

PROCEEDINGS  
OF THE  
NEW ENGLAND ZOOLOGICAL CLUB

NEW HOLOTHURIANS FROM THE WESTERN COAST  
OF NORTH AMERICA AND SOME REMARKS ON  
THE GENUS CAUDINA

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WHILE revising the holothurians of the western coast of North America, I have found a number of species which could not be referred to any forms previously described. Also I have found it necessary to make a few, long-needed changes in the taxonomic arrangement, and to establish, and to re-establish, some generic names.

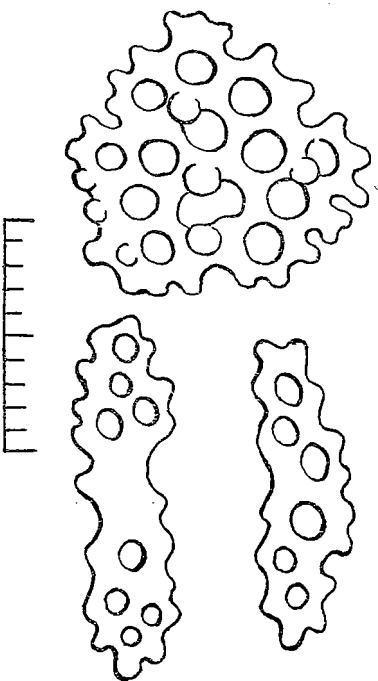
Five new species of *Cucumaria*, s. l., (Order Dendrochirota) are described below; one of these was formerly listed under a wrong name. Two genera are re-established for certain species which do not belong in *Cucumaria*, s. str.

Furthermore, a new name is proposed for the members of the genus *Caudina* (Order Molpadonia) which occur in deeper water, and a few remarks are made on the shallow water species, *C. arenicola*, known from the Californian shores.

Expressed in a key, the diagnostic characters for the three genera of *Cucumaria*, s. l., are as follows:

1. Calcareous ring simple, low, with no posterior prolongations. Feet large, soft, completely retractile, in five bands and, in many forms, also scattered in the interambulacra, chiefly in the dorsal ones. Spicules, knobbed to smooth plates or four-holed buttons; feet with vestigial end-plate and in the walls either plates or rods, the latter often three-armed. *Cucumaria*, s. str., (Type species: *C. frondosa* (Gunnerus)).

1. Calcareous ring high, with distinct posterior prolongations. Feet filled with numerous spicules, not completely retractile, and restricted to the ambulacra. Spicules derived from tables or knobbed buttons; feet with large end-plate, and supporting tables which rarely are reduced to rods.
2. Calcareous ring with long posterior prolongations. Spicules derived from tables. *Pentamera* Stimpson. (*Type species: P. caligera* Stimpson).
2. Calcareous ring with short posterior prolongations. Spicules, knobbed plates, cups, or reticulated bodies. *Eupentacta* n. gen. (*Type species: E. quinqueseptima* (Selenka) ).



*Cucumaria pseudocurata* spec. nov.

Plate and rods from integument and wall of tube feet.

In this and in succeeding figures each division of the scale represents one one-hundredth of a millimeter.

*CUCUMARIA* Blainville, 1835

*Cucumaria pseudocurata* sp. nov.

*Diagnosis*.—A small form; length a few centimeters; tentacles of equal size; feet restricted to the ambulacra, soft, retractile. Calcareous ring simple. Spicules oblong to round plates with a varying number of holes, often reduced to spectacle-shaped rods; feet with vestigial end-plate, sometimes lacking, and rods similar to those found in the body wall; tentacles with spicules of same type. Average length of plates and rods 0.12—0.14 mm.

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*Type*.—M.C.Z., no. 356, from San Mateo, southern California, (A. Agassiz), known from the type locality only. Depth not recorded, probably collected at low tide.  
*Specimens examined*.—The type and fifty other individuals from the same lot.

The species resembles superficially *C. curata* Cowles from Pescadero Point, south of Pacific Grove, California, but the spicules are entirely different, reminiscent of those found in the northern species *C. vegae* Théel. The latter, however, has tentacles of unequal size and numerous feet in the interambulacra. The large number of individuals gathered from the same locality suggests that the development is direct, as it is in *C. curata*; very likely also the eggs are brooded by the female.

PENTAMERA Ayres, 1852

*Diagnosis*.—Small to medium-sized forms. Ventral tentacles small. Calcareous ring with long posterior prolongations. Stone canal attached in the dorsal mesentery; head kidney-shaped with thickened edges; muscle stomach short, intestine likewise comparatively short; course of intestine normal; retractors attached near the middle of the body, where the gonads also are placed, the latter forming two tufts of cylindrical tubes; respiratory trees with few branches. Spicules two-pillared tables, smooth plates, or both, or derivatives of these (spire reduced to two small knobs); feet with large end-plate and oblong supporting tables, rarely reduced to simple rods.

*Type species*.—*Pentamera pulcherrima* Ayres.

A well known form is *P. caligera* (Stimpson), which has been described in detail by Duncan and Sladen, 1881. Comparison of a large number of specimens, chiefly in the U. S. National Museum, shows definitely that *P. caligera* occurs along the coasts of Labrador and western Greenland, as well as in Bering

Sea. According to the literature (*vide* Ludwig, 1900) it occurs also at Nova Zembla, but apparently it is not known from the eastern coast of Greenland, nor from Spitsbergen. The type species itself apparently does not occur south of Bering Sea, but seven species are known from the western coast of North America. One of these formerly was erroneously listed as *C. calcigera*, three were described, respectively, as *C. populifera* (Stimpson), *C. hisoplaca* H. L. Clark and *C. trachyplaca* H. L. Clark, while three are new to science. All have been examined in connection with the revision of the west-coast holothurians.

***Pentamera pseudocalcigera* spec. nov.**

*Chaunaria calcigera* H. L. Clark, 1901, p. 165; 1901a, p. 492; Edwards, 1907, p. 54, text figs. 5-11. *Nec Pentamera calcigera* (Stimpson).

*Diagnosis*.—Medium-sized form, length up to 10 cm. Body, normally, strongly curved, tapering toward both ends; skin rigid, filled with spicules; feet in five crowded bands; base of feet conical. Spicules, large tables (diameter 0.15–0.45 mm.) with round to star-shaped disk, and numerous elongate to star-shaped plates, the latter type dominating, except in very young individuals.

*Type*.—U.S.N.M. Type locality: off California.

*Distribution*.—Southeastern Alaska to southern California, at a depth of about forty to one hundred fathoms.

*Specimens examined*.—The type and about a hundred individuals in the U. S. National Museum and the Hopkins Marine Station, Pacific Grove, California, mostly collected by the 'Albatross.'

The inner anatomy of this species has been carefully described by Edwards. Even the smallest individuals differ distinctly from the Arctic *P. calcigera* and the more southern form *P. populifera* by the more rigid skin and the conical bases of the feet. The tentacles and introvert seem invariably to be darkly pigmented, while the other forms are unpigmented.

The species usually is taken in large numbers at any one locality, and it has therefore been possible to study the changes which the spicules undergo, with advancing age, in specimens

which have been living under identical conditions. The tables are numerous in the young individuals of a few centimeters' length, and measure, in them, from 0.15 to 0.45 mm. across the disk. In the older animals the tables are less numerous,—possibly the spire is reduced,—and the plates are slightly larger.

***Pentamera pseudopopulifera* spec. nov.**

*Diagnosis*.—A small form, up to 5 cm. long; body tapering toward both ends, and frequently curved; feet in five bands, cylindrical, non-retractile. Spicules, small tables (diameter of disk 0.07–0.10 mm.) with stout spire, covering most of the disk, and ending in few teeth; plates rare. Feet with large end-plate and numerous curved supporting tables with two pillars; tentacles and introvert with delicate perforated plates and long perforated rods with a few knobs, apparently retained throughout the animal's life.

*Type*.—U.S.N.M., from Point Dume, Santa Catalina, California.

*Distribution*.—Southern California, at a depth from shallow water to at least fifty fathoms.

*Specimens examined*.—The type and a dozen other individuals from Venice and Corona del Mar, California (U.S.N.M. and M.C.Z.).

This form seems to be a southern representative of *P. populifera* Stimpson. As far as the available material shows, it is slightly stouter and often dark brown or purplish in color, with dark tentacles. Only large specimens have been examined, and in these the tables are much smaller than in *P. populifera* of the same size, and the disk seems never to be star-shaped. Furthermore, the tentacles seem normally to have larger and more numerous plates, which apparently do not disappear as they do in *P. populifera*.

At Corona del Mar, California, *P. pseudopopulifera* was dredged in the same haul as *P. pseudocalcigera*, and the differences in exterior, as well as in size and shape of the spicules, were extremely striking.

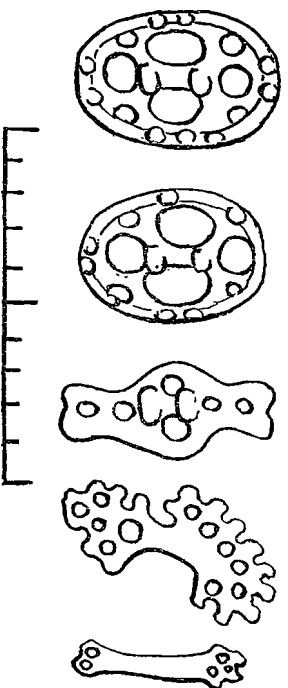
*Pentamera charlottae* spec. nov.

*Diagnosis*.—A small form, length a few centimeters; body normally cylindrical, straight; feet in double rows, cylindrical, non-retractile. Spicules, tables with oblong disk (length 0.14 mm.) and tall two-pillared spire with three or four cross beams and few teeth on the tip. Feet with large end plate and numerous, curved, supporting tables with tall spire; introvert with tables with oblong disk and dentate margin and low spire.

*Type*.—M.C.Z., no. 466, from Pacific Grove, California; known only from tide-pools at the type locality.

*Specimens examined*.—The type and two other individuals from the same locality.

The comparatively large tables with the tall spire and the presence of regular tables in the introvert, set this small species apart from the other species known from the western coast of North America. It seems out of the question that it can be a young individual of any of the other forms known from this region.



*Pentamera montereyensis* spec. nov.

Reduced tables from body wall, reduced supporting table from tube feet, and plate and rod from tentacles.

*Pentamera montereyensis* spec. nov.

*Diagnosis*.—Small form, length a few centimeters; body cylindrical; feet in five bands, cylindrical, non-retractile. Spicules, a scattered layer of oval buttons with two central knobs and up to eight marginal knobs;

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feet with large end-plate and a few perforated rods, but no indications of supporting tables. Introvert and tentacles with oblong reticulated plates with a vestige of a spire and reticulated plates and small rods. Color white, tentacles and introvert with a few pigment spots.

*Type*.—M.C.Z., no. 1840, from Lighthouse Pool, near Pacific Grove, California, (H. L. Clark). Known only from the tide-pools around Pacific Grove. Depth, tide-mark, on rocks.

*Specimens examined*.—The type and a smaller specimen (now lost), collected in 1924.

It seems to be a well defined species and not—as was at first assumed—a poorly developed individual of one of the other species known from Pacific Grove. The type measures 4 cm. in preserved condition, but was more than twice that length in life. The gonads were comparatively small, probably indicating that the breeding season was over. It was collected toward the end of June.

## EUPENTACTA gen. nov.

*Diagnosis*.—Medium-sized forms, length up to 10 cm.; body cylindrical or barrel-shaped; feet non-retractile, restricted to the ambulacra, cylindrical; tentacles ten, two ventral smaller. Calcareous ring with fairly short posterior prolongations; third loop of intestine attached in the left ventral interambulacrum; gonads with long basal stolon. Spicules, knobbed buttons or plates and cups or baskets or reticulated bodies. Feet with well developed end-plate and large supporting tables, sometimes with reduced spire; introvert with tables with low spire; tentacles with large plate and rods.

*Type species, Eupentacta quinquesemita* (Selenka).<sup>1</sup>

<sup>1</sup> Commonly known as *C. atronubiformis* Thiel. Re-examination of Selenka's material in the Museum of Comparative Zoology proves that the two forms are identical. Selenka's specimens of "*C. quinquesemita*," from Charleston, S. C., were on this occasion discovered to be merely *C. pulcherrima* (Ayres), thereby eliminating one zoogeographic puzzle. Selenka's description obviously is based on the Pacific species. (*Vide* Deichmann, 1930.)

The genus represents an interesting stage between *Pentamera* and *Pentacta*. The spicules of *E. quinquesemita* differ very little from those characteristic of the tropical genus *Pentacta*, while *E. pseudokinquesemita* has more simple spicules and seems less specialized.

*Eupentacta pseudokinquesemita* spec. nov.

? *Cucumaria chromyheimi* Mitsuikuri, 1912, p. 235, pl. 8, figs. 71-72, text fig. 46. *Nec C. chromyheimi* Théel.

*Diagnosis*.—Medium-sized form, up to 10 cm. Body more or less barrel-shaped, tapering toward the ends; feet numerous, cylindrical, arranged in five broad bands separated by wide interambulacra. Tentacles ten, the two ventral smaller; introvert well developed. Inner anatomy similar to that of *E. quinquesemita*. Spicules numerous, consisting of irregular knobbed buttons and an external layer of delicate baskets. Feet with large end plate and numerous large supporting tables; frequently with the spine reduced; introvert with small tables with low spine; tentacles with heavy plates and rods, mostly with small holes.

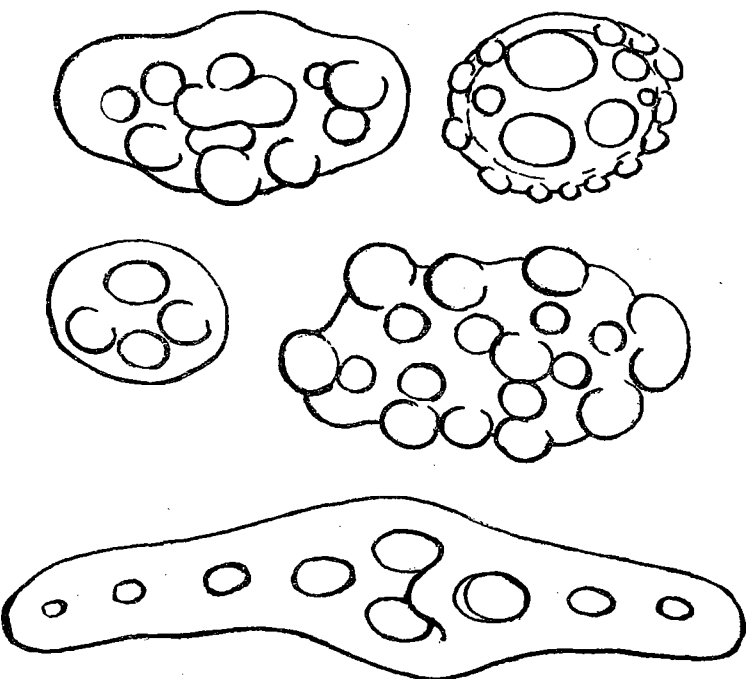
*Type*.—U.S.N.M. Type locality, Aleutian Islands.

*Distribution*.—Known with certainty from the Aleutian Islands and southward to around Puget Sound; possibly also occurring in the Japanese waters (*Mitsuikuri's C. chromyheimi*). Depth, from tide-mark to 70 fathoms.

*Specimens examined*.—The type and about a dozen other individuals from the Aleutian Islands, Sitka and near Puget Sound, in the United States National Museum and Museum of Comparative Zoölogy.

The present species differs from *E. quinquesemita* in having more numerous feet, broad interambulacra, and more simple spicules. Superficially, one would be apt to say that it was a variety of *E. quinquesemita* with poorly developed spicules and more numerous feet, but examination of a number of specimens and careful analysis of the spicules have shown that it is not possible to unite the two forms.

At Sitka both species have been collected in shallow water, but further south *E. pseudokinquesemita* is taken only in deep



*Eupentacta pseudokinquesemita* spec. nov.

Shallow basket from outer layer of integument, knobbed plates from inner layer, and supporting table with reduced spine from tube feet.

water, while *E. quinquesemita* is common in the tide-pools as far south as Morro Bay, California.

## HEDINGIA gen. nov.

*Synonym: Caudina* (partim) auct.<sup>1</sup>

*Diagnosis:*—Caudinid with fifteen tentacles with two pairs of digits, but no unpaired terminal digit. No pseudomesenteries attached to the sides of the third loop of the intestine. Spicules, huge tables or plates with large perforations and smooth or spinous surface. Exclusively deep-water forms.

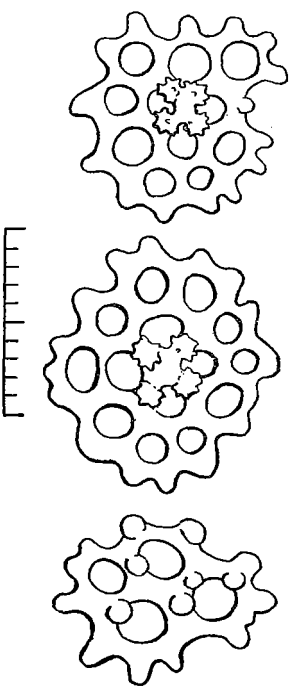
*Type species, Hedingia albicans* (Théel).

To this genus are referred the following species: *H. albicans* (Théel), *H. californica* (Ludwig), *H. planapertura* (Clark), *H. ludwigi* (Ohshima) and *H. fusiforme* (Augustin). The two latter forms have not been examined, so the absence in them of pseudomesenteries has not been proved, but they are unquestionably lacking, for these forms are closely related to *H. californica*, which lacks the structures, as does also *H. planapertura*. In the type species Ostergren (1907, p. 210, foot note) was the first to notice the absence of pseudomesenteries. He based his studies on "*C. armata*" Théel—at that time considered a deep-water variety of *C. arenata* Gould, and later discovered to be a synonym of *H. albicans*.

The members of the genus *Caudina*, s. str., are *C. arenata* Gould and *C. simile* Augustin, respectively from New England and Japan, and *C. arenicola* (Stimpson) from the coast of southern California. The position of the latter species has long been uncertain, on account of the almost complete absence of spicules, but the presence of strong pseudomesenteries makes it reasonable to place it near *Caudina*. Re-examination of a small individual (4 cm. long) from near Cedros Island, Lower California, 44 fathoms, showed that it has spicules which were very similar to those found in *C. arenata*, and slightly larger individuals, from Corona del Mar, California, possessed remnants of spicules which evidently represented the last reduced stages of these spicules, while still larger individuals had completely

<sup>1</sup> *Vidæ Hedding*, 1881; Clark, 1895.

deformed rods or plates. As these juvenile spicules never have been figured before, they are shown here.



*Caudina arenicola* (Stimpson)

Juvenile, 4 cm. long. (Albatross sta. 2838, off Cedros Island, Lower California, 44 fathoms depth.) Tables and plate from body wall.

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