\**Ophiura carnea* Ltk., 1858. N. Europe. 40-300 fms.
- 22 (21) Not so.
- 23 (24) 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. . . . **Ophiocrossota** H. L. Clark, 1928.  
\**Ophioglypha multispina* Ljung., 1867. E. Australia. Littoral.
- 24 (23) Radial shields not separated by a triangular plate whose margins carry papillae.
- 24a (24b) 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. . . . **Ophiogona** Studer, 1876.  
Syn.: *Ophiogona* Lütkin, 1877; *Ophiomaria* A. H. Clark, 1916.  
\**laevigata* Studer, 1876. Kerguelen. Littoral.
- 24b (24a) Not so.
- 25 (36) Tentacle-pores restricted to a few basal arm-joints.
- 26 (29) Disc distinctly higher than the arms.
- 27 (28) Genital clefts bordered on their proximal interrarial 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. . . . **Ophiurolepis** Matsumoto, 1915, emend. Koehler, 1922.  
\**Ophiurolepis carinata* Studer, 1876. Kerguelen and Heard Is. 75 fms.
- 28 (27) Genital clefts without proximal interrarial 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. . . . **Aspidophiura** Matsumoto, 1915.  
\**watasei* Mats., 1915. Japan.
- 29 (26) Disc low and flat.
- 30 (31) No distinct tentacle-scales: first tentacle-pore large, the others very small: disc covered by scales. . . . **Ophioplinthus** Lyman, 1878.  
(The tentacle-pores are sometimes provided with an ill-defined "burr" or vestigial scale.)  
\**medusa* Lyman, 1878. Antarctica. 2,000 fms.
- 31 (30) Tentacle-scales distinct: disc covered by tumid plates.



- 32 (33) Arm-spines minute; primary plates large, circular, with smaller plates between. . . . **Homalophiura** H. L. Clark, 1915.  
 \**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. . . . **Ophiosteira** Bell, 1902.  
 Syn.: *Ophiomages* Koehler, 1923.  
 \**antarctica* Bell, 1902. Antarctica. Littoral. 100 fms.
- 35 (34) Three arm-spines, whereof the middle one becomes transformed into a hyaline up-turned hooklet on distal arm-joints. . . . **Ophiuroglypha** Hertz, 1926.  
 \**Ophioglypha 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.  
 \**Ophiura nodosa* Luetk., 1855. Arctic. Littoral.
- 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.  
 \**Ophiozona gymnopora* H. L. C., 1909. E. Australia. Littoral.
- 43 (42) Tentacle-scales present: ventral interbrachium covered by naked scales.
- 44 (45) Centrodorsal plate small, star-shaped, with five acute interradiating 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.  
 \**axiologa* H. L. C., 1911. Aleutians. 1,200 fms.
- 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.  
 \**tegulitius* Lym., 1878. Indo-W. Pacific. 1,000 fms.
- 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.)

\**wyvillethomsoni* Lyman, 1878. Tonga. 250 fms.



- 48 (37) Disc low and flat, arms broader than high.
- 48a (48b) 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). . . . **Ophiochalcis** Koehler, 1931.  
\**aspera* Koehler, 1931. Indonesia, 60 fms.
- 48b (48a) Not so.
- 49 (50) 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. . . . **Ophiocten** Lütken, 1855.  
\**Ophiura sericea* Forbes, 1852. Arctic. 100 fms.
- 50 (49) 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.
- 51 (52) No arm-combs. Three small, adpressed arm-spines. . . . **Ophiotjalpa** Mortensen, 1915.  
\**vivipara* Mrtsn., 1915. N. Atlantic.
- 52 (51) 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.*)  
Syn.: *Ophioglypha* Lyman, 1860. *Ophioglyphina* Ludwig, 1886; *Ophiozea* A. H. Clark, 1920.  
\**Asterias ophiura* Linné, 1758. Europe. Littoral.

Subfamily **Ophiolepidinae** Matsumoto, 1915

- 1 (28) Tentacle-pores well developed throughout arm.
- 2 (5) No tentacle-scale.
- 3 (4) 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.  
\**petilum* Lyman, 1878. Kermadec Is., N.Z. 600 fms.
- 4 (3) 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.
- 5 (2) Tentacle-scales present.
- 6 (27) Tentacle-scales well-developed throughout the arm.
- 7 (20) Dorsal arm-plates entire, not fragmented nor divided into supplementary plates.
- 8 (9) A row of papillae skirting the outer borders of the genital scales and radial shields: a pair of plates wedged between the radial shields: arm-spines minute. . . . **Ophiothyreus** Ljungman, 1872.  
\**goesi* Ljung., 1872. Cuba. 200 fms.
- 9 (8) 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. . . . **Ophioceramis** Lyman, 1865.  
*\*Ophiolepis januarii* Lützk., 1856. Caribbean. Littoral.
- 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.  
*\*lenta* Koehler, 1904. Indonesia. 1,100 fms.
- 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. . . . **Ophiomidas** Koehler, 1904.  
*\*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.  
*\*parvispinum* H. L. C., 1938. Tasman Sea (Lord Howe Is.). Littoral.
- 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.  
*\*tuberculosis* Koehler, 1931. Kei Is., 150 fms.
- 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).  
*\*Ophiolepis impressa* Lützk., 1859. Caribbean. 50–200 fms.
- 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.  
*\*picta* H. L. C., 1915. New Zealand. Littoral. 50 fms.  
*Ophiotylos* Murakami, 1943, appears to fall very close to *Ophiozonoida*, differing mainly in having rudimentary arm-spines whereas there are 3 short arm-spines in *Ophiozonoida picta*. The type of *Ophiotylos* is *O. leucus* Murakami, 1943, Caroline Island.
- 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. . . . **Ophiozonella** Matsumoto, 1915.  
*\*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. . . .  
**Ophiolepis** Mueller & Troschel, 1840.  
\**superba* H. L. C., Indo-W. Pacific. Littoral.  
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.  
\**Ophiolepis imbricata* M. & T., 1842. Indo-W. Pacific. Littoral.
- 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. . . .  
**Ophioceres** Koehler, 1922.  
\**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.  
\**delicata* H. L. C., 1915. Caribbean. 100 fms.
- 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 porcelainous 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. . . . **Ophiosphalma** H. L. Clark, 1941.  
\**Ophiomusium planum* Lyman, 1878. Caribbean. 1,000 fms.



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