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Contents of Vol. V c.

THE DANISH INGOLF-EXPEDITION

VOLUME V.

9.

ACTINIARIA

PART I.

BY

OSKAR CARLGREN.

WITH 4 PLATES AND 210 FIGURES IN THE TEXT.

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The paper on the Actiniaria, of which I now present the first part, has been drawn up according to the same plan as my reports on the Ceriantharia and Zoantharia of the Ingolf-Expedition. The main part of the material examined by myself belongs to the museums in Copenhagen and Stockholm. I have had at my disposal a rather great collection mainly enclosing the forms dredged by Romer and Schaudinn during their journey around the Spitzbergen, and I have also examined smaller collections from the museums in Upsala, Gothenburg, Lund, Christiania, Bergen, Drontheim, Tromso, Francfort on the Main and Petrograd. I beg to express my best thanks to all, who have supported my work through lending of material.

The paper on the Ingolf-Actiniaria will be divided into four sections:

1) Description of the species.
2) Survey of the literature with critical notes on the arctic and northern Actiniaria.
3) Distribution of the species.
4) Contribution to the anatomy, genealogy and classification of the Actiniaria.

In the present paper I have described all families occurring in the arctic and northern waters excepting the forms which have been referred to the old family Sagartiidae.

I have given special attention here to the size and distribution of the nematocysts and spirocysts. As before emphasized by me the stinging capsules are of great importance to the classification. Nearly related genera show great agreement in the appearance and distribution of the nematocysts, and the species are often characterised by the different sizes of these latter, though in many cases the differences are not great. In fact I think that it is impossible to put up a good system of the Actiniaria without considering the stinging capsules. Concerning my statement of the breadth of the stinging capsules I will remark that it is approximate.

Section I.

Description of the species.

Subtribus Protactininae.

Family *Gonactiniidae*.

Diagnosis: Protactininae with flattened, disclike, proximal body-end. Column of the same structure as the tentacles with spirocysts and a more or less strongly developed, longitudinal muscle- and nerve-layer, not capable of involution. No distinct sphincter. Longitudinal muscles of the tentacles ectodermal (in *Gonactinia* sometimes with a little tendency to be meso-ectodermal?) even as the radial muscles of the oral disc. Actinopharynx not rudimentary, with longitudinal muscles and often with spirocysts, with weak siphonoglyphes or without. Mesenteries typically arranged in cycles, each pair of mesenteries, except the directives, with the longitudinal muscles facing each other. 8 (the "*Edwardsia*-mesenteries"), 10 or 12 mesenteries perfect. Reproductive organs arranged in the usual manner, as a rule on all perfect mesenteries. Muscles of the mesenteries weak, especially the parieto-basilar muscles. No ciliated lobes to the mesenterial filaments. Stomata absent or only the oral stomata present.

In this family I have previously (1900) placed the genera *Protanthea*, *Gonactinia* and preliminarily also *Bolocceroides*. Concerning the last genus, which has formerly been referred to the Boloceriidae, its affinity with *Protanthea* and *Gonactinia* has been admitted by Pax (1914 p. 608) and Poche (1914 p. 97), whereas Mc. Murrich (1904 p. 255) and later Stephenson (1918 p. 6) have not accepted it as belonging to the family Gonactiniidae. These latter authors, however, have not given any important arguments for their point of view, no more have they refuted my objections against the affinity of the genus with the Boloceriidae (vide Carlgren 1911). As I have pointed out, one of the differences between *Protanthea* and *Gonactinia* on one side and *Bolocceroides* on the other is that the former are devoid of ciliated streaks on the filaments, the latter not. In 1900 I also proposed to establish a special subfamily for the genus *Bolocceroides*. Though I am continually of opinion that *Bolocceroides* is nearly related to the above-mentioned species, I think that it may be the most practical to refer it with *Bunodeopsis* and *Alicia* to the family Aliciidae, a heterogeneous family, as I will show in another paper.

To the family Gonactiniidae I furthermore refer the genus *Sideractis*. The diagnoses of this family and of the genera *Protanthea* and *Gonactinia* are a little altered and more detailed here.

Genus **Protanthea** Carlgr.

Diagnosis: Gonactiniidae with smooth column which is broader in the distal part than in the proximal one. Longitudinal muscle layer and nerve-stratum very well developed. Tentacles long, numerous, at the base a little constricted, in the apex not swollen. Oral disc conical. Only the 8 "*Edwardsia*-mesenteries" perfect. All stronger mesenteries with filaments and reproductive organs. No differentiation into filament-mesenteries and genital-filament-mesenteries. Sterile, weak mesenteries in variable numbers in the distal part of the body.

Protanthea simplex Carlgr.

Protanthea simplex sp. n. Carlgren 1891 a p. 81, textfigs.

— — Carlgr., Carlgren 1893 p. 24. Pl. 1 figs. 9, 16, Pl. 3. figs. 1—7, Pl. 4. figs. 3—10. Pl. 10. fig. 2. 1905 p. 158. Arndt 1912, p. 123, Grieg 1913, p. 143.

Diagnosis: Body cup-like with 24 rather distinct, longitudinal furrows, without fossa. Margin undulated. Tentacles numerous from about 100 to 160 in 5 or 6 cycles, the inner ones about the length of the column or longer, the outer ones considerably shorter. Actinopharynx with numerous, weak, longitudinal furrows and 6 deeper of which 2 form the siphonoglyphes which are aborally prolongated. Pairs of filament- and genital- mesenteries $6 + 6 = 12$ in the whole length of the body. Numerous sterile, filament-lacking mesenteries in the distal part of the body, in number corresponding to that of the tentacles. Longitudinal muscles of the mesenteries weak, with low folds, form no pennons. Parieto-basilar muscles weak, not folded. No stomata. Nematocysts in the ectoderm of the column rib-like, partly $17—22 \times 1,5$ to $2\ \mu$, partly $29—50 \times 3—3,5\ \mu$, in the tentacles partly $19—24 \times 2—2,5\ \mu$, partly $44—58 \times 3,5—4\ \mu$, the latter very numerous and closely arranged in the distal part (batteries of stinging cells), in the actinopharynx $22—31 \times 2—2,5\ \mu$. Spirocysts in the ectoderm of the column and tentacles from about $22 \times 2,5\ \mu$ to $43 \times 5\ \mu$, very numerous in the column and in the proximal part of the tentacles, in the distal part of the latter more sparse. Actinopharynx without spirocysts.

Colour: salmon-red, with tentacles a little paler, or white. Reproductive organs white or salmon-red.

Dimensions: Length of the column to about 1,5 cm. Breadth of the oral disc to about 1,5 cm. Diameter of the pedal disc to about 1 cm.

Occurrence: Sweden. Gullmarfiord (Saltkällefiord, Skårbergen, Börsås, Orstadhufvud, Humlesäcken) (Carlgren and others) from some few to 30 fathoms on Ascidiae, Serpula- and Chaetopterus tubes, rather common. Koster Isl. E. off Hammholmen 80—100 m.

Norway. Christianiafjord, Dröbak (Carlgren 1899) Hardangerfiord, Jonanes, Straumastein 100—400 m (teste Grieg), Oxen 100 150 fms. (Asbjörnsen, labelled *Anthea cereus*), Osterfiord (Appellöf, teste Grieg). Drontheimfiord, Röberg 200—400 m. (Arwidsson, Arndt and others) Skarnsund 100—200 m on Lophohelia (Oestergren, Arndt, Mortensen), Lofoten. Tysfiord 500 m on Lophohelia (Nordgaard).

In 1893 I have given a detailed description of this interesting, very primitive species, and therefore I here only add some statements especially concerning the size and distribution of the stinging capsules. The spirocysts in the ectoderm of the column are very numerous, their size variates from about 22 × 2,5 μ to 43 × 5 μ. In the tentacles they are of about the same size as in the column, and numerous in the proximal part, but sparse in the apex, which condition evidently is correlated with the unequal occurrence of the nematocysts in these parts (compare below). In the ectoderm of the actinopharynx I have not found any spirocysts in maceration-preparations. In my description of the species 1893 I have also expressed my suspicion that the very few spirocysts I observed in this part probably are not normal components of the actinopharynx. In the ectoderm of the column the nematocysts are numerous and partly of a smaller type 17—22 × 1,5 μ, partly of a larger one 29—50 × 3—3,5 μ. In the latter the basal part of the spiral thread is often discernible. Furthermore I have seen a few nematocysts with the thread thrown out. These capsules were of larger dimensions (60—80 × 4—4,5 μ). In the tentacles I have also observed nematocysts of two unequal dimensions, partly 19—24 × 2—2,5 μ, partly 44—58 × 3,5—4 μ. The former are rather numerous, the latter very much so in the summit of the tentacles, where they are closely packed together, so that they completely intercept the view of all other nematocysts and cells, hereby causing the distal part of the tentacles to form strong stinging batteries. Further down on the tentacles these capsules are more sparse, although also here they generally occur, the spirocysts at the same time appearing in greater numbers. The nematocysts of the actinopharynx are rather common and comparatively small (22—31 × 2—2,5 μ). Sometimes I have also here observed such large nematocysts as in the tentacles, but probably they have only been attached to the actinopharynx and belong to the tentacles. The basal part of the spiral thread is often discernible in the nematocysts of the actinopharynx. In expanded as well as sometimes in contracted state small papilliform elevations on the column are to be observed ("weissliche Flecke" Carlgren 1893) almost as in *Sideractis,* though here perhaps not so distinct. In these places the ectoderm is a little thickened, I have, however, not found any real difference in the structure of the ectoderm of the papilliform elevations and of that of the grooves between them. The shallow furrows are not always distinct, especially when the actinopharynx is expanded. In larger specimens I have noticed a greater number of tentacles than before stated by me.

Genus **Gonactinia** M. Sars.

Diagnosis: Gonactiniidae with smooth, cylindrical column. Margin not undulated. Longitudinal muscle- and nerve-layer well developed. Tentacles long, few, at the base not constricted, not swollen in the apex. Oral disc flattened or conical. Perfect mesenteries 7—10, commonly 8 (the *Edwardsia*-mesenteries"). The stronger mesenteries differentiated in filament-mesenteries and genital-filament-mesenteries. The weaker mesenteries without filaments. Arrangement of the mesenteries often irregular, probably in connection with the reproduction by transverse partition.

Gonactinia prolifera (M. Sars.) Sars.

Actinia prolifera n. sp. M. Sars 1835 p. 3, 11 Pl. 2, fig. 6.

Gonactinia prolifera Sars, M. Sars 1851 p. 142, 1853 p. 379, 386. Danielsen & Koren 1856 p. 87. Koren, 1857, p. 93. Andres, 1883, p. 366. Blochmann & Hilger, 1888, p. 385, Pl. 14, 15. Haddon, 1889, p. 340, textfig. 2. Prouho, 1891, p. 247, Pl. 9, figs. 1—3. Carlgren, 1893, p. 31, Pl. 1, fig. 14, Pl. 4, figs. 11—13; 1904, p. 546, fig. 1. Appellöf, 1893, p. 27. 1895, p. 11. Grieg, 1913, p. 143. Kerb, 1913, p. 1. textfigs. 1—5. Pax, 1915.

Diagnosis: Tentacles 14—18 commonly 16, of about the same length as the column, almost all of the same size. Actinopharynx of about half the length of the column with longitudinal furrows corresponding to the insertions of the mesenteries. Siphonoglyphes a little differentiated with aboral prolongations. Spirocysts in the ectoderm of the column about 17—22 × 2,5 μ, in the tentacles 13 × 1—24 × 2,5 μ. Actinopharynx without spirocysts. Nematocysts in the ectoderm of the column about 17—29 × 2,5—3 μ, in the tentacles partly 22—24 × 2 μ, partly 29—43 × 3,5—4 μ, the latter numerous in the distal part. Only the 4 lateral "*Edwardsia*-mesenteries" with both reproductive organs and filaments. Directive mesenteries and often the 5th couple with filaments. Mesenteries of the second cycle only common in the dorsolateral exocoels. Arrangement of the mesenteries often irregular (compare above!). Longitudinal muscles of the mesenteries and the parieto-basilar muscles very weak. No stomata.

Colour: Flesh-coloured or white with transparent inner organs.

Dimensions: Length of the column and the tentacles about 0,3 cm.

Occurrence: Sweden. Gullmarfiord in several places attached to sea-weed, Serpula-tubes or mussel-shells (Carlgren). Väderöarne (Zool. Stat. 1911) to shells of Lima, Kosterfiord. Hamnholmen 106—80 m. (Zool. Stat. 1910). North-Sea without distinct locality (Uddström).

Norway. Coast of Bergen, the islands off Bergen and the outer parts of the fiord. Solsvik Bergen 20—30 m (Kerb), Herlöfiord (teste Appellöf), Hardangerfiord, Straumastein, Saetvetnes 10—25 m (teste Grieg), Slaetholmen (M. Sars), Bougeströmmen, Manger (M. Sars), Gibostad (Dons), Hammarfest M. Sars).

Coast of Murman, Olenja Guba littoral (teste Pax).

Further distribution: Mediterranean (Prouho).

Remarks: This species has been described before in detail by Blochmann and Hilger 1888 and by myself 1893.

Concerning the distribution and size of the stinging capsules I will state as follows: In the ectoderm of the column there are nematocysts as well as spirocysts, rather numerous, the size of the former variates from about 17—29 × 2,5 μ, the latter from about 17—22 × 2,5 μ, possibly there are also smaller spirocysts, what I have not been able to decide. In the ectoderm of the tentacles the spirocysts appear everywhere in great numbers, they variate from about 13 × 1 μ to 24 × 2,5 μ. The nematocysts were of two different sizes, partly smaller and not so numerous, 22—24 × 2 μ, partly larger, 29—43 × 3,5 μ. On one part of the latter the basal part of the spiral thread was discernible. As in *Protanthea* the greater part of the large nematocysts were concentrated in the summit of the tentacles, further down they were much fewer in numbers. The distal part of the tentacles also forms rather strong batteries of nematocysts. I have not been able to decide the size of the nematocysts in the actinopharynx, as it is very difficult to get positive maceration-preparations of the little actinopharynx. Spirocysts appear to be absent here.

In a publication (1913) Kerb discusses the transversal partition of *Gonactinia*, and verifies as myself (1893) that the reproductive organs develop as well in the distal as in the proximal dividing pieces. Furthermore he means having found that also the proximal piece divides transversely. I am, however, of opinion that his experiments are not thoroughly proving, Kerb having started not from a chain of 3 indiduals, but only from one of 2 individuals. Under such circumstances it is therefore possible that the proximal piece dividing a second time was a middle piece, and not the primitive proximal piece of the chain. A chain of 3 individuals is namely to my mind very common in *Gonactinia*. (Carlgren 1904 p. 145. Kerb has evidently overlooked this paper). Thus of 10 transversely dividing specimens of *Gonactinia*, collected by Sars himself, no less than half the specimens were in tridivision, and yet *Sars* himself states having observed only a single one. In the above-mentioned paper I have tried to explain the reason why the chain of three individuals is overlooked. Besides it is possible that under very favourable circumstances the partition takes place so rapidly that the proximal piece is dropped before the middle piece is erected. In order to get a binding evidence that the most proximal piece divides again, it is necessary to follow the development of the division in a chain of 3 individuals. The experiments of Kerb only show that a proximal part is able to divide a second time, but leave undecided, whether it was a primitive proximal part or a middle piece that divided transversely.

Genus **Sideractis** Dan.

Diagnosis: Gonactiniidae with weak muscularity, without sphincter. Column and actinopharynx with weak, ectodermal, longitudinal muscles extending into the indistinct pedal disc. Column with spirocysts, but without nematocysts. Tentacles hexamerously arranged at least to the stadium of 24 tentacles, conical, of ordinary length, the inner ones considerably longer than the outer ones. Apex of the tentacles hemispherical, smooth, with batteries of large, stinging capsules, the peduncle of the tentacles with small, papilliform elevations which also occur, though less numerously, on the oral disc and on the distal part of the column. Oral disc conical. Actinopharynx longitudinally sulcated, without differentiated siphonoglyphes. 6 pairs of perfect mesenteries with filaments, and fertile. Variable numbers of weak mesenteries, sterile and without filaments. Parieto-basilar muscles weak. Typical nematocysts absent.

The above diagnosis of the genus completely differs from that given by Danielssen 1890. Above everything I must emphasize that the statement of Danielssen that the circular muscles are mesogloeal, is wrong. Besides, the description of the anatomical conditions by Danielssen is on several points erroneous and very incomplete. After an examination of well preserved material, compared with that of Danielssen, the genus turned out to be a very primitive form belonging to the family Gonactiniidae.

Danielssen has established the genus as a separate family, Sideractidae, which in his opinion would be related to the family Boloceriidae. Also Mc. Murrich (1893 p. 153) adopts this opinion. This is, however not the case, as the following description will clearly show. Verrill (1899 p. 143, 144) declares that the genus probably belongs to the Paractidae. Now my suggestion (1902 p. 43) that the genus is related to the family Antheadae (Actiniidae) is correct — at the time of this statement I had only had the opportunity of examining the most distal part of the original specimen in which only fragments of the column were left. In reality the genus is closely related to the family Gonactiniidae. It is true that it differs in several respects from *Protanthea* and *Gonactinia*, above all as regards the structure of the tentacles and the presence of a greater number of perfect mesenteries, but in spite of these differences I think that it is not necessary, at least not at present, to establish a special family for *Sideractis*, which establishment in such a case would have to be founded for one thing on the structure of the tentacles and on the greater number of perfect mesenteries. Thus I refer *Sideractis* to the family Gonactiniidae together with *Protanthea* and *Gonactinia*. The genus contains only one known species, *Sideractis glacialis* Dan.

Sideractis glacialis Dan.

Pl. 1. Figs. 17—19.

Sideractis glacialis n. sp. Danielssen 1890 p. 14. Pl. 1. fig. 1. P. 7. figs. 10, 12.

Diagnosis: Pedal disc wide, indistinct, with undulated border. Column with longitudinal furrows corresponding to the insertions of the mesenteries. Tentacles 24—38, in the stadium of 24 tentacles arranged in three cycles (6 + 6 + 12). Arrangement of the tentacles in later stadia more irregular through the development of new tentacles in the transversal plane (always?). Papilliform elevations composed of ectodermal thickenings, containing numerous spirocysts. Stinging capsules of several kinds in the apex of the tentacles, partly typical spirocysts, partly capsules with thread densely rolled-up (size: 86—106 × 12—14 μ), partly of equal width with the basal part of the spiral thread distinct and of two different sizes 55—79 × 5 μ and 24—29 × 3 μ. Stinging capsules in the actinopharynx with thread densely rolled-up, 53—60 × 13—17 μ, and others of equal width as those in the apex of the tentacles, 24—31 (seldom 46) × 5—6 μ.

Colour: Almost transparent. Column and tentacles greenly shimmering, the oral disc redly so. Apex of the tentacles with a white annulus. Actinopharynx and filaments pale red (Danielssen).

Dimensions: In living state. Diameter of the pedal disc 2 cm. Height of the column 0,5 cm (Danielssen). In preserved state: 1) The type specimen: Diameter of the oral disc 1,5 cm. Length of the inner tentacles 0,6 cm breadth 0,25 cm, length of the outer tentacles 0,35—0,4 cm. 2) The best preserved specimen from Sunde: Length of the column 0,4 cm, cone of the oral disc 0,15 in height. Inner tentacles 0,35, outer tentacles 0,2 cm.

Occurrence: 70 41′ N. 10 10′ W. 263 fms. Temperature at the bottom ÷ 0,3, brown clay with stones. (Norw. North-Atl. Exp. 1877) 1 sp.

Norway. Sunde, mouth of the Hardangerfiord proper (G. O. Sars) 2 sp.

Exterior aspect: The indistinct pedal disc was extended, thin and membranous in the original specimen, in one specimen from Sunde completely pulled off, in the other one (Pl. 1. figs. 17, 18) partly rather much damaged, and the filaments of one side pressed out. Though the preserving of it was anything but good, I do, however, think that I am able to decide that it was furnished with radial furrows. In sections through the pedal disc deep incisions, where the mesenteries inserate, are namely to be observed. Danielssen also says that the border of the pedal disc is undulated. The column is low or high according to the more or less contracted state of the body (the specimens from Sunde were both cylindrical and very much contracted). In the reproduced specimen (Pl. 1 fig. 17) distinct, longitudinal furrows appear on the column, on the distal part one can see small, papilliform elevations of the same appearance as on the proximal parts of the tentacles, but these elevations are much more indistinct here than there, and sometimes not visible at all.

The tentacles are of ordinary length, but broad. Their form is conical, in the apex they are hemispherical and smooth, while the larger, proximal part bears small, papilliform elevations, very closely packed; in the extended, reproduced specimen and in the type specimen (Pl. 1. fig. 19) they are very distinct On the other, very contracted specimen from Sunde these elevations are not visible, neither on the tentacles nor on the oral disc or the column. The inner tentacles are considerably longer and broader than the outer ones. The reproduced specimen had 24 tentacles (6—6—12), the other specimen from Sunde 28. Besides the 24 tentacles arranged in the usual manner there are on each side of the directive plane 2 tentacles developed in the transversal plane (in the primary, lateral exocoels). Danielssen declares that his specimen is provided with 32 tentacles, octomerously arranged. That is, however, not so, in fact there are 38 tentacles developed. On one side 18 tentacles namely appear, on the other 20. It is difficult to find out how the tentacles really are arranged, because of the bad preservation of the type specimen. I think, however, that on basis of my notes I can make the conclusion that the richer development of tentacles takes place mainly in the transversal plane. It is also possible that after the stadium of 24 tentacles another arrangement of the tentacles appears; I am really more inclined to think that in the type specimen the arrangement is decamerous instead of octomerous. Perhaps this arrangement is only temporary, so that the animal after having reached the stadium of 48 tentacles (if it obtains so many) rearranges the tentacles hexamerously. Concerning the mesenteries I have observed such a rearrangement to take place in *Condylactis georgiana* (Carlgren 1898 p. 11, 12).

The oral disc is on the extended specimen conical, with the more or less split-like mouth in the apex of the cone (Pl. 1, fig. 18). It is wide and furnished with radial furrows extending into the actinopharynx, whereby the margin of the mouth becomes of an indistinctly crenellated appearance. On the oral disc we find the same papilliform elevations as on the tentacles, though they are smaller and more indistinct. The actinopharynx is longitudinally sulcated. Danielssen declares that there are 8 furrows, on the specimens from Sunde there are about 14. The furrows in the directive plane differ in no respect from the others.

Anatomical description. Only the distal part of the original specimen remained after the examination by Danielssen, and even of this a large piece was not well preserved. For the anatomical examination I have cut out a piece with 4 tentacles. Furthermore I have sectionised the best conserved specimen from Sunde, mostly transversally.

The pedal disc possesses, judging from the specimen from Sunde, a thick ectoderm containing numerous mucus-cells. Whether spirocysts occur also here I cannot decide, as maceration-preparations do not give any positive result, because of the unfavourable conservation and the sticking of the filaments to the pedal disc. On the other hand I have in sections found nematocysts agreeing with both smaller kinds of

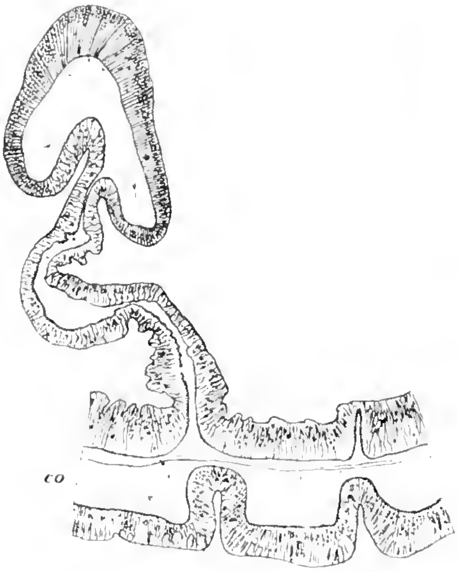

Fig. 1.

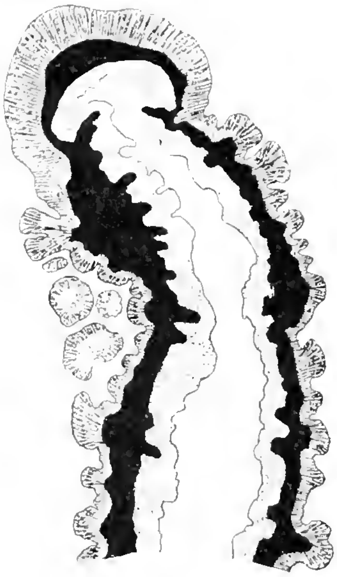

Fig. 2.

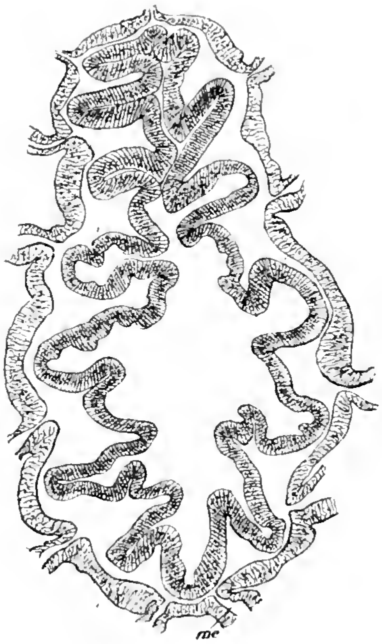

Fig. 3.

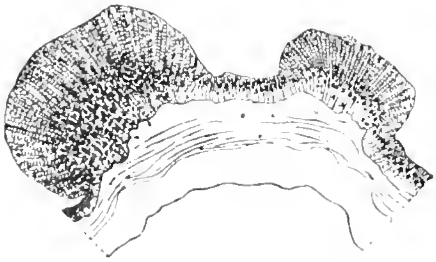

Fig. 4.

Fig. 5.

Sideractis glacialis. Textfig. 1. Transversal section through one part of the column (*co*), a perfect and an imperfect mesentery at the transition of the actinopharynx in the filaments. Fig. 2. Longitudinal section through the distal part of a tentacle. Fig. 3. Transversal section through the actinopharynx and the bases of the mesenteries (*me*). Fig. 4. Part of the tentacle in section, showing the papillae containing spirocysts. Fig. 5. Transversal section through the peduncle of a tentacle.

these in the filaments. If spirocysts really are present, they are at any rate very rare. The ectoderm of the pedal disc is provided with very weak, radial muscles. The mesogloea is thin and only at the insertions of the mesenteries very much thickened. It is homogeneous, with sparsely scattered and ramificated cells, the mesogloea has, however, this appearance in all parts of the body.

The ectoderm of the column is of equal height and contains, in addition to the supporting cells, numerous mucus-cells, while I have not observed any granulous gland-cells. It ought to be mentioned that no such cells have been discovered by me in the ectoderm of the tentacles or in the oral disc, only in the filaments and very sparsely in the ectoderm of the actinopharynx they seem to be present. Typical spirocysts are found in the ectoderm of the column, in the small elevations of the distal part they are most numerous, in the proximal part more sparse. The papilliform elevations are almost exclusively thickenings of the ectoderm, only in a small degree the mesogloea takes part in the composition of the papillae which contain very numerous, densely packed spirocysts; the parts of the ectoderm between the papillae are on the other side more destitute of spirocysts. At the base of the ectoderm there is a weak stratum of nerve-fibrillae and nerve-cells and also a distinct, though weak layer of longitudinal muscles (textfig. 1) which are especially conspicuous in preparations stained with iron-haematoxylin. The mesogloea is rather thick between the furrows, while Danielssen says that it is thin. This difference must, however, certainly be referred to the unequal state of contraction of the type specimen and of the specimen from Sunde, examined more in detail by myself. The inner part of the mesogloea is homogeneous here as also in the mesenteries; in the outer parts cells and now and then fibrillae are scattered or accumulated. Danielssen has interpreted the fibrillae as mesogloeal, circular muscles. In reality the circular muscles of the column are very weak and endodermal and form no sphincter. The endoderm is high and provided with numerous mucus-cells.

The ectoderm is higher in the smooth, hemispherical ends of the tentacles than in the the other part of the tentacles which is set with elevations, and much thicker than the mesogloea, and in all places of the same height (textfig. 2). It is characteristic by its abundance of stinging capsules, by which the apex of the tentacles form strong batteries. In addition to common spirocysts of the same appearance as those of the column there are large stinging capsules with densely rolled-up thread and of considerable size (86—108 × 12—14 μ — sometimes there are still larger capsules). Besides, I have here observed very large, irregularly formed capsules, of a granulate appearance and of variable length which are probably stages of development of the former. I have namely found capsules of an intermediate shape, that is to say capsules which in form and granulation agree with the latter, but in the appearance of the spiral thread with the former. All these capsules are, however, rather rare, whereas another sort of capsules is very common. They are drawn out, of equal width, with distinct basal part to the spiral thread and much thinner than the large spirocysts (55—77 × 5 μ). Their thread is very twisted and its windings, close by the basal part, very distinct. Stages of development of these capsules with indiscernible thread are also found. At last there appear smaller capsules of the same appearance as the drawn-out capsules but of smaller sizes (24—29 × about 3 μ). The stratum of nerve-fibrillae is distinct, but not thick, the muscles of the ecto- and endoderm weak. The mesogloea is mostly very thin, the endoderm thick. The proximal part of the tentacles, carrying elevations, is built just as the distal part of the column. The spirocysts are very numerous in the elevations (textfig. 4), mucus-cells are here also rather common, though rarer in the apex of the tentacles. The mesogloea is thick, irregularly and grossly folded and of the same structure as in the column. The endoderm is thinner than the other layers, the endodermal muscles weak. The oral disc is built as the proximal parts of the tentacles, the elevations are, however, not as densely packed. The radial muscles are a little stronger than the longitudinal muscles of the tentacles, and the mesogloea not as much folded as there.

The ectoderm of the actinopharynx makes several folds (compare above), supported by thick balks of the mesogloea (textfig. 3). In addition to numerous supporting cells mucus-cells are rather commonly found in the ectoderm of the actinopharynx, but granular gland-cells very rarely — in maceration-preparations I have only observed few of these latter furthermore stinging capsules, partly some uncommonly large with strongly twisted thread of the same appearance as those in the tentacles, but a little shorter (53—60 × 13—17 μ), partly smaller ones, almost equally wide and with distinct basal part to the spiral thread (24—31 × 5—6 μ. Very seldom I have observed still larger ones of the same kind (46 × 5 μ); I have also found stinging capsules in different stages of development (compare above). The nerve-layer and the longitudinal muscles are very weak, the mesogloea in the longitudinal ridges thick, and endoderm of the same appearance as in the column. No differentiated siphonoglyphes.

The number of mesenteries in the sectionised specimen from Sunde was 24, of which 6 pairs were perfect, and of these 2 pairs of directives. The twelve mesenteries of the second cycle were regularly developed. They are thin and rise a little out of the column, only in the distal part they are stronger. Danielssen says that there are 16 pairs of perfect and 16 pairs of imperfect mesenteries in the type-specimen. This is, a priori, rather unlikely as the animal had only 38 tentacles. Danielssen is certainly erring here as so many times before. Nevertheless a third imperfect cycle might be present as well in the type-specimen as in the second specimen from Sunde, in as much as more than 24 tentacles occur in both specimens. The muscles of the mesenteries are very weak. The longitudinal muscles are attached to large folds of the mesogloea, (textfig. 1), the parieto-basilar muscles are not folded, and basilar muscles lacking. The mesogloea is thick in the upper part, thin in the lower one, and only at the insertions of the mesenteries it is thickened. The endoderm is rather high with numerous mucus-cells.

The filaments of the mesenteries are simple, without ciliated lobes, and join only on the mesenteries of the first cycle. They enter into the ridges of the actinopharynx without any direct limit (textfig. 1), their structure even much corresponding to that of the actinopharynx. They are very meandrian and of considerable diameter. The gland-cells are rather rare, especially the mucus-cells; the supporting cells numerous, in sections with densely packed nuclei as in the ectoderm of the actinopharynx. The stinging capsules are like those of the actinopharynx. The larger ones with twisted thread are rather rare and 41—62 μ long and about 17 μ broad. Also of these latter I have observed stages of development. They are of variable size and show the same structure as the stinging capsules in the apex of the tentacles. The thinner capsules of equal width are also rather rare and 24—31 μ long and about 7 μ broad. Besides, I have seen some smaller capsules of the same kind (17—19 × 4 μ). In transversal sections the mesogloea shows a T-like appearance. No endodermal limit-streak is found.

The examined species from Sunde was a male with well developed spermatozoa. Only the 6 first mesenteries are fertile. The information, given by Danielssen, that the reproductive organs appear in the imperfect mesenteries, needs confirming.

Family *Ptychodactiidae*.

Diagnosis: Protactininae with pedal disc not well defined from the column. Longitudinal muscle- and nerve-layer in the column weak. Spirocysts in the ectoderm of the column few (or absent?). Sphincter absent or very weak, endodermal. Actinopharynx now very rudimentary, now well-developed, yet always of large diameter and furnished with special arrangements accelerating the circulation. Mesenteries few or numerous, all with reproductive organs. Muscles of the mesenteries weak, typically arranged. Ciliated lobes of the filament absent. Incomplete mesenteries in the distal part above the glandular streak of the filaments with curious structures giving the appearance of a half-funnel. Reproductive organs only in the proximal parts of the mesenteries, the glandular streaks of the filaments more distal.

Genus **Ptychodactis** Appellöf.

Diagnosis: Ptychodactiidae with low but broad column lacking all sorts of papillae. Spirocysts in the ectoderm of the column very rare (or absent?). No sphincter. Tentacles numerous. Actinopharynx short, possibly rudimentary, not distinctly differentiated from the oral disc, with curled aboral prolongations on the stronger mesenteries. No siphonoglyphes. Mesenteries numerous, those of the first cycle, and as a rule also those of the second, perfect. Glandular streaks of the filaments very meandrian. The proximal parts of the mesenteries only slightly coalesced.

Ptychodactis patula Appellöf.

Pl. 3, Fig. 6.

Ptychodactis patula n. sp. Appellöf 1893 Pl. 1—3.
— — App. Carlgren 1914 p. 13.

Diagnosis: Body low, often disc-like, broader in the proximal end than in the distal one. Column and pedal disc in preserved state with circular ridges and furrows. Tentacles in 4—5 (to 6?) cycles, about 100—122, a little smaller in number than the mesenteries, distinctly longitudinally sulcated conical, short, with weak, ectodermal, longitudinal muscles. Oral disc with shallow, radial furrows and weak, radial muscles, actinopharynx with ectodermal, longitudinal muscles. Curled prolongations of the actinopharynx on the mesenteries of the first and of most of the second cycle. Pairs of mesenteries to about 72 (6 + 6 + 12 + 24 + one more or less complete fifth cycle). Parieto-basilar muscles and stomata absent. Spirocysts in the column and in the oral disc extremely rare, also in the tentacles not common. Nematocysts not especially numerous and small, in the column about 11—14 × 2—2,5 μ, in the tentacles from 10 × 2—2,5 μ to 19 × 3,5 μ and in the actinopharynx 12 × 2,5 μ to 19 × 3,5 μ.

Colour: Specimens living on Primnoa yellow with salmond-red filaments, those on Muricea blue (Nordgaard).

Dimensions: Proximal part of the animal to about 7,5 cm broad. Length of the tentacles 1—1,5 cm (Appellöf). Specimen from the Ingolf-Exp. (compare below).

Occurrence: Norway. Drontheimfiord 100 fms. on Muricea placomus and on Primnoa lepadifera (Nordgaard, G. O. Sars)

N. of Iceland, 66°3′ N. 20°05′ W. 44 fms. Temperature at the bottom 5,6° (Ingolf-Exp. St. 127) 1 sp.

The anatomical description of the species given by Appellöf I have further completed in 1914 and, among other things, I have pointed out the presence of the curious, half-funnel-like formations on the imperfect mesenteries. I now want to add something to this, especially with regard to the actinopharynx. The specimen dredged by the Ingolf-Expedition is much smaller than the specimens described by Appellöf, has produced only few reproductive elements and is very contracted. The diameter of the pedal disc was 2 cm, the height of the column 1 cm and the breadth at the distal end about 1 cm, the greatest length of the tentacles 1,2 cm. The tentacles were only 40 in number. The outer habitus of this specimen agrees very well with the description which Appellöf gives of the species, and very much resembles the specimen reproduced in fig. 1 in the paper by Appellöf, though the body is a little higher (Pl. 3. fig. 6) and the mouth is almost closed and sourrounded by a wall rising above the other part of the oral disc. From the upper rim of this wall (opening of the mouth?) to the lower end of the actinopharynx the distance is 0,35—0,45 cm (in reality the distance is a little greater, as the undermost part of the actinopharynx is bent outward). The whole thing looks as if the actinopharynx is much longer than stated by Appellöf. As however no distinct limit exists between the oral disc and the actinopharynx — the ectodermal radial muscles and the radial furrows on the oral disc are prolongated as longitudinal muscles resp. longitudinal furrows into the actinopharynx (a factum already emphasized by Appellöf) and the occurrence and the size of the stinging capsules are the same in both regions — it is almost impossible to decide, where the actinopharynx begins. If we are of the same opinion as Appellöf and regards the actinopharynx as reduced to a thin joint, the animal has the capability — as the Ingolf-specimen shows — of turning down the central parts of the oral disc, so that they look like the actinopharynx, and "the mouth" is not on the rim of the actinopharynx, but completely surrounded by the oral disc. If in opposition to this we consider that the actinopharynx begins at the "mouth", the actinopharynx is nowise as much reduced as Appellöf assures, though on such a supposition certainly short. I therefore hold it best to modify a little the diagnosis of the genus concerning the length of the actinopharynx. Furthermore the actinopharynx of the Ingolf-specimen shows the same appearance as that of the specimen described by Appellöf, the prolongations of the actinopharynx on the mesenteries are however not as strongly folded in the former. Concerning the inner organisation I cannot give any information of the arrangement of the mesenteries as I have not found it desirable to totally sectionise the specimen. The half-funnel-shaped formations on the imperfect mesenteries agree in their structure with those described by me before (1914). The glandular streaks were very meandrian, and the slightly developed reproductive organs were limited to the lower parts of the mesenteries under the glandular streaks. The longitudinal muscles of the column were distinct, though they do not seem to form a continuous lamella. The spirocysts of the tentacles were rare and about 14—17 × 2,5 μ in size, those of the column and of the oral disc very uncommon — after much searching in the maceration-preparations I found only one spirocyst in the column and one pair in the oral disc. Also the nematocysts are not particularly numerous and, like the spirocysts, they are of inconsiderable size, in the column 11—14 × 2,5 μ, in the tentacles 10 × 2—2,5 μ to 19 × 3,5 μ and in the actinopharynx 12 × 2,5 μ to 19 × 3,5 —4,5 μ. The spiral thread is often discernible in the greater nematocysts of the tentacles and of the actinopharynx. I have examined the stinging capsules as well in one of the type-specimens as in the Ingolf-specimen.

Family *Halcuriidae (Endocoelactiidae).*

Diagnosis: Protactininae with pedal disc not well defined from the column. The ectoderm of the column as well as that of the actinopharynx with spirocysts, (spirocysts sometimes absent: in the column of *Halcurias endocoelactis*, teste Stephenson). Longitudinal muscles as a rule absent in the column (in *Halcurias pilatus* present, teste Mc. Murrich). No sphincter. Tentacles arranged either in two alternating cycles or in several such, very much displaced (18 + 10 + 16 + 8 + 16) and not arranged as in the typical Actiniaria. Longitudinal muscles of the tentacles ectodermal, radial muscles of the oral disc ectodermal or with a little tendency to be mesogloeal (meso-ectodermal). Actinopharynx strong with 1—2 siphonoglyphes. Mesenteries from the second cycle developed in the endocoels — each pair of mesenteries with the longitudinal muscles facing away from each other — and arranged either cyclically, or, from the 20(—28) mesentery-stage, bilaterally in 8 or in a few more development-zones. In the latter case each bilateral pair consists of a micro and a macro-mesenterium (or of two equally developed mesenteries?). Longitudinal muscles of the mesenteries mostly weak, sometimes forming pennons. All stronger mesenteries with reproductive organs.

In this family I (1918) have included the genera *Halcurias* Mc. Murr. (= *Endocoelactis* Carlgr.), *Synhalcurias* Carlgr., *Synactinernus* Carlgr., *Isactinernus* Carlgr. and *Actinernus* Verr. (= *Porponia* R. Hertw.). Compare this paper. To these genera Stephenson (1918b) adds a new genus, *Carlgrenia* which evidently is much related to *Halcurias* and possibly might be referred to this genus. Concerning the species *Halcurias endocoelactis*, described by Stephenson (1918a), it is questionable if this species really is an *Halcurias*. The in certain respects incomplete description of the species, given by Stephenson, founded on his examination of a single specimen, seems to me to indicate that we have to do with a distinct genus. The arrangement of the mesenteries is not the typical *Halcurias*-distribution, but seems to be more irregular as in *Synhalcurias*. Probably the development of the later mesenteries resembles that in *Actinernus* and is also bilateral. It is, however, not quite identical as it looks as if the new mesenteries develop more unilaterally, in so much as the development-zones seem to be found on both sides of the 4 mesenteries of the second cycle Judging from the description by Stephenson it forms a transition between the *Halcurias*- and the *Actinernus*-types. Also the absence of the spirocysts in the column, if not overlooked by Stephenson, — (S. has examined the column only on sections and not on maceration-preparations which give the only certain criterium if the spirocysts are very rare or absent) — speaks for the opinion that this species may form the type of a new genus, because all other known Halcuriidae have spirocysts in their column-ectoderm. I propose for this new genus the name *Halcuriopsis* and give here a preliminary diagnosis based on the description by Stephenson:

Elongated Halcuriidae, not distally lobated. Column smooth without papillae and spirocysts. Tentacles short, conical, without thickenings of the mesogloea at the outer side of the base, comparatively few. Arrangement? Longitudinal muscles of the tentacles ectodermal, not strong. Only one siphonoglyphe. Mesenteries comparatively few, the older with strong muscle-pennons, to the stage of 20 mesenteries developed as in Halcurias, from this stage new mesenteries originate, probably in only 8 development-zones on both sides of the 4 mesenteries of the second cycle. Both mesenteries of the same pair equivalent.

Genus **Actinernus** Verr.

Diagnosis: Halcuriidae with thick cylindrical body, in the distal part more or less increasing in breadth and often forming distinct lobes commonly 8 in number. Sometimes these lobes are only indicated or wanting in young individuals. Tentacles of ordinary length, conical or cylindrical, excepting the youngest (and in *A. elongatus* also the inner ones?) cannot be covered by the column; on the outer side with very thick mesogloea which continues bridgelike in the mesogloea of the column. The arrangement of the tentacles more or less distinct, not frequently like that of *Halcurias*. For the greater part the tentacles are concentrated in two cycles with the largest tentacles in the apex of the lobes. Oral disc wide, especially where distinct lobes are present, more narrow between the lobes, with weak, radial ridges and shallow furrows between. Actinopharynx well developed with rather numerous, deep, longitudinal furrows and 2 broad siphonoglyphes, to which several mesenteries are attached. Mesenteries numerous, arranged in the beginning as the older mesenteries of *Halcurias*, after the stage of 20 mesenteries or a little later the mesenteries originate bilaterally, in 8 or some more development-zones, situated between the distal lobes. The development of the mesenteries goes on mostly from the edges of the endocoels towards their middle. The bilateral pairs consisting each of one micro- and one macro-mesenterium. Dioecious.

Actinernus nobilis Verr.

Actinernus nobilis n. sp. Verrill 1879 p. 474.
— — Verr. Verrill 1885 p. 534 fig. 23, Andres 1883 p. 584.
Carlgren 1914 p. 70. 1818 p. 32 textfigs. 8—10, 25.

Diagnosis: Body cup-like, short, toward the distal part forming 4 greater and 4 smaller, alternate lobes. The lobes sometimes (often?) show a tendency to divide into feeble, indistinct, secondary lobes. Mesogloea-bridges on the outer side of the tentacles broad, somewhat depressed from without inwards, teeth-like, rather short and sharp-pointed in the apex. Distal parts of the tentacles of normal appearance, conical, in the summit pointed, not sulcated, or feebly lengthwise so. Arrangements of the tentacles indistinct, at least in two cycles. Number of tentacles to about 120. The thick-walled nematocysts in the ectoderm of the pedal disc 25—31 (36) × 2,5 μ, those of the column 24—38 × 2—2,5 (3) μ, those of the tentacles partly 38—61 × 2,5—4 μ, partly 22—29 × 2 μ, those of the actinopharynx 34—41 × 2,5 μ. Spirocysts in the column commonly 31—48 × 5 μ, sometimes larger, those in the tentacles of variable size, the largest up to 67 × 7 μ, those in the actinopharynx about as those in the tentacles. Arrangement of the mesenteries bilateral after the stage of 20—28 mesenteries. Longitudinal muscles of the tentacles comparatively weak, radial muscles of the oral disc somewhat stronger, both of these ectodermal. Longitudinal muscles of the mesenteries not strong, form no distinct pennons. Parieto-basilar muscles weak.

Colour: In recently preserved state: oral disc and tentacles deep purplish brown, with radiating lines of paler colour on the oral disc, mouth (actinopharynx) deep brown inside, sides of body milk-white with traces of orange-colour where the outer coat remains (Verrill).

Dimensions: Up to 10 cm broad and 7,5 cm high in preserved state (Verrill).

Occurrence: Davis Strait 63°30′N. 54°24′ W. 582 fms. Temperature at the bottom 3,3 (Ingolf-Exp. St. 25).

Further distribution: North-Atlantic. Northern part of U. S. A. from deep water rare, common at Nova Scotia from a depth of 200—300 fathoms (Verrill).

This species I have described in detail in 1918, wherefore I now only give a diagnosis of the same.

Subtribus Nynactininae.

Athenaria s. Abasilaria.

The group Athenaria (Carlgren 1898), or more distinctly termed Abasilaria (Carlgren 1905), differs from the more differentiated Actiniaria, Thenaria or Basilaria, through the character that the basilar muscles are wanting in the former, present in the latter, and includes almost all the old groups, Actinines pivotantes, proposed by Milne-Edwards 1857, and the family Ilyanthidae established by Gosse 1858, excepting the genera which afterwards proved to belong to quite different Anthozoa, such as *Sphenopus*, *Arachnactis* and *Cerianthus*. I am of opinion that in the system of Gosse 1858 we also find no less than four families of Athenaria represented, the Edwardsiidae by the genus *Edwardsia*, the Halcampidae by *Halcampa*, the Halcampoididae by *Peachia* and the Ilyanthidae by *Ilyanthus*. Besides these families I include in the group the families Limnactiniidae n. fam., Andwakiidae and Halcampactiidae which certainly would have been referred to the Actinines pivotantes or Ilyanthidae, if they had been known at the time of the formation of these groups. The diagnoses which different authors have given of these groups are namely such that they in reality almost correspond with the character of the group which I have called Athenaria. Thus Milne-Edwards characterizes his Actinines pivotantes as follows. "Espèces dont le pied est très petit et le corps fort allongé", and Gosse his family Ilyanthidae in the following manner. "Corporis extremitas inferior obtuse rotundata sine basi adhaerente ....". Other authors, having used the group to about the same extent, give the following diagnosis of it. "Column elongated, tapering below to a pointed or rounded base, without a distinct disc .... (Verrill 1864)", "Actinianae liberae basi musculari carentes" (Andres 1880), "Körper verlängert wurm- oder säulenförmig, hinten zugespitzt, nicht scheibenartig verbreitet und daher nicht festheftend, nur in Sand vergraben" (Klunzinger 1877), "Hexactinien mit abgerundetem aboralen Körperende ohne Fussscheibe" (R. Hertwig 1882). Thus the absence of a real pedal disc is the main character which these authors have given the Actinines pivotantes or Ilyanthidae, the same character which distinguishes the Athenaria, still with the difference that the absence of the basilar muscles is the principal character, while the shape of the proximal body-end, if pointed, rounded or flattened disc-shaped, is of little importance as pointed out by me (1905 p. 517), though it is true that most Athenaria commonly show a rounded-proximal body-end. This part is namely in certain species able to alter its shape, f. inst. *Milne-Edwardsia loveni* alters the shape of its proximal end in accordance with the variation of the canals in the dead Lophohelia-stocks, and the commonly rounded or a little flattened proximal end of *Milne-Edwardsia carnea* is capable of flattening out disc-like, so that it gets a considerable breadth, at the same time as the body becomes low and conical what I have observed in a specimen, the cuticle of which was dropped in the aquarium (Compare *Milne-edwardsia carnea*). *Halianthella* (= *Marsupifer*) has the same capability. A specimen of this latter, taken by the German deep-sea expedition was namely almost cake-like and reminded of a very contracted Thenaria with a real pedal disc (with basilar muscles). The aboral, flattened end was attached to a stone. Under such circumstances there is nothing at all to prevent referring to the Athenaria such a genus as *Octineon* which is devoid of basilar muscles, and the proximal body-end of which forms a wide, basal plate incrusted with sand.

The absence of basilar muscles is common to the Athenaria, Protactininae and Protostichodactylinae (Corallimorphidae, Discosomidae, Carlgren 1900).

My suggestion to divide the Actininae into two groups, Athenaria and Thenaria, has been opposed by Mc. Murrich and Poche. Mc. Murrich (1904 p. 221) declares that this division in Athenaria and Thenaria "tends to the confusion of unrelated forms and the separation of others which are nearly related", an idea which I showed (1905 p. 517) to have no foundation whatever, in as much as I pointed out that the opinion of Mc. Murrich that the basilar muscles of the Thenaria are homologous with the parietal muscles of the Athenaria, on which he mainly supports his statement, is false. At the same time I reject the supposition of Mc. Murrich that *Haloclava* and *Eloactis* would be Thenarians. Mc. Murrich prefers to divide the Actiniaria at once in families "recognizing in addition to the Edwardsiidae, which will include in addition to the Edwardsiae and Halcampidae (Auct.) the genus *Scytophorus*, the Gonactiniidae, which will include *Gonactinia*, *Protanthea* and possibly *Oractis*, the Peachiidae, including *Peachia* and *Haloclava* and the Ilyanthidae having essentially the limitations recognised by Andres (1883)." On further examination we find, however, that the enumerated forms are devoid of basilar muscles, while all other genera, described in the paper of Mc. Murrich 1904, are Thenarians. In the system of Pax (1914), which is for a great part based on my works, he begins by placing among Nynantheae the same families as I myself (1900 p. 24), and gives as first character "ohne Fussscheibe und Basilarmuskeln", while he continues by enumerating families which are mainly characterised by the presence of a well-developed pedal disc, (an exception being made by the free-swimming Minyadidae which belongs to the Stichodactylinae, owing to my examination (1914).

Under such circumstances it seems difficult to me to understand that it would be wrong, from a classificatory point of view, to comprehend all families without basilar muscles in a large unity and all with basilar muscles in another. The absence of the basilar muscles is namely, as shown by me, a primitive character occurring only in lower Actiniaria, and moreover it is characteristic of the Zoantharia (s. str.) and Madreporaria, the Anthozoa, to which the Actiniaria are most nearly related. In those groups there is no real pedal disc but rather a basal plate of exactly the same nature as in *Protanthea* and *Octineon*. Thus as we find that several families are devoid of basilar muscles, while others have such, and as furthermore this lacking of basilar muscles is a primitive character which they have in common with Zoantharia and Madreporaria, the basilar muscles appearing only in the more differentiated Actiniaria, I cannot see that there is any ostensible reason against dividing the Nynactininae into Athenaria and Thenaria (Abasilaria and Basilaria). It would, of course, be different, if it was to be proved that forms without as well as with basilar muscles appeared in one family. In a single case genera without, and some with basilar muscles have in fact been referred to one family, namely the Aliciidae. In my opinion such a classification is not well founded, and the family is heterogeneous, as I have already stated (1900 p. 96) and will further discuss later on. The objection by Poche (1914 p. 96) that circumstances in the family Aliciidae prove the groups Athenaria—Thenaria to be untenable, is invalid. His other objection to my classification is no better; he namely writes: "Die Einwendungen Mc. Murrich's gegen die Unterscheidungen der Abteilungen Athenaria und Thenaria, die im Wesentlichen auf das Fehlen bezw. Vorhandensein der Basilarmuskeln gegründet ist, hat Carlgren allerdings zum Teil in befriedigender Weise widerlegt. So wird man seiner Bekämpfung der von Mc. Murrich behaupteten Homologien der Basilar- mit den Parietalmuskeln gewiss beistimmen, ebenso seiner Zurückweisung des auf Haloclava und Eloactis gegründeten Einwandes. Unwiderlegt bleibt aber der Einwurf betreffs der nahen Zusammenstellung von Edwardsia und Halcampa einerseits, mit Ilyanthus andererseits." As far as I understand, Mc. Murrich in his paper (1904 p. 221) does not make any manifest objection especially to the placing of *Ilyanthus* near the Edwardsiidae, and even if he does object, I do not see his reason for it, *Ilyanthus* being no more a Thenarian than *Haloclava* and *Eloactis*, but really an Athenarian. The occurrence of a rather well-developed, endodermal sphincter in *Ilyanthus*, in contradistinction to the weak, endodermal muscles in *Edwardsia* forming no sphincter, does not speak against the classification proposed by myself. The nature of the sphincter is namely at most a family character. Mc. Murrich wrongly refers *Halcampa* with its mesogloeal sphincter to the Edwardsiidae, and *Oractis* which is provided with a well-developed endodermal sphincter, together with the sphincter-lacking *Protanthea* and *Gonactinia* to the Gonactiniidae.

If thus the establishment of the groups of Athenaria and Thenaria is well founded, it remains to make clear the extent of the different families which would have to be placed in the former group. The classification of the Actiniaria, lacking a pedal disc, varies considerably according to the different authors, in as much as some of them discern only one, others few or several families. The previous authors, such as Milne-Edwards (1857), Gosse (1858), Hincks (1861), Verrill (1864, 1868), Klunzinger (1877), Studer (1879), Andres (1880) place all genera — those afterwards discovered I of course leave out of consideration — together in a single section or family Actinines pivotantes sc. Ilyanthidae. A later author, Faurot (1895) also uses the former term. Only in 1880 Andres distinguishes the Edwardsiidae as a separate family which is accepted by Haddon (1889); 1882 and 1888 R. Hertwig however attributes a greater systematic importance to this family, in as much as he establishes a tribus for the genus *Edwardsia* which is accepted among others by Mc. Murrich (1893) and Carlgren (1893); the latter divides the tribus into two families Edwardsidae and Milne-Edwardsidae. 1898 Carlgren again assigns to the tribus a lower systematical rank which it has later on generally kept. Mc. Murrich (1904 p. 232) even enlarges it, by placing in it not only the *Edwardsia* but also *Scytophorus* and Halcampidae (Auct.), and Delage and Hérouard (1904) place in their subordo Edwardsina both the Edwardsinae and the Protantheinae (*Gonactinia*, *Protanthea* and *Oractis*).

Disregarding the Edwardsiidae we find the other genera belonging to my Athenaria — I leave out of consideration some genera which have been placed in another family, such as *Oractis* — arranged in a single family Ilyanthidae with the subfamilies Halcampinae, Halcampomorphinae and Andwakianae in the paper of Carlgren (1893) and in that of Haddon (1897) — in the latter paper there are, however, only two subfamilies, Halcampinae and Halianthinae, while R. Hertwig 1888 divides them into two families, Ilyanthidae and Siphonactinidae. Haddon (1889), however, places both *Halcampa* and *Peachia* (=*Siphonactinia*) in the family Halcampidae. In the work of Andres (1883) our Athenaria, except the Edwardsidae, is represented by four families, Halcampidae, Siphonactinidae, Mesacmeidae and Ilyanthidae, a division also used by Pennington (1885). — the Mesacmaeidae are, however, not mentioned here. Mc. Murrich (1893) distinguishes 3 families, Halcampidae, Ilyanthidae and Siphonactinidae, but some years later (1904) only 2, Ilyanthidae and Peachiidae (= Siphonactinidae), while the Halcampids are placed with the Edwardsiidae. 1900 Carlgren divides the Athenaria, excepting the Edwardsiidae, in five families, Halcampomorphidae, Halcampidae, Halcampactidae, Andwakiadae and Ilyanthidae, an arrangement which Pax accepts (1914 p. 609), though he, as well as other authors, does not make use of the term Athenaria. In a paper by Poche (1914) we find almost the same families, Peachiidae, Halcampidae, Halcampactiniidae, Andwakiidae and Ilyanthidae; in the former the genera are, however, grouped in another way than in the systems of Carlgren and Pax. Stephenson recently (1918) uses the Ilyanthidae as originally defined, excepting, however, the Edwardsiidae.

A curious division we find in the works of Delage and Hérouard (1901), who regard the Edwardsina and Halcampina as suborders equivalent to the Actinina and Stichodactylina. The first group includes among others the family Edwardsinae, the second the families Halcampinae and Monaulinae, which latter Hertwig (1882) refers to a separate tribus Monauleae, while the Ilyanthinae and the Mesacmaeinae are placed in the third group.

From which point of view shall we classify my Athenaria viz. mainly the old groups Actinines pivotantes sc. Ilyanthidae (s. lat.)? That it is necessary to separate the genera provided with acontia, from the other genera, hardly needs further discussion, and would not likely be denied by any recent author. As some Athenaria provided with acontia lack a sphincter, while others have a distinct mesogloeal one, it may be practical to divide them into two families, Halcampactiidae (Halcampactiniidae) and Andwakiidae, in the same way as we separate the two families Actiniidae and Paractiidae of the Thenaria, on account of the nature of the sphincter. Unfortunately only Pax and Poche have clearly stated their view concerning this question and adopted my opinion. On the other hand, it is necessary further to discuss the arrangement of the forms without acontia. Are the Edwardsids to be placed together with the Halcampids, as proposed by Mc. Murrich; are the Siphonactinids = Peachiidae to form a particular family; are the Halcampids (s. lat.) with mesogloeal sphincter, and those lacking one, to be united in a single family; and finally, is a particular family to be established for the genus *Ilyanthus*? Concerning the first question, which is closely connected with the third, I must at any rate positively refuse the attempt to place the Edwardsids together with forms provided with a mesogloeal sphincter, viz. the Halcampids (s. str.). The only principal point of view for the arrangement of the other Athenaria is namely, in my opinion, the structure of the sphincter and its occurrence. Most of these forms are devoid of sphincter, some have a mesogloeal and a few a rather well-developed, endodermal one. Why should we not apply this feature as a basis of classification in this case, when in the more differentiated Actiniaria with basilar muscles we lay so much stress, and with full right, on the appearance of the sphincter as a basis for the arrangement of the families? We distinguish the family Actiniidae from the Paractiidae mainly by the structure of the sphincter, in as much as the sphincter is lacking or endodermal in the first family, but mesogloeal in the second. If for instance the genus *Paractis* should turn out to be provided with an endodermal sphincter instead of a mesogloeal one, it would no doubt by all authors be referred to the family Actiniidae. As we cannot suppose that the mesogloeal sphincter is developed in another way in the Athenaria than in the more differentiated Actiniaria — I at least cannot find anything tending to prove that the mesogloeal sphincter of the Halcampids variates, so as to make it now endodermal, now mesogloeal, with transitory stages between[1]; in the genera *Halcampa*, *Parahalcampa* and *Cactosoma* the sphincter is mesogloeal and conspicuous, in *Halianthella* strong and even double — it seems most consistent to me to separate the acontia-lacking Athenaria, provided with a mesogloeal sphincter from the other forms, and to place them in a separate family, Halcampidae. Thus I cannot adopt the classification neither of Mc. Murrich nor of Poche, who do not see any reason in the character of the sphincter for the formation of a family Halcampidae, based on the occurrence of a mesogloeal sphincter. Besides, how inconsistent Poche is in keeping the family Ilyanthidae, based on the occurrence of a diffus-circumscript endodermal sphincter, while he separates the two with acontia provided families, Andwakiidae and Halcampactiniidae, though the only difference between these latter consists in the former having a mesogloeal sphincter, the latter none. The family Halcampidae, based on the presence of a mesogloeal sphincter, must therefore be maintained.

Concerning the family Ilyanthidae s. str., it might possibly be placed together with some of the remaining forms (the family Halcampoididae), as forms with an endodermal sphincter are rather to be referred to forms with no sphincter. I do, however, think that it is more practical to keep this family.

To the family Peachiidae (Siphonactiniidae) the genera *Peachia*, *Eloactis* and *Haloclava* are referred. The characters on which the family might be based are as follows: 1) the bilateral arrangement of the 20

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[1] According to several authors the genus *Aiptasia* has no sphincter or is provided with now an endodermal, now a mesogloeal one. For the species with a mesogloeal sphincter Stephenson (1918 p. 51) has proposed a special genus *Aipt*[illegible] with the species *prima* and *pallida* which he refers to the subfamily Metridinae. Though I have no particular knowledge of these genera I would be inclined to go still further and place the genus *Aiptasia* in a special family Aiptasiidae. The whole family Sagartiidae besides needs a radical revision, some species of *Phellia* probably belong to the Andwakiidae.

Since this paper was written, Stephenson in a paper (1920 Quart. Journ. Mic. Sc. 64) has divided the Sagartians into several families. I agree with him that the Sagartians are not a homogeneous group, and with Bourne (Quart. Journ. Mic. Sc. [illegible], 1919) that they are of different origin. In the second part of this work I will further discuss this question.

mesenteries (the checked development of the dorsolateral mesenteries of the second cycle) 2) the presence of a single, well-developed siphonoglyphe and 3) the arrangement of the tentacles: the inner endocoel-tentacles are shorter than the outer exocoel-tentacles (compare Carlgren 1904 p. 544). There is no doubt that the above-named genera are nearly related to each other, but it is a question, if these genera alone ought to be placed in a particular family. Leaving *Oractis* out of consideration, the position of which I will further discuss later on, we find a bilateral symmetry, though of a somewhat different type in the Edwardsids, in *Pentactinia* — where the number of mesenteries is the same as in *Peachia*, but the ventrolateral mesenteries of the second order not developed, while in *Peachia* the corresponding, dorsolateral mesenteries are missing, in *Parahalcampa* and *Limnactinia*, and at last probably also in *Siphonactinopsis*, the mesenteries of which are twice as many as in *Peachia*. A single, ventral siphonoglyphe is also present on most, perhaps all Edwardsids, though it is only a little differentiated, furthermore in *Pentactinia, Harenactis, Mesacmaca, Scytophorus* and *Parahalcampa*. The same arrangement of the tentacles as in *Peachia* we observe in several Edwardsids, namely in the subfamily Edwardsiinae, while in the Milne-edwardsiinae and the other genera the inner tentacles are longer than the outer ones, or all tentacles of about the same length. Only the arrangement of the mesenteries is thus specifically characteristic of *Peachia, Haloclava* and *Eloactis*, in as much as there are 10 pairs of mesenteries, while the dorsolateral mesenteries of the second order are missing, an arrangement which possibly they have in common with *Siphonactinopsis*, though there are twice as many in the latter. However much the arrangement of the mesenteries varies in the Athenaria I will call the attention to the fact that *Scytophorus* has only 14 mesenteries, and therefore I do not think it justifiable to establish a separate family for *Peachia, Eloactis* and *Haloclava* on account of the number and position of the mesenteries. The maintaining of the family Monaulidae and the establishing of several families owing to the arrangement of the mesenteries are the logical consequences of these facts.

If we keep to the arrangement of the tentacles, it would be much more justifiable to place the subfamily Edwardsiinae together with *Peachia, Haloclava* and *Eloactis* in a family Edwardsiidae, and the subfamily Milne-edwardsiinae together with the other acontia- and sphincter-lacking Athenaria in another one. As it is, however, possible that this conformity in the arrangement of the tentacles in the Edwardsiinae *Peachia*, etc. may depend on a convergence[1], caused by their having parasitic larvae (observed among the genus *Edwardsia* and *Peachia*), I provisionally place the subfamilies Edwardsiinae and Milne-edwardsiinae as before in a single family, Edwardsiidae, while the other acontia- and sphincter-lacking Athenaria are referred to a family which I call Halcampoididae after *Halcampoides*, the most primitive genus. (Halcampoididae, proposed as a subfamily by Appellöf (1896), is synonymous with my family Halcampomorphidae which must be dropped, according to the international rules). Thus I provisionally refer to the Athenaria the same families as in 1900, only adding the new family Limnactiniidae, and with the difference that the name Halcampomorphidae is exchanged for Halcampoididae. Consequently the arrangement of the genera in the different families is as follows:

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[1] I seize the opportunity to rectify an error, slipped in while my paper (1900 b) was being printed Page 544, the first note has "nicht wahrscheinlich" for, in my manuscript "recht wahrscheinlich."

Fam. Edwardsiidae	Subfam. Edwardsiinae	Genera.	*Edwardsia* Quatr. *Isoedwardsia* Carlgr.
	Subfam. Milne-edwardsiinae . . .	Genera.	*Milne-edwardsia* Carlgr. *Paraedwardsia* Carlgr.
Fam. Halcampoididae		Genera.	*Halcampoides* Dan., *Acthelmis* Lütk., *Phytocoetes*[2] Ann., *Halcampella* Andr., *Synhalcampella*[1] Carlgr., *Scytophorus* R. Hertw., *Pentactinia* Carlgr., *Harenactis* Torr., *Siphonactinopsis* Carlgr. *Mesacmaea* Andr., *Peachia* Gosse, *Eloactis* Andr., *Haloclava* Verr., *?Polyopis* R. Hertw.
Fam. Limnactiniidae		Genera.	*Limnactinia* Carlgr., *?Polyopis* R. Hertw.
Fam. Halcampidae.		Genera.	*Halcampa* Gosse, *Parahalcampa* Carlgr., *Synhalcampa*[2] Carlgr., *Cactosoma* Dan., *Mena*[2] Steph., *Halianthella* Kwietn.
Fam. Halcampactiidae.		Genera.	*Halcampactis* Farquh., *Haliactis* Carlgr., *Pelocoetes* Ann.[2], *?Ilyactis* Andr., *?Octophellia* Andr.
Fam. Andwakiidae.		Genera.	*Andwakia* Dan., *Octineon* Mosel, *?Ilyactis* Andr., *?Octophellia* Andr.
Fam. Ilyanthidae.		Genera.	*Ilyanthus* Forb., *Oractis* Mc. Murr.

In the following I will further discuss the position of the genera within the families of which I have mentioned the first six here. Concerning the position of the genus *Oractis* I am a little doubtful. It is true that, according to me, it cannot be placed in the family Gonactiniidae, as proposed by Mc. Murrich, because it is only in the arrangement of the mesenteries that it partly agrees with this family, while it differs essentially from it in the other characters. The only families which are to be considered in the placing of this genus are the Halcampoididae and the Ilyanthidae. The endodermal sphincter which is, in proportion to the small

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[1] Compare the family Halcampoididae.

[2] Since this was written Stephenson (1920 p. 520) has proposed a new family provided with acontia, Diadumenidae, enclosing *Diadumene* Ann, *Pelocoetes* Ann., *Phytocoetes* Ann., and *Mena* Steph. The family is certainly heterogeneous. The type-genus differs in several respects from the three others. The former has a well-developed pedal disc and certainly belongs to the Basilaria, while the three latter probably are Abasilaria. (It is probably a lapsus of Annandale when he (1915 p. 81) speaks of basilar muscles instead of parietal muscles). In consequence of Annandale's description of their structure it seems to me that *Pelocoetes* would belong to the Halcampactiidae, *Phytocoetes* and *Mena* to the Andwakiidae. But on further examination of Annandale's figure 3 (p. 80) in which the acontia are also represented, I think that at least *Phytocoetes gangicus* is not provided with acontia. The figure designated as acontia is namely no such thing, but simply mesenterial filaments. Thus *Phytocoetes* is a Halcampoid and nearly related to *Acthelmis*. Concerning *Mena* (*Phytocoetes*) *chilkaea* I am of opinion that this species is a *Cactosoma*. Nothing in the structure speaks against it; on the contrary the appearance of the sphincter and the presence of papillae on the column indicate that we have to do with this genus. At least it is closely related to this genus. Finally *Pelocoetes* is a good genus and probably belonging to the Halcampactiidae. Though Annandale has not given any figure of the acontia, but says that they are long and relatively stout, it is probable that in this case he has not mistaken the mesenterial filaments for acontia.

The species *Halianthus limnicola* Ann. is, though a Halcampid, probably the type of a new genus. It is neither a *Halcampa* nor a *Cactosoma*. The absence of secondary, imperfect mesenteries in the whole length or almost so of the column and the presence of 12 rows of tubercles on the column, serve to distinguish it from the two genera. Besides, it differs from *Halcampa* in having sometimes more than 12 tentacles, but in this respect it agrees with *Cactosoma*. The presence of extra-tentacles indicates that there are weak mesenteries in the uppermost part of the column as in *Halcampella* of the Halcampoididae. As *Halianthus* is a synonym of *Halcampa* I propose a new name for it *Synhalcampa*, characterized as follows:

Halcampidae with no external differentiation of capitulum, scapus and physa. Aboral extremity provided with a porus. Column with 12 longitudinal rows of solid tubercles, towards the aboral end obsolete. Sphincter weak, close below the base of the tentacles. Tentacles 12 or some more, short, but stout and cylindrical. Two rather well-developed siphonoglyphes and 2 pairs of directives. Six pairs of perfect mesenteries with rather strong pennons. When the tentacles are more than 12, some very weak mesenteries are probably found in the uppermost part of the column. Excepting these, no imperfect mesenteries.

size of the animal, very strong, seems to indicate that we have to do with an Ilyanthid. In another paper I will give a more complete description of the genus than that given by Mc. Murrich.

The new genus *Parahalcampa* from the Antarctic, of which I cannot give a full description here, I characterize as follows:

Halcampidae with elongated body. Column not divisible into regions, without cuticle and "Halcampapapillae". Proximal end physa-shaped, penetrated by apertures. The most distal part of the column with spirocysts. Sphincter as in Halcampa. Tentacles 10, thick and short. A single weak siphonoglyphe. Number of mesenteries 10 + 10. The 10 first (the "Edwardsia-mesenteries" + the fifth couple) perfect, fertile and with strong, longitudinal pennons and filaments. The 10 others (the sixth couple + the dorsolateral and lateral mesenteries of the second order) imperfect, sterile, weak, without longitudinal pennons and filaments, in the whole length of the body. Type *P. antarctica* n. sp.

Family *Edwardsiidae*.

Diagnosis: Athenaria with elongated body, divisible into two or commonly into three regions, without sphincter or acontia. Tentacles always present. 8 perfect and fertile mesenteries. Two opposite pairs, the longitudinal muscles of each turning away from each other, forming the two directive pairs of mesenteries, and between these on each side 2 mesenteries with the longitudinal pennons turning towards the ventral directive. Four to several weak and very short mesenteries in the uppermost part of the column, always without filaments and reproductive organs. Ciliated streaks always present, sometimes discontinuous.

Owing to the presence or absence of nemathybomes (Nesselhöckerkapseln) and to the occurrence of two different types in the arrangement of the tentacles I have (1900) divided this family into two subfamilies, Edwardsiinae and Milne-edwardsiinae, corresponding to my families Edwardsiidae and Milne-edwardsiidae (1893) — a division which I will provisionally keep, though it is possibly a question, if it would not be more correct to place the Edwardsiinae together with *Peachia, Haloclava* and *Eloactis* in a family, and the Milne-edwardsiinae together with the family Halcampoididae (compare above p. 20).

To the former subfamily the genera *Edwardsia* (incl. *Edwardsiella* and *Edwardsioides*) and *Isoedwardsia* belong, to the latter *Milne-edwardsia* and *Paraedwardsia*.

The generally very elongated body-wall is divisible into two or three regions, as it is often the case in the Athenaria. The most distal part, capitulum, is always present, but comparatively short. It is devoid of a cuticle and provided with 8 longitudinal furrows, corresponding to the insertions of the mesenteries. These furrows are more or less distinct, the most conspicuous in the genus *Milne-edwardsia*, especially in *M. carnea* and still more in *M. loveni*, in which the capitulum has a decidedly polygonal appearance. The other part of the column is formed either wholly by the scapus, provided with a cuticle, or by a more or less developed physa, commonly ampullaceous and devoid of cuticle, added to the most aboral part of the column.

The physa is the most distinct in the genus *Edwardsia*, while in the genera *Milne-edwardsia* and *Paraedwardsia* it is either lacking or not well-developed. In the genus *Isoedwardsia* there is never any physa, but the most aboral part shows the same structure as the scapus. Transverse sections through the most aboral part of the body-wall in *Edwardsia* therefore differ in appearance from those of *Isoedwardsia*. In *Edwardsia* we find in this region a thick ectoderm without cuticle (textfigs. 6, 62) and with scattered nematocysts; in *Isoedwardsia* commonly, (but not always) a thin ectoderm, always provided with cuticle, and the nematocysts enclosed in the nemathybomes (textfig. 69, compare below), The physa of the genus *Edwardsia is* probably always perforated by apertures. It is true that I have not examined all the specimens of *Edwardsia*, described here, in that respect, but as I have observed apertures in the physa of all the species (*E. andresi, vegae, arctica, finmarchica, vitrea, longicornis*), the aboral end of which I have thoroughly examined, it may not be precipitate to attribute such apertures to all *Edwardsia*-species. To judge from the structure of the wall of the apertures of *E. vegae* it seems as if the apertures are invaginations of the ectoderm. The apertures are surrounded by a circular thickening, possibly of the ectoderm and forming a movable stopping which is directed outwards (textfigs. 50, 51) or inwards (textfig. 62), according to the different state of contraction of the physa. The endodermal muscles form a circular sphincter round the apertures. The other Edwardsiidae are probably devoid of aperture in the proximal end; I will, however, remark that I have not examined the proximal part of the column as thoroughly as in the genus *Edwardsia*.

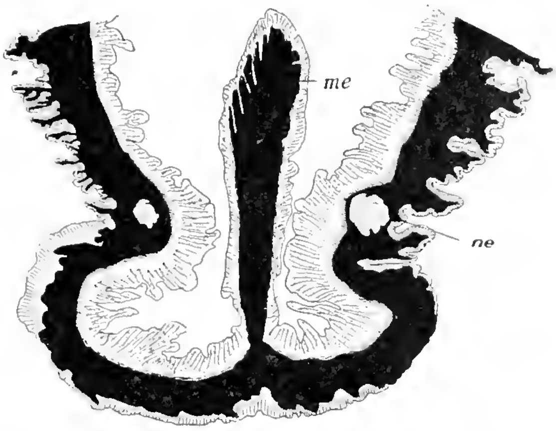

Fig. 6.

Fig. 7.

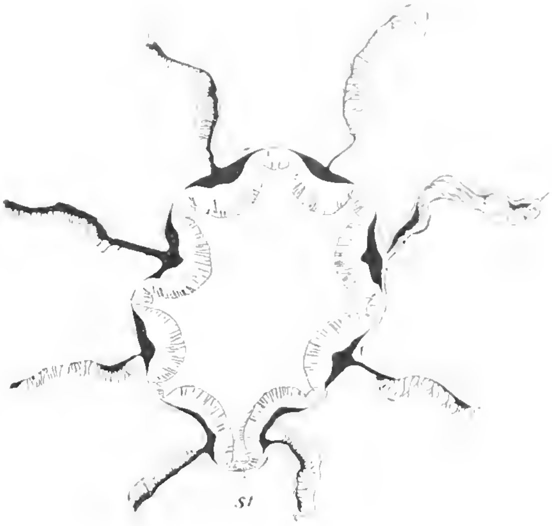

Fig. 8.

Textfig. 6. Longitudinal section of the proximal part of the body of *Edwardsia andresi ne*: nemathybomes, *me*: mesentery. The ectoderm of the physa is partly lost. — Textfig. 7. Transverse section of the upper part of the actinopharynx with parts of the mesenteries of *Edwardsia claparedii*. — Textfig. 8. A similar section in the lower part. *si*: siphonoglyphe.

The scapus is provided with a weaker or stronger cuticle or periderm. In *Isoedwardsia ingolfi* and *Milne-edwardsia loveni* I have found the strongest cuticle. In the genus *Paraedwardsia* there are "Halcampa-papillae", which are wanting in the other genera. Concerning the structure of these papillae I refer to the genus *Halcampa*. The nematocysts of the scapus-ectoderm in the four genera show a different arrangement and are of a very different size, in comparison with the nematocysts of the capitulum. In the simplest case the nematocysts of the scapus are scattered as in *Paraedwardsia*, now placed mainly on the ridges as in *Milne-edwardsia loveni*, now for the greater part collected in larger or smaller clusters as in *Milne-edwardsia carnea, polaris* and *nathorstii*. Sometimes these clusters are arranged in shallow invaginations of the mesogloea as

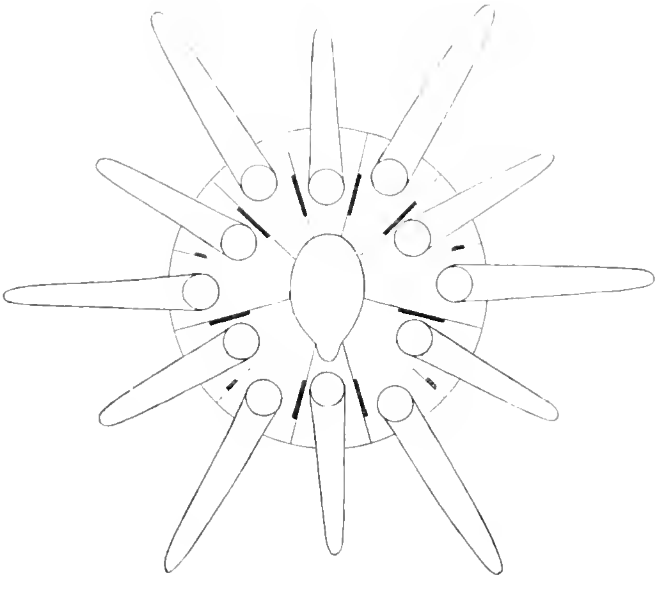

Fig. 9.

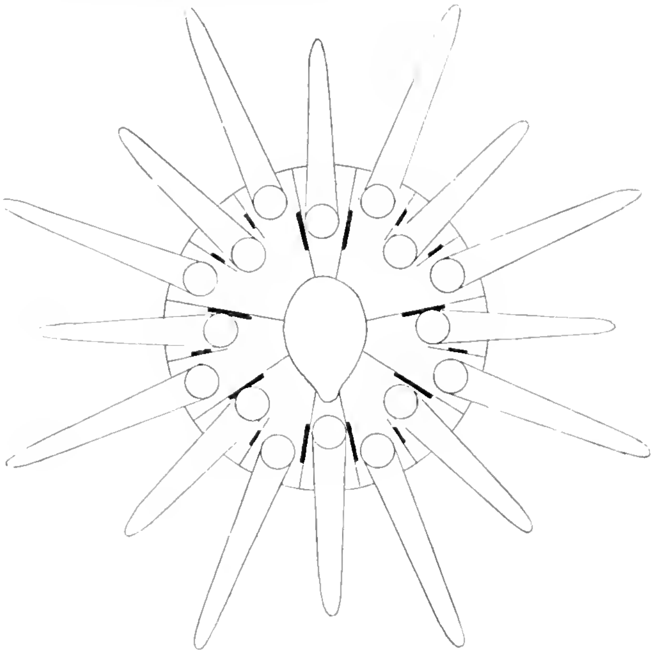

Fig. 10.

Textfigs. 9—11. Arrangement of tentacles and mesenteries in *Edwardsia andresi* (fig. 9), *E. claparedii* (fig. 10) and *Milne-edwardsia loveni* and *carnea* (fig. 11). In order to show the arrangement in pairs, the imperfect mesenteries are drawn as having pennons. In fact that is not the case.

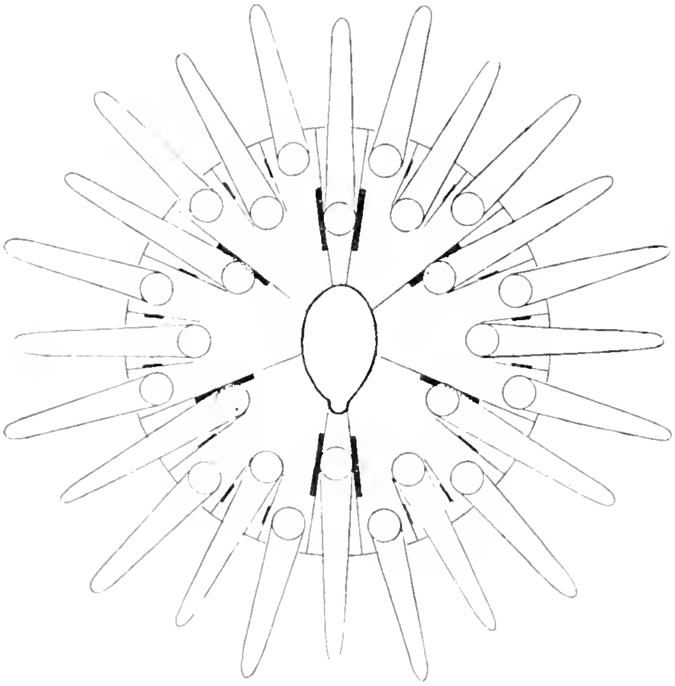

Fig. 11.

in *Milne-edwardsia polaris*. These clusters form weak batteries of nematocysts. In the genus *Edwardsia* and *Isoedwardsia* the nematocysts of the scapus are more concentrated and enclosed in so-called nemathybomes, forming strong batteries of stinging capsules. The nemathybomes are now arranged in 8 longitudinal rows as in *E. tuberculata, claparedii* and *longicornis*, now irregularly scattered as in *E. vitrea, finmarchica, sipunculoides, intermedia* and others. Possibly there are more than 8 longitudinal rows in some species. The nemathybomes appear the most distinctly in the species with 8 rows. Here they are fewer in number, but commonly larger and form conspicuous tubercles on the scapus; on the other hand, if the nemathybomes are scattered they are smaller, but more numerous and projecting a little or not at all over the surface of the scapus, according as the contraction of the animal is strong or weak. The nemathybomes form a capsule in the mesogloea and are filled with more or less numerous nematocysts and their mother-cells. The walls of the nemathybomes are formed by the mesogloea which is only perforated in the apex of the nemathybomes. Here the scapus-ectoderm is in connection with the nemathybomes, and through the aperture the nematocysts eject their stinging threads. The nemathybomes are to be conceived as stinging batteries invaginated in the mesogloea. Also the size of the scapus-nematocysts, in comparison with that of the nematocysts of the capitular ectoderm, seems to depend on, whether the nematocysts are arranged in nemathybomes or not. In the genera provided with nemathybomes, *Edwardsia* and *Isoedwardsia*, the nematocysts of the nemythybomes are narrow and long and commonly several times as long as the small nematocysts of the capitulum. In the sub-family, Milne-edwardsiinae, on the other hand, the nematocysts of the scapus are more short and broad and hardly larger than the nematocysts of the capitular ectoderm, which are generally considerably larger here than in the sub-family Edwardsiinae. Especially in *Milne-edwardsia loveni* and *carnea* there are numerous nematocysts on the capitular ridges (textfigs. 75, 79). The ectoderm of the column probably never contains any spirocysts, nor is it provided with longitudinal muscles; sometimes there is a well-developed nerve-layer in the ectoderm of the capitulum (in *Edwardsia andresi* and *Paraedwardsia sarsii*). The mesogloea contains a few cells and are more or less thickened; on the capitulum it forms the main part of the ridges, when any such appear (as in *Milne-edwardsia loveni* and *M. carnea*). The endodermal, circular muscles are more or less developed, but never concentrated to a sphincter; they here and there break through the mesenteries, as always in the Actiniaria, and are thus in these places enclosed in the mesogloea. In *Milne-edwardsia nathorstii* and *Paraedwardsia sarsii* nematocysts occur in the endoderm.

The tentacles are short, in sexually ripe individuals probably never less than 12. As I have already pointed out in a previous paper the tentacles are arranged in two different ways (compare Carlgren 1893; 1904). The first type, observed in different *Edwardsia*-species and in *Isoedwardsia mediterranean*, and probably characteristic of these genera, we may call the *Edwardsia*-type (textfigs. 9, 10). It is characterized by its inner tentacles, off-shoots from the endocoels, being shorter than the outer tentacles, — an arrangement which we find again in some Halcampoididae, viz. in *Peachia*, *Eloactis* and *Haloclava*. On the other side, in the second type, the *Milne-edwardsia*-type (textfig. 11) the inner tentacles are longer than the outer ones, as it is commonly the case in the Actininae. Representatives of this type we meet in the genera *Milne-edwardsia* and *Paraedwardsia*. This type is probably characteristic of these genera, as I have found such an arrangement[1] in all cases where I have been able to undertake a thorough examination of them. The ectoderm of the

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[1] Bourne (1916, Journ. Linn. Soc. 32 Zool. p. 513) has given an account of the order of succession of the micro-mesenteries and tentacles in the Edwardsiae. I think that in many respects his statements are erroneous. *Edwardsia duodecimcirrata* (*E. Lütkenii*) is no *Edwardsia* but a *Halcampa duodecimcirrata* (compare Carlgren 1893 p. 38). The parasitic larva of *Halcampa*, described by Haddon, is the larva of *Peachia* (Carlgren 1904. Zool. Anzeiger 27 p. 536). The arrangement of the tentacles and the mesenteries in *E. claparedii* is that typical of the *Edwardsia* with 16 tentacles (compare the scheme and Carlgren 1904 l. c. p. 543) and the grouping of the mesenteries evidently identical with that described by Bourne in *E. beautempsii* and *allmanna*. (Andres has confounded the dorsal and the ventral side in *E. claparedii*; in my paper (1893 a) I supposed that Andres's statement of the tentacular arrangement was correct). Unfortunately the order of succession of the tentacles in the *Edwardsia* is not known in details in any species, but we are obliged to construct it from different stages of different *Edwardsia*-species, a proceeding which always leads to a more or less uncertain result. In doing this we are in the first instance to study the tentacles of live specimens and, if necessary, to supply our observations with sections. As, however, the inner tentacles of the genus *Edwardsia* s. str. are (always?) shorter than the outer ones, as in *Peachia*, *Eloactis* and *Haloclava*, it is probable that the tentacles 9—12 are developed on a biradial plan (Carlgren 1904 l. c., a paper overlooked by Bourne), while in the genus *Milne-edwardsia* the tentacles are arranged after the number 6 with the inner tentacles longer than the outer ones and the first 12 tentacles probably developing on a bilateral plan. (Carlgren 1893 textfig. 3, 4, 1893 b, textfig., 1904 p. 534). That the tentacles of *E. claparedii*, *M. loveni* and *carnea* are arranged in such a manner as here stated by me (textfigs. 9—11) is a fact that I have controlled several times in living specimens and in sections. In living *E. claparedii* it is easily seen that the directive tentacles belong to the inner, shorter tentacles which are often bending towards the mouth. The parts of the oral disc lying over the directive chamb-

tentacles contains nematocysts as well as spirocysts. The longitudinal muscles of the tentacles are always ectodermal as are also the radial muscles of the oral disc. The actinopharynx is longitudinally sulcated. In no case I have observed any dorsal siphonoglyphe; on the other hand, I have in representatives of all four genera found a ventral siphonoglyphe, a little developed. It it distinguishable from the other furrows of the actinopharynx through its cells being provided with longer cilia than those of the other part of the actinopharynx (Textfig. 7, 8). The ectoderm of the actinopharynx contains nematocysts, sometimes of two kinds.

The mesenteries are partly perfect, provided with reproductive organs, longitudinal pennons and filaments, partly imperfect without such organs, and only present in the uppermost part of the column. The former, "the *Edwardsia*-mesenteries", are arranged as the diagnosis indicates. There are thus 2 pairs of directive mesenteries and 2 couples of lateral mesenteries, the latter forming pairs with 4 imperfect mesenteries (textfig. 9). In the simplest case there are only 4 imperfect mesenteries developed, belonging to the first order, as in *E. andresi* (textfig. 9). In most species a more or less imperfect cycle of the second order is added, and sometimes one of the third order. The longitudinal muscles of the perfect mesenteries always form pennons with more or less numerous folds. The pennons are always distinctly distinguishable from the other part of the mesenteries, but seem never to be circumscript in the sense that the inner and outer lamellar parts of the mesenteries issue from one point of the fold or very close by each other.

The outer lamellar part of the mesenteries is in the reproductive tract attached to the pennon near its outer edge or somewhat nearer to the middle of it. At the insertions of the mesenteries on the column the perfect mesenteries have developed the so-called parietal muscles; one part of these is placed at the same side as the pennons and is only a differentiation of the longitudinal muscles, the second part, arranged at the opposite side of the mesenteries, is homologous with the parietobasilar muscles in the more differentiated Actiniaria (Carlgren 1905). The parietal muscles also show a different appearance in several species, commonly extending, and as a rule without folding, over a smaller or greater part of the column, whereby the contraction of the body in longitudinal direction is facilitated. In exceptional cases, as in *Milne-edwardsia nathorstii*, these column-muscles are comparatively strong and form rather high folds (textfig. 85). Towards the aboral end of the body the longitudinal pennons taper more and more and end by fusing with the outer

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ers are namely of another colour than the other part of the disc. Bourne supposes that the development of the micro-mesenteries in the Edwardsids is another than in the other Actiniaria and will not regard the mesenteries 9—12 and the other micro-mesenteries as homologous with those on the Actiniaria. In comparing the mesenteries as homologous with those of for instance *Halcampa* (Carlgren 1893 a textfig. 6. 1 a) I cannot find any difference. The arrangement of the mesenteries in *E. claparedii* and in other *Edwardsia* having 16 tentacles agrees for instance with that in *Gonactinia* and in a young specimen of *Sagartia* (*Cylista*) *undata* (Carlgren 1893 a p. 90). Bourne's statement that the micro-mesenteries in *Edwardsia* arise in couples of singles, and not in couples of pairs as in the Actiniaria, certainly needs a more extensive examination before it can be accepted. I think that the development of the tentacles is mainly the same in the Edwardsids and in the other Actininae. As namely, by the appearance of a new pair of mesenteries in the Actiniaria, the new tentacles, one endocoel- and one exocoel-tentacle, do not arise quite simultaneously, and as the foundation of the mesenteries agrees with that of the tentacles, it is clear that in certain stages of development we must find single mesenteries instead of pairs. (Compare Bourne's statement Quart. Journ. Mic. Sc. 63 1910) concerning the development of the mesenteries of *Phellia* Also in the paper by Faurot (1905) in which he describes the development of the tentacles of *Ilyanthus*, we can in some figures see an indication of a different size of both mesenteries of the same pair (that this is not always the case is probably an inadvertency of Faurot, to whom the principal object has evidently been to investigate the order of appearance of the tentacles and not that of the mesenteries). Besides this, it ought to be remarked that in several Actiniaria (in the Actinostolids, in some Haleuriidae as in *Actinernus* and others) a great difference in both mesenteries, belonging to a pair, exists. Thus Bourne's suggestion that the Edwardsiae should form a special group of the Anthozoa, different from the Actiniaria, is, according to me, not well founded part of the mesenteries viz. with the parietal muscles. Thus the mesenteries are provided with a continuous, longitudinal muscle layer at the aboral end of the body. The ciliated streaks are always present. The statement of Andres (1880) that they are lacking in *Edwardsia claparedii*, I cannot confirm, as they were present in the specimens I have examined. In *Isoedwardsia*, at least certainly in *I. mediterranea*, the ciliated streaks are discontinuous viz. scattered in several portions along the middle streak. A similar arrangement we find in *Limnactinia laevis, Scytophorus antarcticus* and *Parahalcampa antarctica*. As far as up till now is known, all Edwardsiids are dioecious. Only the 8 "*Edwardsia*-mesenteries" are provided with filaments and reproductive organs.

A classification of the Edwardsiidae, especially of the species of the genus *Edwardsia*, is rather difficult. The different size of the nematocysts however forms quite a good character, and so do also, though in a smaller degree, the structure of the muscle pennons and that of the parietal muscles. In order to get good points of comparison the sections of the muscle pennons and the parietal muscles have been taken, when possible, in the upper part of the reproductive region. Sections through different tracts of the body are namely of a very different appearance in the same species. In order to decide whether the structure of the pennons and the parietal muscles is practicable as a valuable species-character I have often reproduced figures of both kinds, belonging to species from different localities.

Sub-family Edwardsiinae.

Diagnosis. Edwardsiidae with the physa well-developed or wanting. Scapus provided with nemathybomes. Nematocysts of the capitulum, in comparison with those of the nemathybomes, small. Inner tentacles, endocoel-tentacles, shorter than the outer ones.

The genera *Edwardsia* Quatr. and *Isoedwardsia* Carlgr. belong to this subfamily.

Genus **Edwardsia** Quatref.

Diagnosis. Edwardsiidae with body-wall divisible into three regions; physa, scapus and capitulum. Physa always present, without nemathybomes. Scapus with a more or less developed periderm (cuticle) with nemathybomes containing nematocysts in a rounded cavity in the mesogloea. Nematocysts in the nemathybomes long, in proportion to the breadth. Nemathybomes in 8 longitudinal lines, or more or less irregularly scattered, now distinctly conspicuous upon the scapus-surface, now on a level with it. Nematocysts in the ectoderm of the cuticle-lacking capitulum small. Tentacles 12—16 or in several cycles, the inner shorter than the outer (always?). Actinopharynx with a single, feebly developed, ventral siphonoglyphe (always?).

To the genus *Edwardsia* I have here referred the genera *Edwardsia*, *Edwardsiella* and *Edwardsioides*. The establishment of the last genus is not justified, because, according to my examination of the type-specimen, it is not different from a typical *Edwardsia* (*Edwardsiella*). On the other hand it it questionable, if the genus *Edwardsiella* ought to be maintained. The genus is proposed by Andres (1883) for the Edwardsiidae having more than 16 tentacles. Concerning the number of the tentacles I think that it is of no great importance as a genus-character, because the number varies very much in several species. The arrangement of the nemathybomes, on the other hand, may — as before pointed out by me (1898, 1900) — be used with more success for the distinction of both genera; in the genus *Edwardsia* the nemathybomes are arranged in 8 longitudinal rows, in *Edwardsiella* they are more scattered. As it is on several occasions very difficult to determine the arrangement of the nemathybomes in preserved and often strongly contracted material, a strong contraction causing several displacements in their relative position, it is, however, for practical reasons and in order to avoid confusion, the most reasonable to place together *Edwardsia* and *Edwardsiella* in a single genus *Edwardsia*.

I give below a synopsis of the Arctic and Northern *Edwardsia*-species, examined by myself.

Synopsis of the Edwardsia-species described here.

		Number of tentacles	Nematocysts of the nemathybomes		Nematocysts of the actinopharynx		
A. Nematocysts of the nemathybomes of 2 different sizes. (The larger nematocysts very sparse in **danica**).							
a) 8 distinct longitudinal lines of comparatively few, but large nemathybomes	**tuberculata**	16	60—96 × 2,5 μ	(72) 110—140 × (4) 5—7 μ	. . . .	22—37 × 2,5 μ	27—34 × 5—6 μ
	longicornis	16 (very seldom 12?)	36—65 × 2 (2,5)	36—86 × 3,5—4,5 (5)	14—17 × 2 μ	25—29 × 2,5—3	26—30 × 7
aa) Nemathybomes very numerous and close, mostly arranged in groups.	**pallida**	16	36—53 × 2,5	62—74 × 5	22 × 1,5—26 × 2	[illegible]—36 × 2,5	. . . .
aaa) Nemathybomes not very numerous, scattered. The large nematocysts sometimes wanting? . .	**danica**	(12) 14—20	24—43 × (2,5) 3—3,5 (4)	46—72 × 4,5	15—19 × 1—2	24—34 × 2—2,5	
AA. Nematocysts of the nemathybomes of only one size.							
α) 8 longitudinal lines of nemathybomes (possibly in the proximal part a little scattered). Pennons with few (12—13) folds	**arctica**	16	38—60 × 4—5			29—41 × 3—3,5	26—34 × 4—6
αα) Nemathybomes arranged in 16 longitudinal lines?	**fusca**	12	31—36 × 2—2,5		. .	36—46 × 2,5—3	. . .
ααα) Nemathybomes arranged in the middle line between the insertions of the mesenteries, but not forming any distinct longitudinal lines . . .	**andresi**	12 seldom 13—15	48—67 × 3,5—4			(29) 36—43 (46) × 3—3,5	24—29 × 4—5
αααα) Nematocysts scattered.							
b) Longitudinal pennons with few (to about 15) folds.							
c) Cuticle very well developed. Parietal muscles strong.	**islandica**	16	3[illegible]—48 × 2—2,5			(33) 36—43 × 2	
cc) Cuticle? Scapus-ectoderm incrusted. Parietal muscles ordinarily developed	**incerta**	12? not more than 16	29—37 × 5				
bb) Longitudinal pennons well-developed with about 20—30 folds.							
d) Parietal muscles with very numerous folds	**vitrea**	13—16	[illegible]—42 × 3—3,5		17—29 × 2,5—3,5	36—53 × 3—3,5	. .
dd) Parietal muscles comparatively weak	**vegae**	16	84—101 × 3			38—43 × 3	
bbb) Longitudinal pennons strong with about 50 folds. Parietal muscles comparatively weak . .	**finmarchica**	16—26 (or more?)	(26) 36—48 (60) × 3—3,5 (4)			30—35 × 2,5—3	

Edwardsia tuberculata Düb. and Koren.

Pl. 1. Fig. 20.

Edwardsia tuberculata n. sp. Düben and Koren 1847 p. 267.
— — Düb. & Kor., Koren 1857 p. 93. Sars 1861 p. 262.
O. & R. Hertwig 1879 Pl. 1. figs. 2, 6.
— *clavata* Rathke p.p. Andres 1883 p. 308. Carlgren 1893 a p. 12. Appellöf 1895 p. 7, 11 Grieg 1897 p. 12.
— ? — Rathke. Appellöf 1891 p. 12 figs. 10—11.

Diagnosis. Physa well-developed. Scapus with a rather well-developed periderm and 8 distinct lines of large, rather few nemathybomes. Nematocysts of the nemathybomes partly 60—96 × 2.5 μ, partly (72) 110—190 × (4) 5—7 μ. Nematocysts of the capitulum 11—13 × 1.5 μ. Tentacles 16. Nematocysts of the tentacles 18—26 × about 1.5 μ, their spirocysts 14—22 × 2.5 μ. Nematocysts of the actinopharynx partly typical 22—37 × 2.5 μ, partly with discernible basal part to the spiral thread 27—34 × 5—6 μ. Longitudinal muscle-pennons strong, in transverse sections elongated, in the upper part of the reproductive region with about 30 lower and higher, sparse, often dichotomously ramificated folds. Outer folds, in proportion to the inner ones, only slightly branched. Outer lamellar part of the mesenteries in the reproductive region attached to the pennon rather close to the centre. Parietal muscles strong, with numerous folds (15—20 or more on each side), high, rather perpendicularly issuing and a little branched. The extension of the parietal muscles on the column very inconsiderable.

Colour. Scapus commonly brown.

Dimensions in strongly contracted state with the physa involved unto about 2 cm long and 0.7 cm broad.

Occurrence: Norway. Bergen (Koren, Appellöf) Bergen, Manger 15 fms. (Sars) Bergen Herlö fiord 6—12 fms. (teste Appellöf), Molde (teste Sars), Utne fiord 100 fms. (Bowallius 1882), Vaags fiord, Skavö-Tomberviken 40—80 fms. (teste Grieg), Halnaesviken (teste Grieg), Drontheim fiord Rödberg 150—200 m (Östergren 1891) Norway without distinct locality (Lütken).

Sweden. Koster fiord N. Hellsö 100—150 fms. (C. Aurivillius 1895), Sneholmen (C. Aurivillius 1895), Väderöarne 60—80 fms. (1911).

Denmark. Cattegat (Petersen).

S. of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp. St. 161).

Exterior aspect: The physa is well-developed, but commonly involved. The scapus is provided with a rather strong cuticle. The large but few nemathybomes are arranged in 8 distinct, longitudinal lines and appear very distinctly as papilliform off-shoots on the scapus. The scapus, as well as the capitulum, are polygonal, at least in the contracted state of the animal. The tentacles are 16, cylindrical, in contracted state rather thick. The actinopharynx is longitudinally sulcated.

Anatomical description: This species has before been anatomically examined by O. and R.

Hertwig (1879) and by Appellöf (1891), but in several respects imperfectly. Neither is my description as perfect as desirable, the material not always having been well preserved.

The ectoderm of the scapus is considerably thinner than the mesogloea. The nematocysts of the nemathybomes are numerous and of two kinds, both long, but one much more thin than the other. The longer and broader ones are a little thicker at the basal end, gradually tapering towards the distal end. In these latter the basal part to the spiral thread is commonly discernible.

The size of the nematocysts (n) and the spirocysts (sp.) in the different parts of the body is seen on the following table.

Habitat	physa	nemathybomes		tentacles		capitulum	actinopharynx	
	n.	n.	n.	n.	sp.	n.	n(a)	n(b)
1) Bergen Manger	—	74-96 × 2.5 μ	110-190 × 6-7 μ	19-26 × 1.5 μ	14-20 μ	11-13 × 1.5 μ	29-34 × 2.5 μ	—
2) Bergen (Koren).......	11-13 μ	72-84 × 2.5	122-144 × 6	22-26 × 1.5	17-22 × 2.5	11-13 μ	29-36 × 2.5	—
3) Väderöarne...........	12-14 × 1.5	79-96 × 2.5	113-154 × 5-6	22-26 × 1.5	17-23 × 2.5	11-12 × 1	29-37 × 2.5	29-34 × 5-6 μ
4) Kosterfiord N. Hellsö .	12-16 × 1.5	77-84 × 2.5	130-180 × 5-6	18-24 × 1.5	-22 × 1.5	—	22-29	—
5) — Sneholmen	—	70-77 × 2.5	(108) 127-146 × 5-6	—	—	—	—	—
6) St. 161 (Thor)	—	70 × 2.5	115-130 × 6-7	—	—	—	—	—
7) Norway (Lütken)	—	60-72 × 2(2.5)	96-134 × 6	—	—	—	—	—
8) — —	—	60-70 × 2	72-110 × 4-5	—	—	—	—	—
9) Drontheimfiord	—	72-84 × 2	(86) 103-137 × 6-6	—	—	—	—	—

n(a) typical nematocysts, n(b) nematocysts with a conspicuous basal part to the spiral thread.

As we see, the size of the stinging capsules agrees in the different specimens. Only in the specimens 7 and 8 the nematocysts of the nemathybomes are shorter; these specimens were also about half as long (length 1.1 cm, breadth 0.3 cm) as the others. Also in the smaller specimens the larger nematocysts of the nemathybomes reach a length of more than 100 μ (compare *Edw. longicornis*). Whether the n(b)-capsules, which are broader in the basal end, are constant, I cannot decide, I have not observed any in the specimens 1 and 2. In the maceration preparations of the two "Thor"-specimens, the ectoderm of which was very badly preserved, I found only one smaller nematocyst and 8 larger in the fragments of the nemathybomes. There is, however, no doubt that these specimens are *E. tuberculata*, as the muscles of the mesenteries agree with those of the specimens from Norway.

The 8 "Edwardsia-mesenteries" have strong pennons. O. and R. Hertwig (1879) have given a reproduction of a mesentery in the reproductive region. Owing to the comparatively few muscle-folds of the pennon the mesentery has probably been sectioned in the lower part of this tract, or the section possibly belongs to a smaller specimen. The textfigure 12 shows a section of a pennon in the upper part of the reproductive region. The pennon is rather elongated, the highest folds as usual next to the outside. The about 30 folds are mostly high, the high folds often dichotomously branched. The most ramificated fold is as usual the outermost. The parietal muscles are very high, the folds for the greater part dichotomously branched and issuing almost perpendicularly from the thick, main lamella (textfig. 14). For comparison I have here also reproduced figures of a pennon (textfig. 13) and of a parietal muscle (textfig. 15), belonging to a young, not sexually ripe specimen. The folds of the muscles are here considerably fewer. The extension of the parietal muscles on the column is inconsiderable.

Remark. Andres (1883) and after him I myself (1893) have placed this species together with Rathke's *E. clavata*, on the supposition that the nemathybomes had been overlooked by Rathke. After having examined the Düben and Koren's species I think that it cannot be identical with *E. clavata*, because the nemathybomes in *E. tuberculata* are too large to be overlooked. In fact it is impossible to identify with certainty *Edwardsia clavata* with any here described species, as Rathke's description may be applied to several Scandinavian species. As no type-specimen of *E. clavata* is known, I think that *E. clavata* may be dropped. I have not had the opportunity to see the specimens from Molde nor those collected by Appellöf and by Grieg; probably most of these belong to *E. tuberculata*, at any rate the specimen reproduced by Appellöf (1891) indubitably belongs to this species. On the other hand it is questionable if the specimens, dredged in the Herlöfiord from shallow water (6—12 fathoms) really, are this species, as *E. tuberculata* seems to live in deeper water (compare the occurrence).

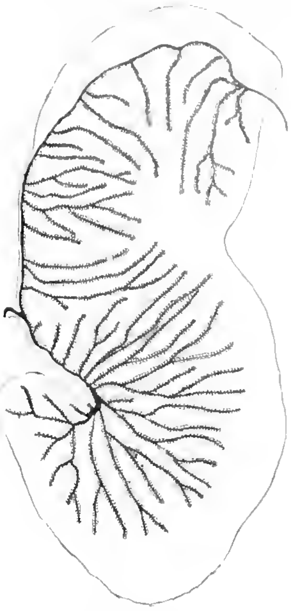


Fig. 12.

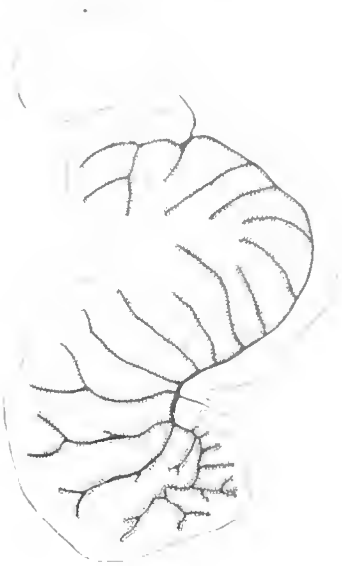


Fig. 13.

Textfigs. 12—15. *Edwardsia tuberculata*. Transverse sections of pennons (figs. 12, 13) and parietal muscles (figs. 14, 15) in the reproductive tract. Fig. 12 spec. from the museum of Christiania, fig. 14 spec. from the Cattegat (Petersen) and figs. 13, 15 young spec. from Utne fiord.

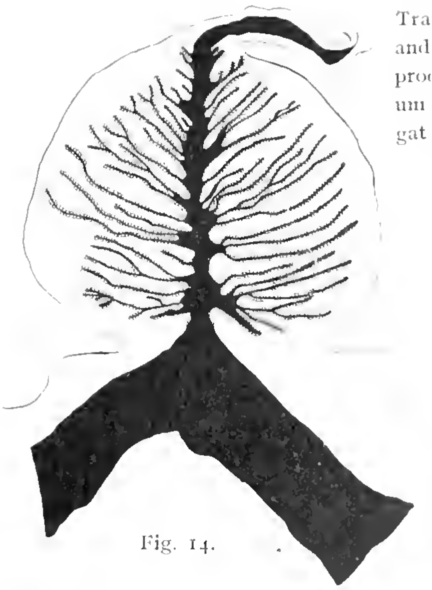


Fig. 14.

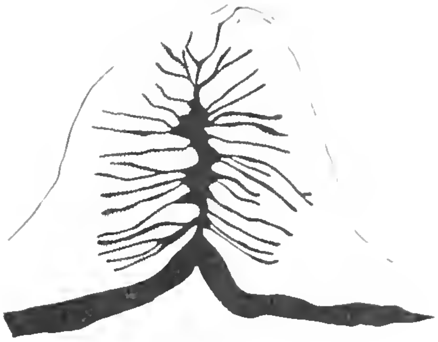


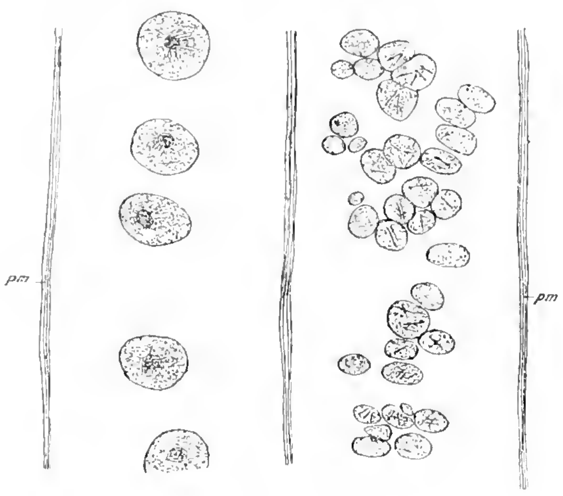
Fig. 15.

Edwardsia longicornis (n. sp.).

Edwardsia clavata var. *longicornis* n. var. Carlgren. 1893 a p. 12.

Diagnosis. Physa distinct. Scapus with a well-developed periderm and 8 lines of rather large but comparatively few nemathybomes. Nematocysts of the nemathybomes partly 36—65 × 2 (2.5) μ partly 36—86 × 3.5—4.5 (5) μ. Tentacles 16, very seldom 12?. Nematocysts of the tentacles 17—23 × 2 (2.5) μ, their spirocysts 14—17 μ long. Nematocysts of the actinopharynx partly typical, 14—17 × 2 μ and 25—29 × 2.5—3 μ, partly with discernible basal part to the spiral thread, broader in the basal end 26—30 × 7 μ.

Longitudinal muscle-pennons rather strong, in the upper part of the reproductive region with about 13—18 folds. Outer part of the pennons stronger than the inner one. The outer lamellar part of the mesenteries attached to the pennon rather close to the centre. Parietal muscle in the reproductive tract with few to rather numerous, thin and a little dichotomously branched folds, issuing from a rather thin, main lamella of the mesogloea. The extension of the parietal muscles on the column ordinary.



a Fig 16. *b*

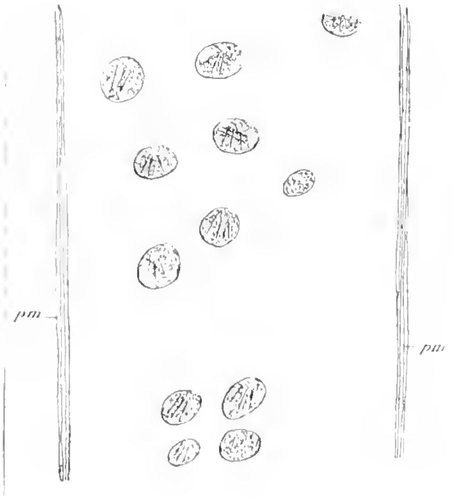


Fig. 17.

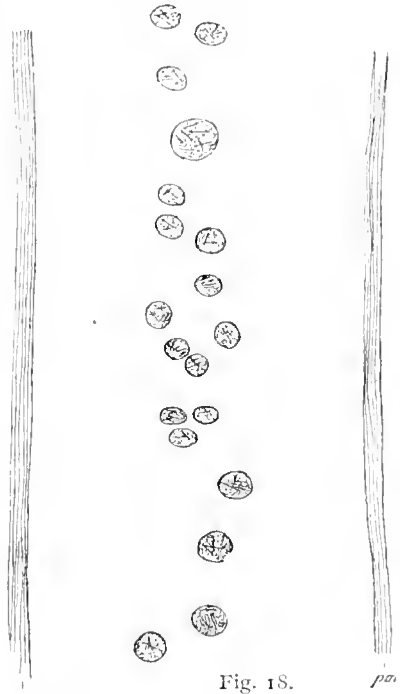


Fig. 18.

Textfigs. 16—18. Arrangement of the nemathybomes between two perfect mesenteries in *Edwardsia longicornis* (fig. 16*a*) in *E. pallida* (fig. 16*b*), in *E. danica* (fig. 17) and *E. andresi* (fig. 18). pm: parietal muscles. The figs. 16 and 18 are drawn in the same magnification, the fig. 17 is more magnified than the others. *E. longicornis* and *pallida* (from Bohuslän) and *E. andresi* (from Lyngen) were well expanded, *E. danica* (from Lille Baelt, Mortensen) was more contracted. The ectoderm in the preparations has been pencilled away.

Colour. Physa uncoloured. Scapus ochreous-yellow to orange or more dirtily-grey. Nemathybomes uncoloured. Capitulum now uncoloured, now paler or darker brownish-red, in the latter case with opaque white spots, with conspicuous insertions of the mesenteries. The spots are arranged in the middle-line and often confluent, forming indistinct, in the upper part broader, longitudinal lines, often terminating below the tentacles with a more clearly defined part. Tentacles uncoloured, with scattered, irregular, yellowish-white and reddish-brown spots. Oral disc yellowish-white shading off into ochre, with smaller white and larger brown spots and stripes.

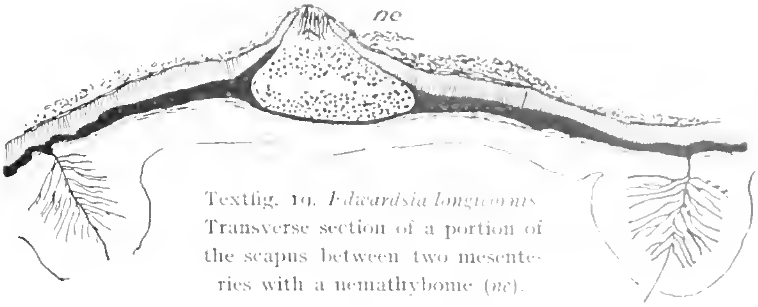
Dimensions in extended state: unto about 3 cm long and 0.3 cm broad.

Occurrence: Norway. Dröbak (Lütken).

Sweden. Bohuslän. Strömstad fiord (1882), Koster, Styrsö 10 fms. (Carlgren 1889), Bolthålan 20—25 fms. (Hansson), Väderöarne 8—10 fms. (Carlgren, Östergren and others) very common, 15 fms. (Goës 1882), Varholmen (Carlgren), Gullmar fiord, Sämstad 8—10 fms. (Carlgren 1889) common, Zool. Stat. Kristineberg (1893), Gasö "ränna" 8—10 fms. (Carlgren 1889—90), N. Gasö fiord (Wirén 1890). Bohuslän without distinct locality (Lovén). Gothenburg Styrsö (Lagerberg).

Denmark: Samsöbelt (Winther), Cattegat without distinct locality (Petersen).
The Sound S. of Hven 9 fms. (Gunhild Exp. 1878 st. 33), S. of Hven 17–
26 m; W.N.W. of Wiken ("Sven Nilsson" st. 30, 52 c).

Exterior aspect. The physa is well-developed, the scapus provided with a thin periderm, with which is combined a rather thick and soft layer, commonly ochre-coloured and probably, at least partly, formed by closely-packed mucus-particles. The comparatively few, but rather large nemathybomes are arranged in 8 longitudinal lines as in *E. tuberculata* (textfigs. 16a, 19), quite another distribution than in *E. pallida* (textfig. 16 b). The nemathybomes are generally distinct, only if the animals are very contracted or the periderm is loosened from the ectoderm, it is sometimes difficult to discern them. Also in contracted specimens the nemathybomes keep in the main the same position, though they are often a little displaced and approached to each other. The upper part of the column at stronger contraction shows a polygonal appearance which is more distinct in extended specimens.



Textfig. 19. *Edwardsia longicornis*. Transverse section of a portion of the scapus between two mesenteries with a nemathybome (*ne*).

The tentacles are almost always 16, arranged in 2 cycles as in *E. claparedii* (compare textfig. 10); in a very small (0.4 × 0.15 cm), but fertile specimen from Samsö belt, sectioned by myself, I have not found more than 12 tentacles. Thus it looks as if the species could be ripe already in a stadium with 12 tentacles and with more than normally weak mesenterial muscles (compare below)[1], at least in the Danish seas, where the genus moreover does not reach the same size as in Bohuslän. Perhaps we here meet with the same case as in *Halcampa duodecimcirrata* which is ripe in a stadium with only 8 perfect mesenteries and 10 tentacles (Carlgren 1893 a), at least at our coast, where it is smaller than at the coast of Norway. The tentacles are conical and, in comparison with those of *E. pallida*, long (the name *longicornis*, however, does not indicate that the tentacles are longer than in the *Edwardsia*-species in common), the inner endocoel-tentacles are about two thirds as long as the outer exocoel-tentacles. The oral disc is conical and provided with radial furrows corresponding to the insertions of the mesenteries. The actinopharynx as usual is furnished with 8 longitudinal furrows, the ventral one of which forming a weak siphonoglyphe.

Anatomical description. The nematocysts of the nemathybomes are of two kinds, one shorter and thinner and of almost equal breadth, the other longer and broader and of different breadth at the basal and at the distal end, the latter the narrower. The size of the nematocysts and the spirocysts in the different parts of the body appears from the following table (see page 34).

The 8 "*Edwardsia*-mesenteries" are provided with well-developed, in transverse sections [illegible] elongated, longitudinal pennons. The highest folds appear as usual at the outside of the pennons, in the innermost part there is often also one high fold. The number of the folds in the upper part of the reproductive region

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[1] It may be possible that we have to do with a distinct species here, but my material is too poor for [illegible] it. The parietal muscles of the Samsö specimen recall those of *E. danica*.

Habitat	nemathybomes n.	 n.	capitulum n.	tentacles n.	 sp.	actinopharynx n (a)	 n (a)	 n (b)
1) Väderöarne	58-62 × 2.5 μ	48-81 × 4-5 μ	—	19-23 × 2 μ	14-17 μ	14 × 2 μ	25-29 × 2.5-3 μ	30 × 7 μ
2) Kristineberg	53-65	48-86	—	—	—	—	—	—
3) Styrsö	41-58 × 2.5	41-72 × 4-5	—	17-22 × 2 (2.5)	14-17	14-17 × 2	—	26 × 7
4) Varholmen	43-61 × 2	46-67 × 3.5 (-5)	—	—	—	—	—	—
5) Dröbak	41-48 × 2	41-58 × 4 (5)	—	—	—	—	—	—
6) Bohuslän Zool. St.	48 × 2	48-65 × 3.5-4.5	—	—	—	—	—	—
7) Kattegat	36-50 × 2	36-61 × 3.5-4	—	—	—	—	—	—
8) —	about 46 × 2	38-53 × 3.5-4	—	—	—	—	—	—
9) Samsö Belt	43-55 × 2	43·65 × 3.5 (5)	—	—	—	—	—	—

n, n(a); typical nematocysts, spirocysts, n(b): nematocysts with discernible basal part to the spiral thread. The specimens provided with smaller nematocysts were small No. 8 (0.55 × 0.15 cm No. 9) 0.65 × 0.15 cm.

never exceeds 20; they variate in number; in several sectioned specimens I have found between 13 to 18 folds. I have reproduced the pennons from 3 different specimens in the textfigs. 20—22, of which textfig. 22

Fig. 20.

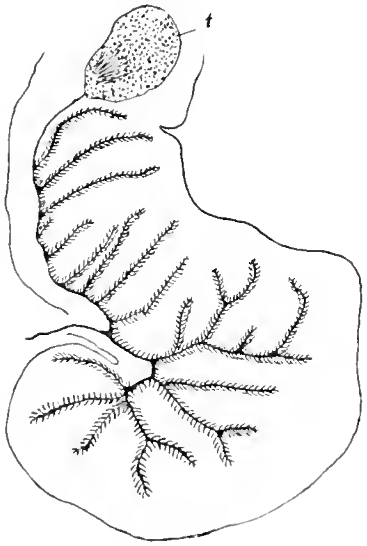


Fig. 21.

Fig. 22.

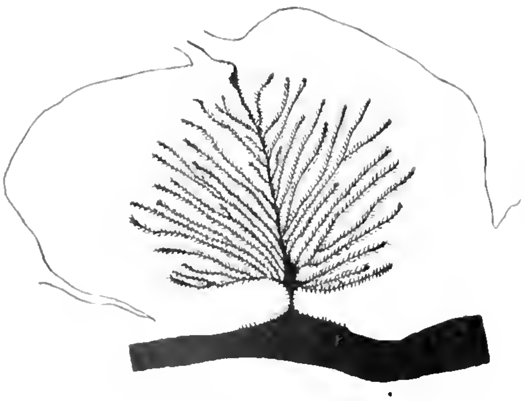


Fig. 23.

Textfigs. 20—24.
Edwardsia longicornis.
Transverse sections of pennons (figs. 20—22) and parietal muscles (figs. 23, 24) in the reproductive tract. Figs. 20, 21, 23 specimens from Bohuslän. Figs. 22, 24 specimen from Samsö Belt, compare the text!

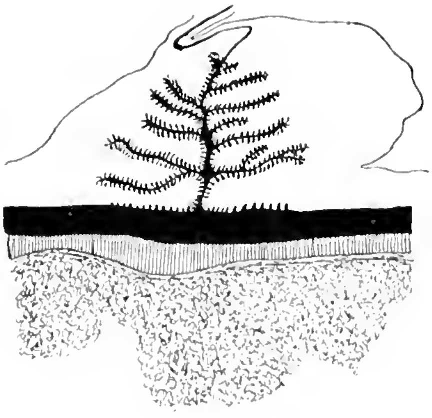


Fig. 24.

is taken from the sexually ripe Samsö-specimen with 12 tentacles. Though the number of folds variates in the different specimens the folds agree in appearance. The outer lamellar part of the mesenteries is attached to the pennon rather close to the centre. The weak, imperfect mesenteries in the uppermost part of the column are comparatively well-developed. The mesogloea off-shoots, supporting the parietal muscles, are often dichotomously branched and delicate, like the main lamella of the mesogloea. The folds of the parietal muscles vary considerably in number, as shown by the textfigures 24 of the Samsö-specimen and by a specimen from Bohuslän (textfig. 23) (compare note p. 33).

In larger specimens the parietal muscles appear similar to those of the textfigure 23. The expansion of the parietal muscles on the column is the ordinary one.

Remarks. This species is nearly allied to *E. tuberculata*, but is distinguished from this species by a more delicate form, by fewer folds of the muscles in the pennons, and above everything by smaller nematocysts of the nemathybomes. To this we might object that this difference in structure is due to a difference in age. As, however, the smallest specimens examined of *E. tuberculata* are smaller than the larger of *E. longicornis*, and as nevertheless the nematocysts of the two specimens differ very much in size, I must regard them as two different species. Besides this, *E. longicornis* seems to live in more shallow water than *E. tuberculata* which prefers deeper water. I have never found *E. longicornis* to reach the dimension of *E. tuberculata*, and yet I have a great material of the former for examination.

Edwardsia pallida (n. sp.).

Edwardsia clavata var. *pallida* n. var. Carlgren 1893 p. 12, 14 Pl. 2 figs. 5—9.

Diagnosis. Physa well-developed. Scapus with a thin periderm with irregular aggregates of nemathybomes. Nemathybomes in the aggregates mostly very closely packed. Nematocysts of the nemathybomes partly 36—53 × 2.5 μ, partly 62—74 × 5 μ, the latter often curved. Tentacles 16, now very short, cylindrical, not pointed, now longer and more conical. Nematocysts of the tentacles 17—19 × 1.5—(2) μ, their spirocysts 11—14 × 1—1.5 (2) μ. Nematocysts of the actinopharynx partly 22—26 × 1.5—2 μ, partly 29—36 × 2.5 μ. Longitudinal muscle-pennons rather strong, in the upper part of the reproductive region in transverse sections elongated with at most 20 (about 14—17) folds. Outer and inner part of the pennons comparatively richly branched with high folds, the middle part with simple or only slightly branched, short folds. The outer lamellar part of the mesenteries attached to the pennon not far from the outside. Parietal muscles in the reproductive region rather strong, with folds somewhat closely arranged, rather high and a little ramificated. Mesogloea in the parietal muscle-tract thickish. The expansion of the parietal muscles on the column is the ordinary one.

Colour. Physa uncoloured. Scapus mostly dirty-grey, sometimes ochreous-yellow, especially in the upper part. Capitulum uncoloured, transparent, its upper part sometimes yellowy-white, with indistinct white lines on each side of the mesenterial insertions. Close to the tentacles a reddish-brown area is sometimes found, but it only seldom forms a continuous annulus as it is interrupted by the white lines. Tentacles uncoloured, transparent, with a brown streak at the base, at the inside of their apex a more or less distinct white spot and often another one at the base of the tentacles. Oral disc yellowy-white, with brown streaks around the mouth.

Dimensions in very extended state to about 6 cm. long, commonly shorter, breadth 0.3—0.4 cm.

Occurrence. Sweden. Bohuslän, Väderöarne 8—10 fms., sand (Carlgren, Oestergren) together with *E. longicornis*, but less frequent than this species. — 60 fms. (Gunhild-Exp. 1878).

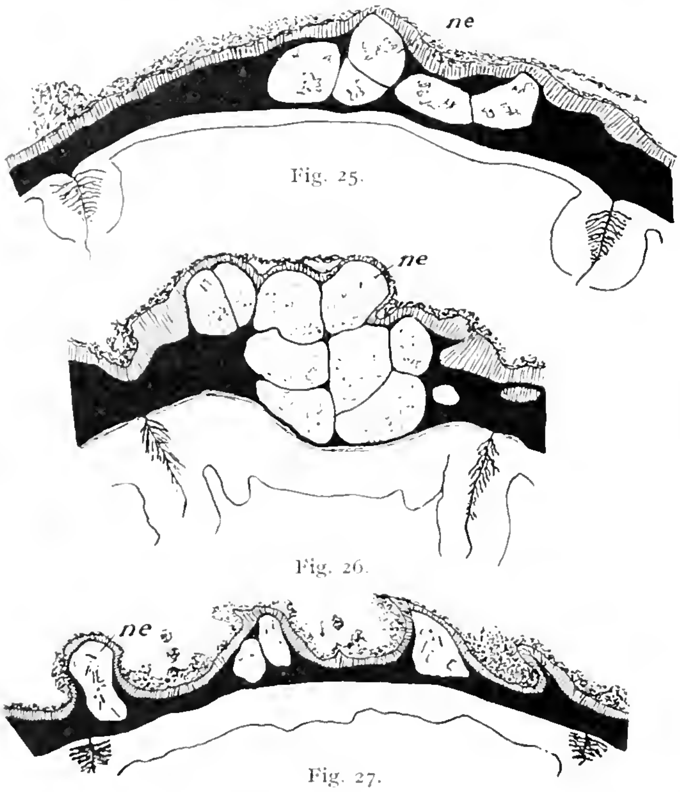


Fig. 25.

Fig. 26.

Fig. 27.

Textfigs. 25—27. Transverse sections of the scapus between two mesenteries of *Edwardsia pallida* (figs. 25, 26) and *Edwardsia danica* (fig. 27). ne: nemathybomes. Fig. 25 is drawn from an expanded specimen, fig. 26 from a contracted, fig. 27 from a rather much contracted specimen.

Exterior aspect. The physa is well-developed. The scapus is provided with a thin, slightly adherent periderm, commonly of a dirty-grey colour. The insertions of the mesenteries are conspicuous, apparently neither the scapus nor the capitulum are polygonal, at least not in extended state. The nemathybomes are not visible to the naked eye, wherefore the scapus seems to be devoid of them. They do, however, appear in great numbers and are mostly irregularly packed together in groups (textfigs. 16b, 25, 26, compare the anatomical description). The tentacles are 16 in number, now very short, cylindrical, not pointed, now conical and longer. The arrangement of the tentacles in two cycles is not as distinct here as in other *Edwardsia*-species, at any rate not when the tentacles are short. The oral disc and the actinopharynx are of usual appearance, the latter provided with 8 longitudinal furrows of which the ventral one is the broader and forms a weak siphonoglyphe.

Anatomical description. The nemathybomes of the scapus are comparatively small and usually collected in irregular groups; here and there a single nemathybome appears. In the aggregates the nemathybomes are very closely packed, separated from each other by a thin mesogloea-lamella. They therefore get an appearance as if they were composed of several nemathybome-capsules (textfigs. 25, 26 — Carlgren 1893 Pl. 2 fig. 9; in the reproduced figure in my paper 1893 it seems as if a single nemathybome is situated right opposite to the parietal muscle; the cavity is, however, an artificial product caused by the loosening of the ectoderm from the mesogloea.) Also in other *Edwardsia*-species with scattered, not regularly arranged nemathybomes, for instance in *E. vitrea, andresi, danica,* the nemathybomes may in transverse sections get an appearance recalling that of the nemathybomes in *E. pallida*, especially if the animals are contracted, in which case the nemathybomes are of course more close than when the scapus is extended. In no other species I have, however, observed nemathybomes as strongly agglomerated as in *E. pallida*. That the nemathybomes are in reality very close we may conclude from the textfigures 25 and 16b, the latter of which represents a piece of a compartment with the nemathybomes, seen from the surface, in a very extended specimen. In contracted animals the nemathybomes are still more closely packed (textfig. 26). The nematocysts of the nemathybomes are of two sizes, partly 36—53 × 2.5 μ, partly 62—74 × 5 μ, the latter are often a little curved; one part of the nematocysts appears granulated. The nematocysts of the tentacles are 17—19 × 1.5 to almost 2 μ, their spirocysts 11—14 × 1—1.5 (2) μ. The nematocysts of the actinopharynx are partly 22—26 × 1.5—2 μ, partly 29—36 × 2.5 μ.

The siphonoglyphe is provided with longer cilia than the other part of the actinopharynx.

The 8 "*Edwardsia*-mesenteries" are well-developed, the other 8 mesenteries in the uppermost part of the column are also distinct. I have before described and reproduced the former (Carlgren 1893 Pl. 2 figs. 5—8) from different parts of the body. The longitudinal muscle-pennons are in transverse-sections somewhat elongated and show, at most, about 20, commonly 14—17 folds. They are especially high in the outer and also in the inner part and rather richly ramificated; between these folds there are shorter ones, simple or a little branched (textfig. 28 transverse-section through the upper part of the cnido-glandular tract). The outer lamellar part of the mesenteries is attached to the pennon rather close to the outside. The parietal muscles of the same tract show rather numerous folds, a little branched and attached to thickish off-shoots of the mesogloea, the main lamella of the mesogloea is likewise in the outer part thick (textfig. 29). The expansion of the parietal muscles on the column is the ordinary one.

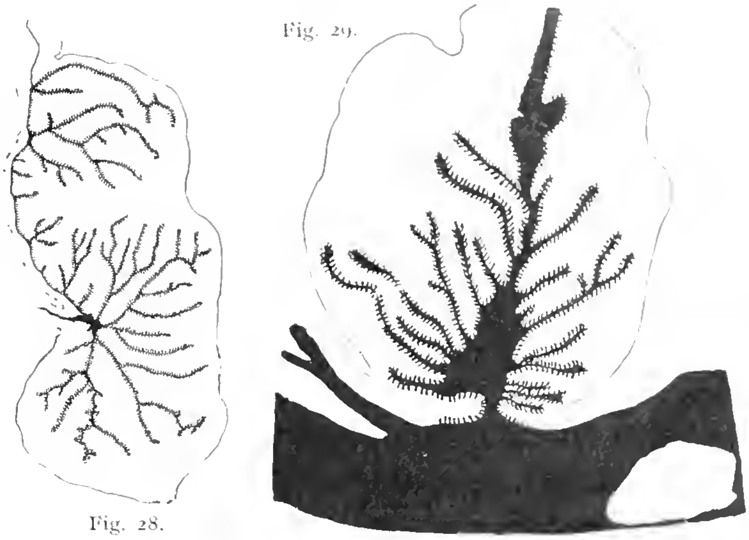


Fig. 29.

Fig. 28.

Textfigs. 28—29. *Edwardsia pallida*. Compare the text!

Remarks. I have before (1893) described this species as a variety of *E. clavata*. A closer examination, particularly of the distribution of the nemathybomes, however, proves that it is well differentiated from the species, called by myself *E. clavata* var. *longicornis* = *E. longicornis*, though they were both of them dredged in the same locality (compare *E. tuberculata, longicornis* and *danica*).

Edwardsia danica n. sp.

Dimensions. Physa well-developed. Scapus with a rather well-developed periderm. Nemathybomes from somewhat small to small, scattered, but not closely packed together in groups. Nematocysts of the nemathybomes partly 24—42 × (2.5) 3—3.5 (4) μ, partly 46—72 × 4—5 μ, the latter sometimes very sparse (or absent?). Tentacles in varying numbers unto 20 of ordinary length. Nematocysts of the tentacles 17—19 × 1—2 μ, their spirocysts 10—17 × 1—2 μ. Nematocysts of the actinopharynx partly 15—19 ×

1—2 μ, partly 24—34 × 2—2.5 μ. Longitudinal muscle-pennons rather strong with folds of ordinary height and a little branched, in numbers less than 20, the stronger folds in the outer part, shortened inwards, and in the innermost part one or two longer folds. Outer lamellar part of the mesenteries attached to the pennon rather close by the centre. Parietal muscles comparatively weak, dichotomously branched. Expansion of the parietal muscles on the column considerable.

Colour. Scapus dirty-grey to ochreous-coloured.

Dimensions. In extended state the largest specimen with 20 tentacles (from Little Belt) was 2.4 cm high and 0.2 cm broad. The largest, a little contracted, specimen was 2 cm long and 0.25 cm broad.

Occurrence. Cattegat (Petersen), Torboskär-Skagen 19—22 fms. (Gunhild-Exp. 1878), Little Middelgrund 10 fms. (Gunhild-Exp. 1878), Laholm bay 10—12 fms. (Gunhild-Exp. 1878), Great Belt Winther), Little Belt (Mortensen 1900), 7—24 fms. (Schiödte), off Lyngs Odde 10 fms. (Mortensen 1912), Samsö Belt (Winther).

The Sound (Möller, Lütken). Between Landskrona and Haken 17—21 m S. of Hven 17—26 m; W. of Knähaken 23-25 m, W. of "Disken" 24 m ("Sven Nilsson" St. 27, 30, 42, 43 a, 52 c), S. of Hven 6—24 fhs. (Gunhild-Exp. 1878).

Exterior aspect. The physa is of usual appearance. The scapus is provided with a rather well-developed periderm. The nemathybomes are small, not visible to the naked eye and not protuberated on the surface of the scapus. They are scattered, not as numerous and not as aggregate as in *E. pallida*, which becomes evident by a comparison of the figs. 16 b, 17, p. 32.

In surface preparations (textfig. 17) as well as in sections (textfig. 27) they show a different agroupment. Sometimes two nemathybomes close by each other are seen in contracted specimens of *E. danica* (textfig. 27); in shape they are, however, different from those of *E. pallida*. In order to control the arrangement of the nemathybomes I have sectioned several specimens of both species, examined them in surface preparations and always found thorough differences in the agroupment of the nemathybomes. The tentacles are of usual size and appearance. They vary considerably in number. In the smallest, extended specimen from Little Belt (Mortensen 1912) there were only 12 tentacles (this specimen is, however, probably not fertile; I have sectioned the lower part of it, but not found any reproductive organs); in 3 other sectioned fertile specimens (from Samsö Belt, Little Belt and the Sound St. 27) the number of tentacles was 14, 16 and 16. The best, extended specimen (from Little Belt Mortensen 1912) with evolved tentacles had 20 tentacles. In *Edwardsia pallida* I have observed only 16 tentacles. The oral disc and the actinopharynx are of usual appearance. A weak, ventral siphonoglyphe is present.

Anatomical description. The periderm of the scapus is rather well-developed, in the paler specimens thinner. The nemathybomes are small and contain nematocysts of two different sizes, both a little broader at the basal end. The large capsules were mostly very sparse, in some specimens I did not find any in the maceration preparations; it is, however, possible that they are present also there. In the maceration preparations of the specimens 4 and 5 (compare the table) I observed only some few capsules. They always show a discernable basal part to the spiral thread what is also often the case with the smaller nematocysts. The nematocysts of the actinopharynx are also of two sizes. The size of the spirocysts (sp.) and nematocysts (n) in the diverse regions of the body is as follows.

Habitat	nemathybomes n.		capitulum n.	tentacles n.	tentacles sp.	actinopharynx n	actinopharynx n.
1) Little Belt (Mort. 1900)	29-39 × 3.5-4 μ	55-72 × 5 μ		17-19 × 1-2 μ	10-14 × 1-2 μ		24 × 2-2.5 μ
2) — (— 1912)	24-33 × (2.5) 3*	—	7-12 × 1.5 μ	17-19 × 2	10-17 × 1-2		
3) — (Schiödte) .	26-43 × (2.5) 3-3.5	—	—	—		—	
4) The Sound (St. 27)	29-41 × 3.5-4	55-65 × 5	—	—	—	—	—
5) — (St. 42)	24-41 × 3	46-55 × 5	—	17-19 × 2	10-14 × 1-1.5	17-19 × 1.5-2	29-34 × 2.5
6) — (St. 43 a)	32-43 × 3	48-65 × 4.5-5	—	14-18 × 1.5-2	10-14 × 1.5	15-19 × 1.5-2	26-31 × 2-2.5
7) — (St. 30)	29-43 × 3-3.5	53-72 × 4-5	—				
8) — —	26-41 × 3-3.5	—	—	—	—		
9) — (Lütken) ...	31-43 × 3-3.5	—	—	—	—	—	—

* Measured on sections.

The 8 "*Edwardsia*-mesenteries" have well-developed, longitudinal pennons. The folds are rather high, but not as branched as in *E. pallida* (textfigs. 30, 31). The most ramificated folds are situated in the outer part, but also in the innermost part there are one or two such folds. The middle part of the pennon is more weak. The number of the folds is about the same as in *E. pallida*. The outer lamellar part of the mesenteries is attached to the pennon at some distance from its outside, in the reproduced pennon (fig. 30) a little nearer to the centre. The parietal muscles are comparatively weak, and more or less dichotomously branched (textfig. 32), they are, however, sometimes a little stronger than the reproduced ones. The expansion of the parietal muscles on the column is considerable.

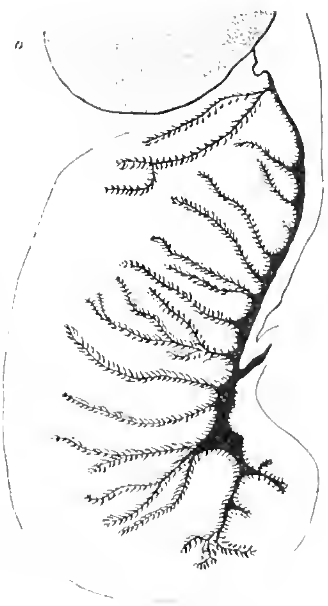


Fig. 30.

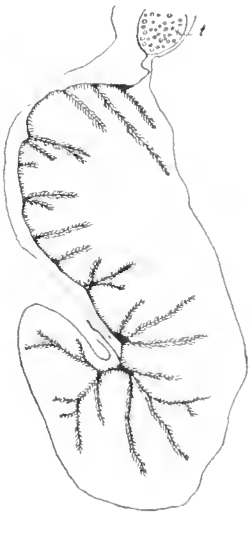


Fig. 31.

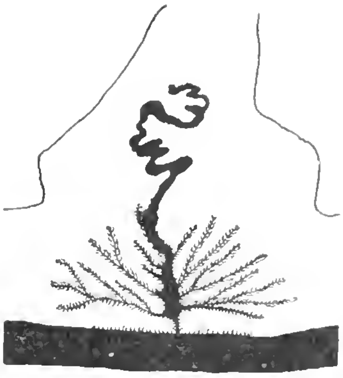


Fig. 32.

Textfigs. 30-32. *Edwardsia danica*. Transverse sections of pennons (figs. 30, 31) and parietal muscle (fig. 32) in the upper part of the reproductive tract. Figs. 31, 32 spec. from Little Belt (Mortensen 1900). Fig. 30 from the Sound St. 27 (»Sven Nilsson«).

Remarks. Among the Swedish species this species is the most nearly related to *E. pallida*. The arrangement of the nemathybomes is, however, another here, the number of tentacles in some cases greater, the smaller nematocysts of the nemathybomes shorter, etc.

Edwardsia arctica n. sp.

Dimensions. Physa ordinarily developed. Scapus with a rather well-developed periderm, especially in the lower part. Nemathybomes somewhat large, probably arranged in 8 longitudinal rows, possibly a little scattered in the proximal part. Nematocysts of the nemathybomes 38—60 × 4—5 μ, those of the capitulum about 14 μ long. Tentacles 16. Nematocysts of the tentacles 19—26 × 2—2,5 μ, their spirocysts 12—24 × about 3 μ. Nematocysts of the actinopharynx partly 29—41 × 3—3.5 μ, partly (24) 26—34 × 4—6 μ, the latter with discernible basal part to the spiral thread. Longitudinal muscle-pennons with few, 10—13 folds, only branched in the outer part. The outer lamellar part of the mesenteries attached to the pennon next to the outside. Parietal muscles ordinarily developed, in transverse sections through the distal part of the column looking like a half-opened fan. The expansion of the parietal muscles on the column considerable.

Colour in alcohol, rusty- to ochreous-coloured, in the distal part sometimes dirty-grey.

Dimensions in contracted state. Length to about 0.9 cm, breadth to about 0.35 cm.

Occurrence. East-Greenland. Mackenzie bay north of Franz Joseph's fiord 12—35 m mud (Sw.-Polar-Exp. 1900. N. 17) 2 sp., Scoresby Sound Famae islands 70°5′ N. 22°33′ W. 5—9 m mud (Sw.-Greenland-Exp. 1899 No. 32) 5 sp. South of the little Pendulum island 74°35′ N. 18°23′ W. 18—21 m mud and sand (Sw. Greenland Exp. 1899 No. 20) 1 sp.

Jan Mayen 71°12′ N. 8°28′ W. 1275 m grey clay (Sw. Greenland-Exp. 1899 No. 17) 1 sp. (badly preserved and young specimen, determination dubious.

Nova Zembla Matotschkin Sharr 2—5 fms. clay and sand (Nova Zembla-Exp. 1875 No. 80).

Kara Sea 73°38′ N. 63°45′ E. 80 fms. shells (Nordenskiöld-Exp. 1876, No. 38) 2 sp.

Exterior aspect. The physa is ordinarily developed and perforated by apertures. The scapus is provided with a periderm, most developed in the proximal part, the distal part of the scapus is polygonal. The nemathybomes are rather large, possibly a little irregularly arranged in the proximal part; in the distal part they form an undulating row in the middle of each compartment. It is probable that the nemathybomes are grouped in 8 longitudinal rows, but as all the animals were very strongly contracted this arrangement may have been disturbed by the contraction. The capitulum is of usual appearance. The tentacles are 16 in number. The actinopharynx and the siphonoglyphe were not well preserved.

Anatomical description. The ectoderm of the physa is high with scattered nematocysts, 10—14 μ long. To the physa foreign bodies sometimes adhere. The ectoderm of the scapus is rather high with an ordinarily developed periderm, to which a great many foreign bodies are sticking. The nematocysts of the nemathybomes are numerous. A general view of the size of the nematocysts of the examined specimens shows as follows.

Habitat	scapus	tentacles	actinopharynx n (a)	actinopharynx n (b)
Mackenzie bay	48-60 5 μ	22-26 × 2.5 μ	34-38 × 3.5 μ	31-34 × 5-6 μ
Famae Islands	38-58 4	22-24 × 2.5	34-41 × 3.5	26 × 5 (few observed)
Pendulum Isl.	41-50	22-24 × 2.5	29-36 × 3.5	—
Matotschkin Sharr	41-50 × 4-5	—	—	—
Kara Sea	43-53 × 4-5	19-24 × 2-2.5	34-36 × 3	24-29 × 4-5

in the (b) nematocysts of the actinopharynx the basal part to the spiral thread is discernible.

The ectoderm of the capitulum is high and contains scattered nematocysts, about 10—12 μ long. The ectoderm of the tentacles is provided with numerous nematocysts 19—26 × 2—2.5 μ, and very numerous spirocysts, 12 × 1.5—24 × 3 μ. The actinopharynx-ectoderm contains, in addition to the nematocysts mentioned in the table above, also smaller nematocysts, 19—26 × 2—2.5 μ; possibly these latter belong to the involved tentacles.

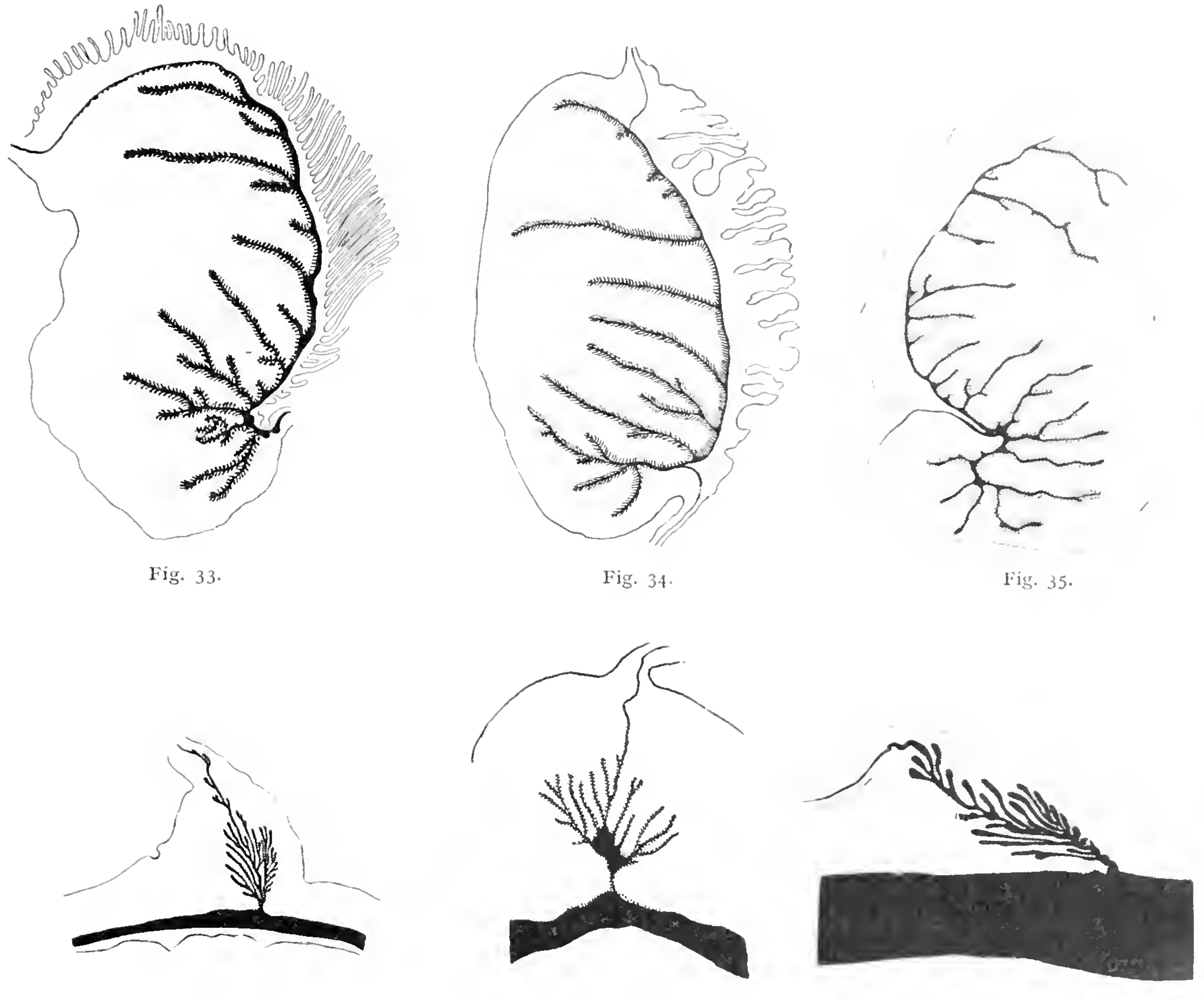


Fig. 33. Fig. 34. Fig. 35.

Fig. 36. Fig. 37. Fig. 38.

Edwardsia arctica. Transverse sections of pennons (fig. 33—35) and parietal muscles (fig. 36—38) in the reproductive tract. Figs. 33, 36, specimen from Scoresby Sound, figs. 34, 37 specimen from Mackenzie Bay. Figs. 35, 38 specimen from the Kara Sea.

The imperfect mesenteries are very weak. The longitudinal muscle-pennons of the 8 "*Edwardsia*-mesenteries" are not strong and form in the reproductive tract about 10—13 only slightly ramified folds. The sections through the reproductive region of three specimens, textfig. 33 spec. from Scoresby Sound (a), textfig. 34 spec. from Mackenzie Bay (b), and textfig. 35 spec. from the Kara Sea (c) show a great conformity in the arrangement of the folds. The endoderm on the opposite side of the muscle-pennons is strongly lobed, the most conspicuously in the specimens a and b; in c the folds are sticking together so that the outline seems to be more even. On the pennon-side the endoderm is, on the other hand, richly provided with vacuoles. The outer, lamellar part of the mesenteries is attached to the pennon, close by its outside. The parietal muscles (textfigs. 36—38) are comparatively strong, now fan-shaped, now — especially in the distal part — elongated towards the centre. The shorter folds are mostly situated in the inner part of the muscle. The expansion of the parietal muscles on the column is rather considerable. The ciliated streaks are well-developed. The species is dioecious.

Edwardsia fusca Dan.

Edwardsia fusca n. sp., Danielssen 1890 p. 112, Pl. 5, fig. 6, Pl. 19, figs. 5—9.

Diagnosis. Physa well-developed, ampullaceous. Scapus with a well-developed, incrusted periderm, polygonal, with 16? rows of small nemathybomes. Their nematocysts about 31—36 × (2)—2.5 μ. Capitulum polygonal. Tentacles 12. Nematocysts of the tentacles 24—27 × 2.5 μ, their spirocysts 14 × 1.5 —26 × 2.5 μ. Nematocysts of the actinopharynx 36—46 × 2,5—3 μ. Longitudinal muscle-pennons of the mesenteries rather strong, in the ciliated tract with 15—20 especially in the outer part richly ramified folds. Outer lamellar part of the mesenteries attached (in the ciliated tract) close by the outside of the pennons. Parietal muscles somewhat strong with rather numerous transversely elongated folds. Expansion of the parietal muscles on the column probably the ordinary one.

Colour. Capitulum brownish-red with 12 rather broad, dark-auburn lines, between which paler longitudinal areas are observed. Oral disc flesh-coloured with two brown annuli of small, brown patches. Tentacles with 3 dark-brown annuli. Scapus brown, physa flesh-coloured (Danielssen).

Dimensions in extended state: Length of the body, tentacles included, 5.5 cm, scapus 2.8 cm. Capitulum 1.2 cm (Danielssen). The strongly contracted specimen, sectioned by myself, was about 1 cm long.

Occurrence. 70°36′ N. 32°35′ E. 271 m clay. Bottom temperature 1°9. (Norwegian North-Atl.-Exp. St. 262) 1 sp.

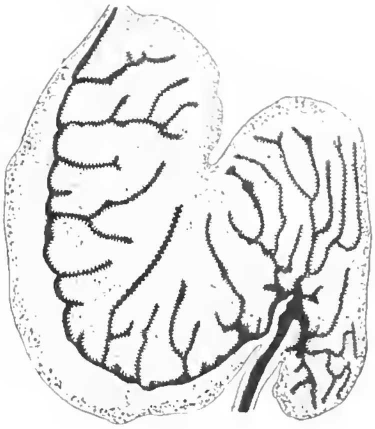
Exterior aspect. The physa is ampullaceous, well-developed and provided with 8 fine, longitudinal lines (probably the discernible insertions of the mesenteries). The scapus is provided with a strongly incrusted periderm, its form is cylindrical. Between the insertions of the mesenteries there are 16 rows of small nemathybomes in all, two in each compartment (Danielssen). (In the specimen, examined by myself, the nemathybomes were indistinct and seem to be more irregularly arranged, it is therefore questionable, if the nemathybomes are arranged in such a way as stated by Danielssen. The mesenterial furrows were indistinct in the proximal part, distinct in the distal one.) The capitulum is well-developed, in the distal part, close below the oral disc, provided with 12 ridges, proximally reduced to 8. According to Danielssen there are papillae (nemathybomes?) in the physa as well as on the capitulum. (This statement is certainly not correct, as the nemathybomes of *Edwardsia* never appear on the capitulum nor on the physa.) The tentacles are 12 in number. The oral disc is inconsiderable. Actinopharynx and siphonoglyphe? — The above description is compiled from that of Danielssen, I have placed my own remarks in brackets.

Anatomical description. Danielssen has described this species anatomically, but in most cases erroneously. I have only been able to examine a specimen imperfectly, mainly in the region of the scapus. Though my observations need completing, I think that they may aid to characterize the species.

The ectoderm of the scapus is very thin in comparison to the mesogloea, the periderm thick, and the small nemathybomes provided with (rather sparse?) nematocysts of a length of about 31—36 μ and a breadth of (2) 2.5 μ. The nematocysts were commonly not well preserved. Danielssen has reproduced a section through the scapus (Pl. 19, fig. 7) giving a rather good figure of the scapus. The nematocysts of the tentacles are 24—27 μ in length and 2.5 μ in breadth, their spirocysts vary from 14 × 1.5 μ to 26 × 2.5 μ. The ectoderm of the scapus is provided with numerous gland-cells, the nematocysts of which are 36—46 × 2.5—3 μ.

The longitudinal pennons of the mesenteries are rather strong, in the region of the ciliated tract with about 15—20 folds, somewhat richly branched, especially in the outer part. The innermost fold is longer than the largest one of the middle part. The lamellar outer part of the mesenteries are attached to the pennon close by its outer edge (textfig. 39). The parietal muscles were not well preserved, strong with rather numerous, long folds, running parallel to the column. Their expansion on the column is probably the ordinary one, but it is difficult to decide, on account of the strong contraction of the muscles. The ciliated streaks are of the usual structure.

Remarks. The anatomical figures 8 and 9, Pl. 19 in the work of Danielssen are quite useless. The figure 9 illustrates nothing, and as to the figure 8 it need hardly be said that the capitulum and the actinopharynx are not sectioned, as declared by Danielssen, but only the scapus, of which one part is involved. This confusion of the body-parts also explains Danielssen's statement that the capitulum has papillae. In many other respects Danielssen's description is certainly wrong, for instance his account of the actinopharynx and of the reproductive organs, as well as his discovery of acontia.



Textfig. 39. *Edwardsia fusca.* Transverse section of pennon in the ciliated tract

Edwardsia andresi Dan.

Edwardsia andresi n. sp. Danielssen 1890 p. 106, Pl. 5, fig. 5, Pl. 20.

— — Dan., Appellöf 1893 p. 12, Pl. 3 fig. 19, Carlgren 1904 p. 542—543 fig. 8, Carlgren in Nordgaard 1905 p. 158.

Diagnosis. Physa well-developed, perforated by apertures. Scapus with a thin, easily deciduous periderm. Nemathybomes accumulated in the middle line of each compartment, but not forming a single longitudinal row. Nematocysts of the nemathybomes 48—67 × 3.5—4 μ, those of the capitulum 10—12 μ in length. Tentacles 12, seldom 13—15. Nematocysts of the tentacles numerous, 24—29 (34) × 2—2.5 μ, their spirocysts numerous, from 12—14 × 1—1.5 μ to 26 × 2.5 μ. A weak ventral siphonoglyphe. Typical nematocysts of the actinopharynx (29) 36—43 × 3.5—5 μ, nematocysts with distinct basal part to the spiral thread 24—29 × 4—5 μ. Longitudinal muscle-pennons of the mesenteries strong, in transverse-sections of the reproductive region rather elongated with some twenty to some thirty folds, somewhat ramificated, especially in the outer part of the pennon. The outer lamellar part of the mesenteries attached to the pennon not far from the outside of it. Parietal muscles very strong, in transverse-sections often more or less trianguloid with rather richly branched folds. The expansion of the parietal muscles on the column is considerable.

Colour. Scapus green with a few brownish-yellow patches, capitulum and tentacles pellucid. At the uppermost margin of the capitulum some dots of a rather intense brown colour, placed two and two together on a milky-white ground, appear like a double ring — a brown one and a white one below. Tentacles of the extremities of a faint violet, extending like a fine line a short way down the aboral side; they also have a brown annulus at the base. Oral disc brown, of a somewhat paler colour than the brown actinopharynx (Danielssen). In preserved state the periderm is dirty-green or -grey, sometimes more or less dirty-ochreous-coloured.

Dimensions in expanded state. Length of the column 9 cm, breadth of the same 0.8—1 cm, length of the tentacles 1.6—2 cm (Danielssen). In preserved and very contracted state the length amounts to 2.7 cm.

Occurrence. Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3°9 (Ingolf-Exp. St. 32) 1 sp.
West Greenland. Bredefiord 220—310 m. (Rink-Exp. 1912 St. 64) 1 sp.
Iceland 6—7 miles N. W. of Borgarfiord 85 fms. (Haller 1867) 1 sp.
Beeren Island-Spitzbergen. 75°58′ N. 13°18′ E. 350 m. (Sw. Spitzbergen-Exp. 1898 No. 41) 1 sp.
Norway-Beeren Island. 73°27′ N. 23°11′ E. 460 m. (Sw. Spitzbergen-Exp. 1898 No. 2) 11 sp.
Norway Finmark Skjerstadfiord 320 m. (Nordgaard) 481 m.; Bottom temp. 3°2 (Norw. N. Atl.-Exp. 1877 St. 253) numerous sp.
— — Lyngen 300 m bottom temp. between 3°5 and 3°65 (Nordgaard 1899) numerous sp.
— — Ögsfiord (Sars labelled *Edwardsia duodecimcirrata)*.
— — Tromsö Faernes (1881).
North Atlantic. 61°40′ N. 3°11′ E. 220 fms. Bottom temp. 6°34 (Michael Sars-Exp. 1902 St. 51).).
Skagerrak 139 fms., 300 fms. (J. Lindahl 1877) numerous sp.

Exterior aspect. The physa is well-developed and perforated by apertures in such a way as described by me below in *E. vegae*. The long scapus is provided with a thin, sometimes transparent, rather easily deciduous periderm which sometimes may be incrusted with foreign bodies. In its contracted state the mesenterial furrows are very distinct, wherefore the scapus seems polygonal, and also when the scapus is extended, these furrows are rather conspicuous. According to the figure reproduced by Danielssen there is in each compartment a single, longitudinal row of nemathybomes. Such a regular arrangement I have never observed, neither in a type-specimen nor in the numerous specimens examined by myself. In the contracted specimens the nemathybomes are commonly more irregularly arranged, though collected in the middle line between the insertions of the mesenteries. On transverse-sections two or exceptionally some more nemathybomes may simultaneously be hit in the middle line. Also in 3 expanded specimens (from Faernes, Lyngen (textfig. 18) and Davis Strait) I have observed the same irregular arrangement with sometimes 2 or a few more nemathybomes besides each other. In strongly contracted individuals the nemathybomes appear very indistinctly, so that the scapus seems to be smooth. The capitulum is short, smooth, with shallow, mesenterial furrows. It is not provided with papillae (nemathybomes?) as Danielssen says. The number of tentacles is generally 12 which I have observed in a great number of specimens; I have found 13 tentacles once, 14 three times and 15 once. In the specimen from Bredefiord one tentacle was provided with an offshoot at the base, another one was bifurcated, circumstances which are probably connected with a regeneration. The inner tentacles are—as usual in *Edwardsia*—shorter than the outer ones. The oral disc is small, the mouth oval. The actinopharynx is provided with 8 longitudinal furrows, a distinct ventral siphonoglyphe is present.

Anatomical description: The ectoderm of the physa is of ordinary height with sparse, scattered nematocysts, about 12 μ long. In contracted specimens the mesogloea is in the periphery of the physa thicker than the ectoderm, thinner in the centre of it. Its endoderm is higher than its ectoderm and rich in vacuoles, as is usually the endoderm of the column. The periderm and the ectoderm of the scapus are thin. The nemathybomes are rather large and, especially in the distal part of the column, provided with numerous, often a little curved nematocysts. Their size varies between 48 and 67 × (3) 3.5—4 μ. The following table shows the size of the nematocysts of a series of specimens:

Habitat	scapus	tentacles	actinopharynx
Faernes	48—67 × 3.5 μ	—	38—40 × 3.5—4.5 μ
Iceland	56—62 × 3.5—4	24—34 × 2.5 (3) μ	36—43 × 3
Skagerrak	48—53 × 3—3.5	25—29	36—43 × 4—5
Lyngen	48—62 × 3.5	—	—
Beeren Isl.—Spitzbergen	48—60 × 3.5	—	
Norway—Beeren Isl.	48—65 × 3.5	24—29 × 2	(29)—43 × 4—5
St. 51 "Michael Sars"	50—62 × 3—4	—	—
Davis Strait	53—61 × 3—3.5	24—29 × 2—2.5	34—41 × 4

The endodermal, circular muscles are well-developed. The ectoderm of the capitulum is high and provided with numerous, about 10—12 μ long, thick-walled nematocysts. At the base of the ectoderm there is a well-developed layer of nerve-cells and fibrillae which Appellöf (1893) was the first to observe and reproduce. The nematocysts of the tentacles are numerous, (concerning their size compare the table!), the spirocysts vary from 12 × 1—1.5 μ to 26 × 2.5—3 μ. The longitudinal muscles of the tentacles and the radial muscles of the oral disc are well-developed. The ectoderm of the actinopharynx is high in the ridges, in the furrows lower, its nematocysts numerous. The siphonoglyphe is distinct and provided with longer cilia than the other part of the actinopharynx.

The imperfect mesenteries in the most distal part of the body are comparatively well-developed. If only 4 of these are present, they are found in the lateral and ventro-lateral "*Edwardsia*"-compartments (textfig. 9). The longitudinal muscle-pennons (textfigs. 40—42) of the 8 perfect mesenteries are strong, in transverse sections through the reproductive tract rather elongated and provided with some twenty to some thirty folds of ordinary height. These folds are rather richly branched, especially in the outer and in the innermost parts. The inner folds are commonly considerably shorter than the outer ones, and the outer part of the mesenteries attached close by the outside of the pennons. The parietal muscles (textfig. 43—45) are strong; in transverse-sections in the reproductive region and a little higher up more or less trianguloid and rather richly branched. The inner part of the parietal muscles displays short, somewhat thick folds. In the textfigs.

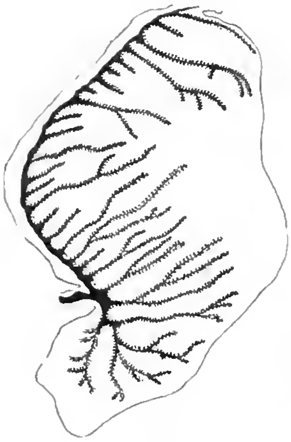


Fig. 40.

Fig. 41.

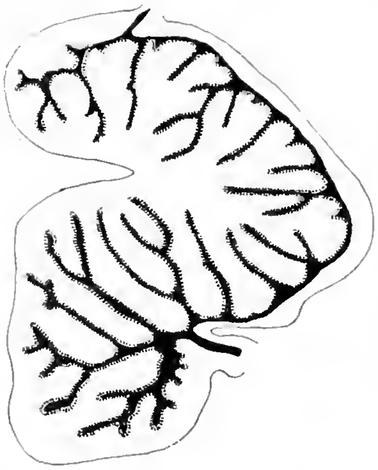


Fig. 42.

Textfigs. 40—45. *Edwardsia andresi.* Transverse sections of pennons (figs. 40-42) and parietal muscles (figs. 43-45) in the upper part of the reproductive tract or a little above (fig. 41). Figs. 40, 43 spec. from Bredefiord. Figs. 41 type-specimen. Fig. 44 spec. from Lyngen. Figs. 42, 45 specimen from Iceland (younger than the others).

Fig. 43.

Fig. 44.

Fig. 45.

43—45 I have reproduced the parietal muscles of three specimens from different localities. These figures plainly show the conformity of the three specimens, as do also the figures of the corresponding longitudinal pennons (textfigs. 40—42). The expansion of the parietal muscles on the column is rather inconsiderable. The ciliated and the intermediate streaks are well-developed, in the proximal part of the filaments there is a distinct boundary streak. Danielssen states that acontia are present, but that is certainly not so. The species is dioecous.

Remarks. The description of the species given by Danielssen differs in several respects from mine.

Among **Danielssen's** figures of the species only the figures 1, 2, 3, 5 and 13 (Pl. 20) are usable, but nowise good, the others are very bad. The section reproduced in the figure 7 has in the centre not hit the actinopharynx, but the involved part of the column; the figures 10 and 11 show nothing as to the presence of acontia and testes. As already corrected by **Appellöf** (1893 p. 18) this species has normally developed directive mesenteries.

The above description of the species is based not only on a type-specimen but also on several individuals from different localities.

Edwardsia islandica n. sp.

Diagnosis. Physa rather well-developed. Scapus with a very strong cuticle and with rather few, scattered, small nemathybomes. Nematocysts of the nemathybomes 36—48 × 2—2.5 μ. Tentacles 16. The nematocysts of the tentacles about 22—24 × 1.5 μ, their spirocysts 12—17 × 2—2.5 μ? The nematocysts of the actinopharynx (33) 36—43 × 2 μ. Longitudinal muscle pennons of the mesenteries somewhat strong with a few (to about 12) folds which are of about equal height and rather richly branched. Lamellar outer part of the mesenteries in the upper part of the reproductive region attached to the pennons not far from the outside of these latter. Parietal muscles, especially in comparison with the pennons, very strong, mostly trianguloid and with numerous folds. The expansion of the parietal muscles on the column is considerable.

Colour?

Dimensions: Breadth of the column 0.4 cm. As to the length I cannot give any exact information, the single specimen, dredged at the same time as *E. tuberculata* having been sectioned, and the thickness of the sections not having been stated.

Occurrence: South of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp.) 1 sp.

Exterior aspect: The physa is rather well-developed. The scapus is provided with a very strong cuticle and with rather few, small, scattered nemathybomes. The capitulum is polygonal. Number of tentacles 16. The actinopharynx is strongly folded. I cannot decide whether a siphonoglyphe is present or not, the ectoderm of the actinopharynx not being well preserved.

Anatomical description: The ectoderm of the physa was considerably higher than that of the scapus. The scapus-ectoderm is provided with a thick cuticle which in several places may become as thick as the ectoderm. The cuticle very much recalls that of *Isoedwardsia ingolfi*, though it is not quite as thick. It is strongly folded because of the strong contraction of the scapus. The small nemathybomes only contain a single kind of capsules 36—48 × 2—2.5 μ in size. The ectoderm of the capitulum is higher than that of the scapus. The nematocysts and spirocysts of the tentacles and the nematocysts of the actinopharynx I have only been able to measure in sections. The nematocysts of the tentacles are about 22—24 × 1.5 μ, the spirocysts about 12—17 × 2.5 μ; the latter measures are, however, very uncertain. The numerous nematocysts of the actinopharynx were (33) 36—43 × 2 μ. The nematocysts of the tentacles and of the actinopharynx are measured on sections.

The 8 "*Edwardsia*"-mesenteries are rather strong with some few (to about 12) folds which are of about equal height and show a tendency to rich ramification (textfig. 46). The small, imperfect mesenteries of the uppermost part of the column are thick. The parietal muscles, especially when compared with the longitudinal pennons, are strong, trianguloid and provided with numerous folds, particularly in the upper part of the reproductive tract (textfigs. 47, 48). The expansion of the parietal muscles on the column is considerable and comprises about the whole breadth of the parietal muscles. The ciliated streaks are well-developed. The specimen was a male.

Fig. 46.

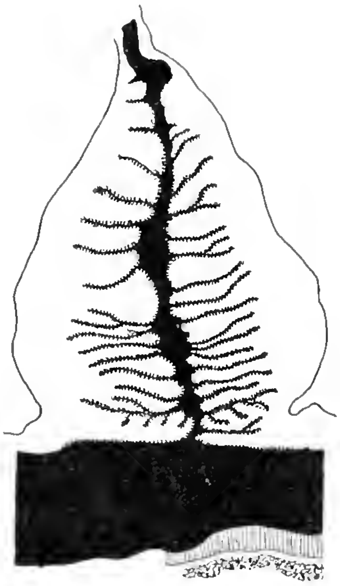


Fig. 47.

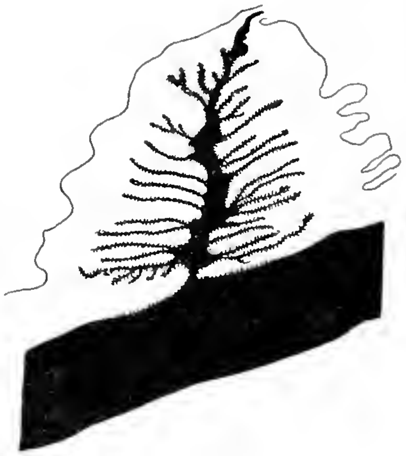


Fig. 48.

Textfigs. 46—48. *Edwardia islandica*. Transverse section of pennon (fig. 46) and parietal muscles (figs. 47, 48) in the upper part of the reproductive tract.

Edwardsia incerta n. sp.

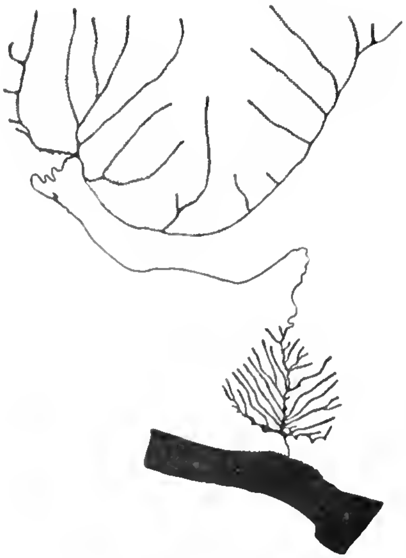
Diagnosis: Physa well-developed. Scapus with a thick ectoderm, incrusted with foreign bodies, with scattered, large nemathybomes, containing a few nematocysts 29—37 × 5 μ in size. Tentacles not more than 16, probably 12. Nematocysts of the tentacles 22—26×2 μ, the spirocysts 14—22 μ in size. Longitudinal muscle pennons of the mesenteries in transverse-sections with some few, about 12 folds, only ramificated in the outer parts. The lamellar outer part of the mesenteries attached close by the outside of the pennons. Parietal muscles comparatively well-developed, in transverse-sections fan-shaped, considerably broader than in *E. arctica*. The parietal muscles are considerably expanded on the column.

Colour in alcohol: Scapus dirty grey.

Dimensions in contracted state: length 0.9 cm, breadth 0. 15 cm.

Occurrence: East-Greenland 72°28′ N. 21°48′ W. 180 m mud with some stones (Sw. Greenland-Exp. 1899) 1 sp.

The muscle pennons of the mesenteries of these species recall those of *E. arctica*; the nematocysts of the nemathybomes, however, differ in size. On account of the imperfect and badly preserved material I cannot give any minute description of the species. A transverse-section of a muscle pennon and of a parietal muscle is reproduced in textfig. 49.



Textfig. 49. *Edwardsia incerta*. Compare the text!

Edwardsia vitrea (Dan.) Carlgr.

Pl. 1, Figs. 5, 11.

Edwardsioides vitrea n. sp. Danielssen 1890, p. 100, Pl. 5, fig. 3, Pl. 16, figs. 4—10.

Diagnosis: Physa rather well-developed. Scapus with a very thin periderm, with scattered nemathybomes, the nematocysts of which are (34) 36—42 × 3—3.5 μ. Number of tentacles 13—16. Nematocysts of the tentacles 17—29 × 2.5—3.5 μ, the spirocysts unto 29 × 2.5—3.5 μ. Nematocysts of the actinopharynx very numerous, partly (31) 36—53 × 2.5—3.5 μ, partly 17—24 × 2.5 μ. Longitudinal muscle pennon strong, in the upper part of the reproductive region with 20—30 longer and shorter folds, the former with numerous, small secondary folds. The outer lamellar part of the mesenteries attached close by the outside of the pennon. Parietal muscles very strong, in transverse-sections through the reproductive tract often trianguloid, with very numerous, long, closely packed folds. The expansion of the parietal muscles on the column the ordinary one.

Colour: Periderm greenish, transparent. The integument inside almost as clear as glass, with a faint play of reddish colour and with pale light-red longitudinal furrows. In fully expanded state the capitulum has a faint, rose-red tinge, and so has the physa. Tentacles beautifully bright-red (Danielssen). Scapus in preserved state dirty-grey or partly ferruginous.

Dimensions in extended state: 4—5 cm in length and 0.8 cm in breadth (Danielssen). In contracted state the length is to about 3 cm and the breadth to about 0.7 cm.

Occurrence: East-Greenland Franz Joseph Fiord 73°16′ N. 23°15′ W. 28—36 m clay with stones sand and shells (Sw. Greenland-Exp. 1899 No. 44) 2 sp.
Spitzbergen Wijde bay 40 fms. (Sw. Spitzberg-Exp. 1861) 1 sp. Great fiord 78° 37′ N. 19° E. 5—10 fms. Sand (Malmgren 1864) 3 sp. Great Islet 80° 15′ N. 30° E. 95 m (Römer and Schaudinn St. 37) 1 sp.
68°21′ N. 10°40′ E. 836 m clay and sand. Bottom temp. — 0.7 (Norw. N. Atl.-Exp. St. 164) 1 sp.

Exterior aspect: The physa seems to be smaller than in the former, species described. According to Danielssen it is incapable of involution; this is probably not correct. In the examined type-specimen (fig. 5, Pl. 1) the scapus is separated from the physa by an annular lacing in. Danielssen also states that the physa is provided with sparse suckers (nemathybomes?). This is certainly not the case, I never observed any such. On the other hand foreign bodies sometimes seem to be attached to the physa; in the type-specimen there were namely fragments of such adhered to the physa, probably by the secretion of the mucus-cells. According to my examination of the species from Great Islet, the physa of which I have sectioned, the physa is perforated by apertures. The scapus is provided with 8 longitudinal furrows, corresponding to the insertions of the mesenteries, and with scattered, rather numerous nemathybomes. Danielssen declares that the suckers (nemathybomes) are arranged in somewhat regular transversal rows which, however, does not seem to be case. The periderm of the scapus is very thin. When the animal is very much expanded the periderm is almost inconspicuous (Danielssen). The involved part of the scapus is a little polygonal. The capitulum is short and provided with distinct, longitudinal furrows, corresponding to the insertions of the mesenteries.

The statement of Danielssen, that the capitulum has suckers, is not correct. The tentacles were 16 in the specimen from Great fiord, Wijde bay and in the examined type-specimen; the specimens from Greenland had only 13, resp. 15 tentacles. The specimen from Wijde bay (Pl. 1, fig. 11) showed a neomorphose (Carlgren 1904 p. 458). The oral disc is small, the actinopharynx as usual short. Siphonoglyphe?

Anatomical decription: The apertures of the physa are surrounded by circular muscles. At the aperture in the mesogloea there is an annular wall of the epithelium (whether of the ectoderm or of the endoderm I cannot decide, the epithelium not being well preserved). This wall probably forms a movable stopping, differently located according to the different state of concentration of the physa. In the Wijde-specimen the wall turned towards the ectoderm, (textfigs. 50, 51), while in *E. vegae* (compare this species) it turned inwards. The wall is almost exclusively composed of elongated cells with large nuclei. The nemathybomes of the examined type-specimen are flat and, on account of the bad preservation, containing only a few whole nematocysts, the greater part of which are shrivelled, and as the stinging thread is thrown out there is no distinct limit between the capsule and the thread. The nematocysts in the nemathybomes of the other specimens were numerous, excepting the badly preserved Wijde-specimen where I found only a few nematocysts. In the following table I have set up the size of the nematocysts in the different tracts of the animal. It ought to be mentioned that the nematocysts are measured only in sections of the type-specimen. The measures are therefore a little uncertain.

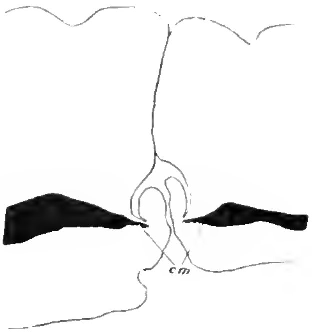


Fig. 50.

Textfigs. 50—51.
Edwardsia vitrea.
Section of a central aperture in the physa fig. 50 through the middle part fig. 51 through the rim. cm. circular muscles.

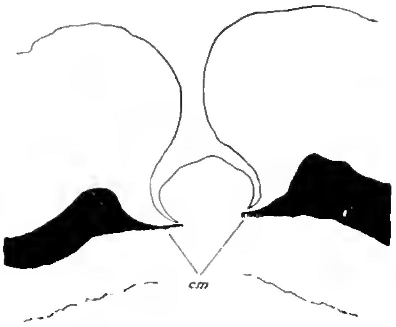


Fig. 51.

Habitat	scapus	capitulum	tentacles	actinopharynx	
Great fiord	36—38 × 3.5 μ	14—17 × 2 μ	24—29 × 2.5—3.5 μ	38—51 × 3.5 μ	—
68°21′ N (type sp.)	about 38	—	—	36—53 × 3	17—22 μ
East-Greenland	37—42 × 3—3.5	14—17 × 2	17—29 × 2.5—3.5	36—48 × 3.5	20—24 × 2.5
Wijde bay	34—38 × 3	10—12	19—25	31—36 × 3	—

In the specimen from Wijde bay I found only 2 nematocysts in the maceration preparation of the nemathybomes, and in the specimen from Great Islet none, (as the parietal muscles of the latter are very strong it is, however, probable that we have to do with *E. vitrea*).

The periderm of the scapus is very thin and only a little incrusted. The nematocysts of the capitular ectoderm are rather numerous, in the tentacles very numerous. The spirocysts of the tentacles obtain a size of 17—29 × 2.5—3.5 μ, I have also observed smaller capsules. The ectoderm of the actinopharynx is high, several times thicker than the mesogloea, and contains nematocysts of two different sizes.

The longitudinal muscle pennons of the mesenteries are strong. Unfortunately I cannot describe the pennons of the type specimen in the upper part of the reproductive tract as Danielssen has sectioned this part; on the other hand I have been able to examine the pennons of the lowermost part of the actinopharynx region (textf. 55) and of the lowest part of the reproductive tract (textfig. 56). In the latter figure we see that the pennon begins to diminish, showing however numerous branched folds, especially at the outer side. In the former sections we find about 30 high, rather richly ramificated folds, of about equal height. I have reproduced pennons in the upper part of the reproductive region of the specimens from Great fiord (textfig. 54), from Greenland (textfig. 53) and from Wijde bay (textfig. 52); they all agree well. The folds are about 25—30 in number and provided with numerous, small, secondary folds. The outer lamellar part of the mesen-

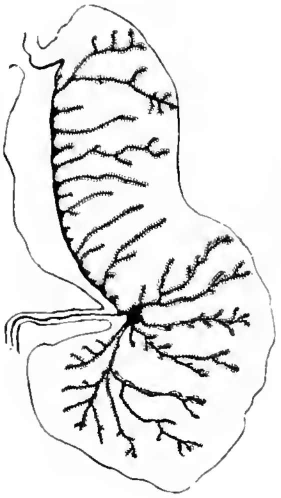


Fig. 52.

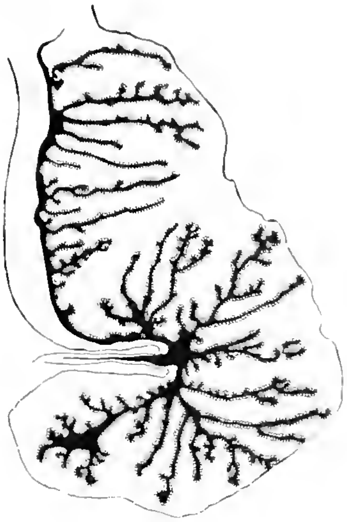


Fig. 53.

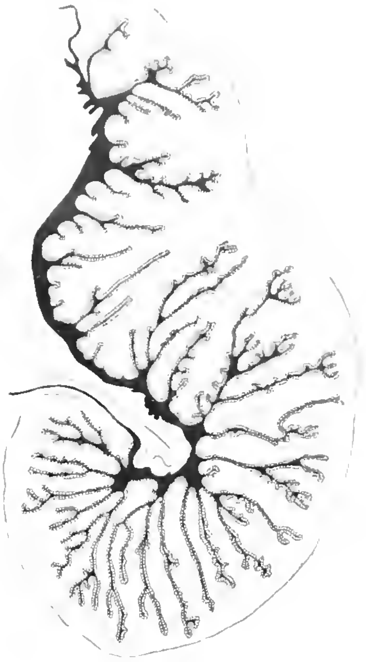


Fig. 54.

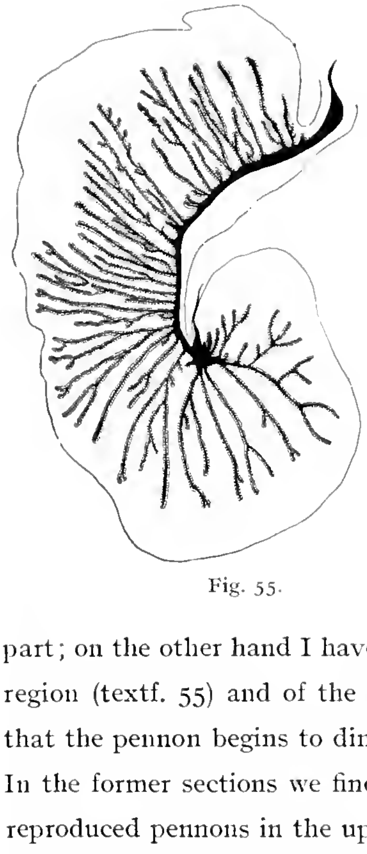


Fig. 55.

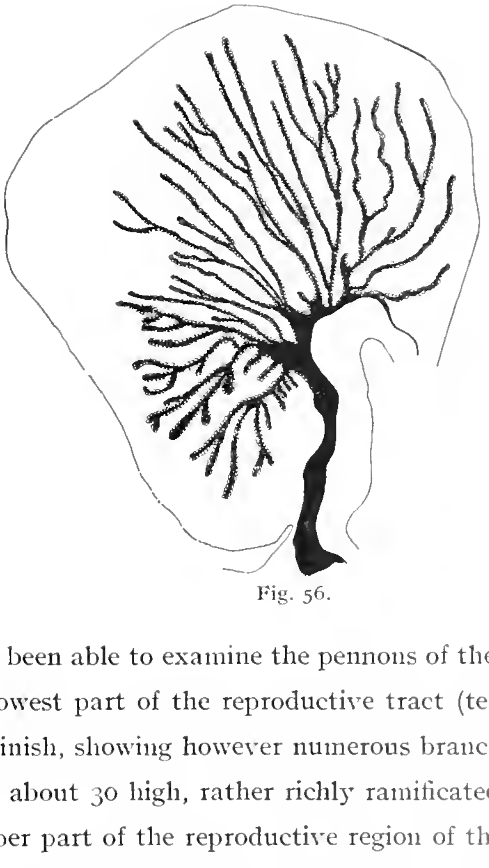


Fig. 56.

Textfigs. 52—56.
Edwardsia vitrea.
Transverse section of pennons in the upper part of the reproductive tract (figs. 53, 54) or in a corresponding part (fig. 52). Fig. 52 young specimen from Wijde Bay, fig. 53 specimen from Franz Joseph Fiord, fig. 54 specimen from Great fiord. Figs. 55, 56 Transverse section of a mesentery of the type-specimen, fig. 55 through the lower part of the actinopharyngial region, fig. 56 through the lowest part of the reproductive tract.

teries is attached close by the outside of the pennon. The parietal muscles are very strong, in the inner part commonly more branched than in the outer one, where the high folds sometimes have no branches at all. The folds are numerous and, especially towards the outside, closely packed together. According to the state of contraction the parietal muscles of transverse-sections are of a different appearance; they are, however, more or less trianguloid. For comparing purposes I have reproduced the parietal muscles of five specimens. Especially the muscles reproduced in the figs. 58, 60, and sectioned in the upper part of the reproductive region, do very well agree. The distribution of the parietal muscles on the column is the ordinary one. The ciliated tracts are of usual appearance. The type-specimen as well as the other examined specimens were females. I cannot confirm Danielssen's statement that the species is monoecious. Also in other respects Danielssen's description is erroneous.

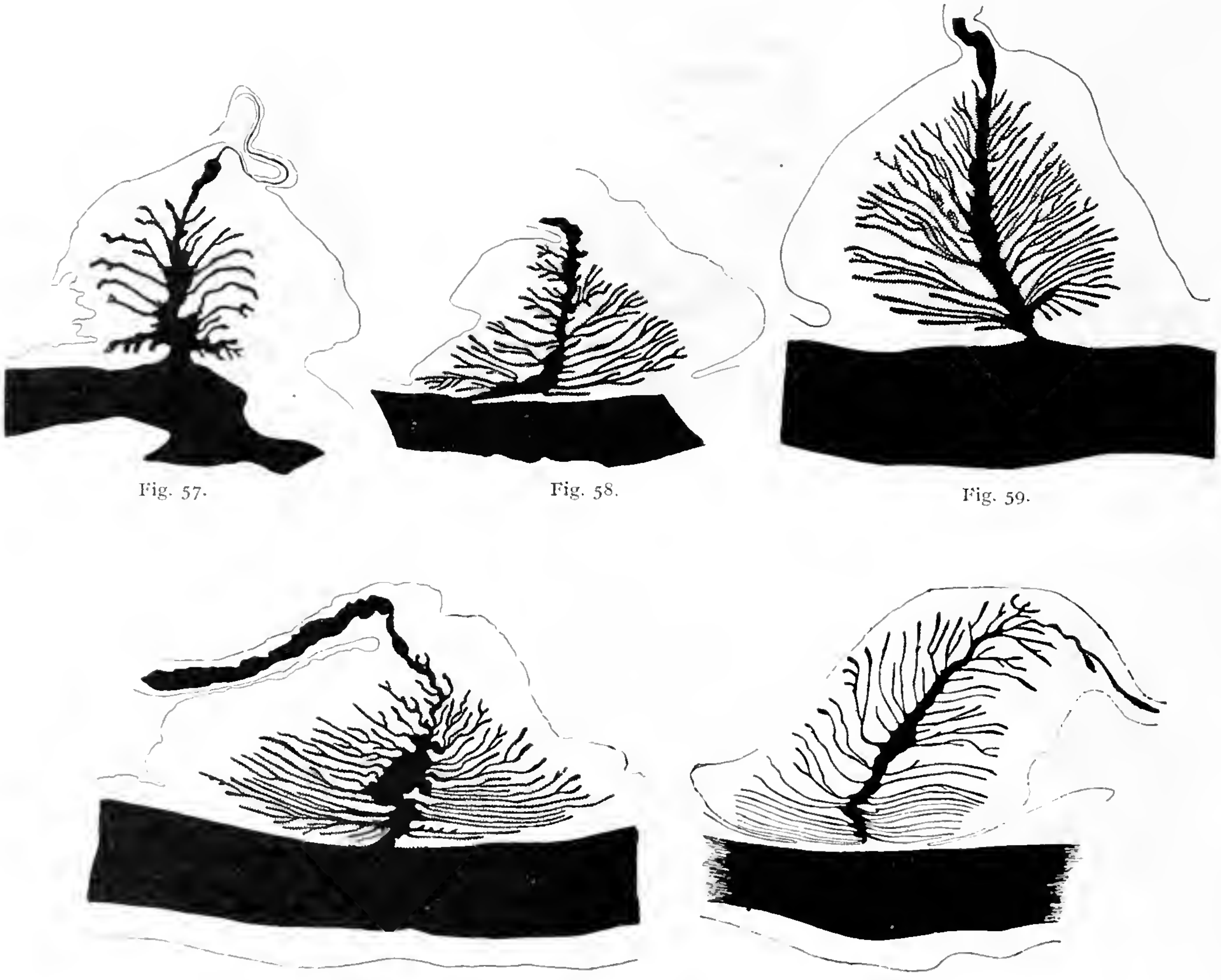


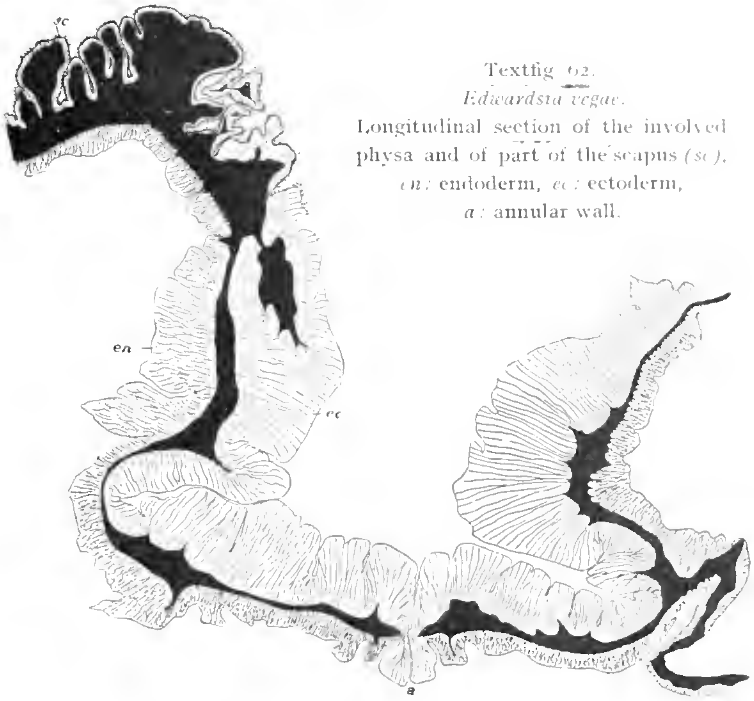
Fig. 57. Fig. 58. Fig. 59.

Fig. 60. Fig. 61.

Textfigs. 57—61. *Edwardsia vitrea*. Transverse section of parietal muscles. Fig. 57: young specimen from Wijde Bay, fig. 58 specimen from Franz Joseph Fiord, fig. 59 specimen from Great Island, fig. 60 specimen from Great Fiord, fig. 61 type-specimen.

Edwardsia vegae n. sp.

Diagnosis: Physa well-developed, perforated by apertures. Scapus with a rather well-developed periderm, polygonal, with scattered, especially in the lower part large nemathybomes. Nematocysts of the physa 14—19 μ, those of the nemathybomes 84—101 × 3 μ, those of the tentacles 19—24 × 2 μ, those of the actinopharynx 38—43 × 3 μ. Tentacles 16. Longitudinal pennons of the mesenteries in the reproductive region with about 25—30 strong folds which are rather high and richly ramificated in the outer part, low and only slightly branched in the inner one. Outer lamellar part of the mesenteries attached to the pennon at some distance from its outside. Parietal muscles with somewhat numerous, in the outer part closely packed folds; in transverse-sections through the reproductive tract folds trianguloid. Expansion of the parietal muscles on the column?



Textfig 62.
Edwardsia vegae.
Longitudinal section of the involved physa and of part of the scapus (*sc*), *en*: endoderm, *ec*: ectoderm, *a*: annular wall.

Colour in preserved state: Scapus dirty-brown.

Dimensions in strongly contracted state with the physa and one part of the scapus involved: Length 1.7 cm, largest breadth about 0.5 cm.

Occurrence: Arctic Sea of Siberia. Off Pittlekaj North of the winter harbour of the Vega 9—10 fms. stones (Vega-Exp. 1879, No. 1002) 1 sp.

Exterior aspect: The physa is well-developed, but involved. It is perforated by a central aperture, surrounded by a ring of probably 8 apertures. The scapus is provided with 8 distinct, longitudinal furrows and is thus polygonal. The nemathybomes are large, especially in the lower part, scattered over the whole surface and distinctly discernible to the naked eye. The capitulum being damaged, I cannot decide whether it is polygonal. The short tentacles are 16 in number. The actinopharynx is short. As it was not well-preserved I cannot say whether a siphonoglyphe is present or not.

Anatomical description: The ectoderm of the physa is very high, considerably thicker than its mesogloea and provided with sparse nematocysts, 14—19 μ long. On transverse-sections through the centre of the physa a central aperture is seen which is probably formed by an involution of the ectoderm (textfig. 62). From the aperture an annular wall (*a*), probably of ectoderm, extends into the coelenteric cavity. (Compare *Edwardsia vitrea*). By the side of the central aperture I have on certain sections observed apertures of similar appearance. Accordingly there is probably a central aperture, surrounded by a ring of 8 apertures. On the inner side of the apertures a distinct layer of circular muscles is developed as in *Halcampa*. The scapus-ectoderm is thin, its periderm ordinarily developed, the mesogloea thick, probably on account of the strong contraction of the body. The nemathybomes are large and contain, in addition to round cells, rather numerous nematocysts, about 84—101 × 3 μ in size. They were often curved and therefore difficult to measure. The endodermal circular muscles of the column are well-developed. The nematocysts of the tentacles are numerous and 19—24 × 2 μ in size, the spirocysts reach a length of unto 18 μ. The rather numerous nematocysts of the actinopharynx are 38—43 × 3 μ.

The longitudinal pennons of the "Edwardsia-mesenteries" are strong, in the reproductive region with 25 to 30 folds which are high in the outer part of the pennons and here rather richly branched, while the inner part is lower and only little ramificated (textfig. 63). The outer lamellar part of the mesenteries issues at a good distance from the outside of the pennon. The parietal muscles are rather strong, with somewhat numerous folds which are long in the outer part, in the inner one short. The former are placed almost perpendicularly to the lamella of the mesenteries; the latter are turned inwards (textfig. 64). Whether the parietal muscles are continued on the column I cannot decide as they were not well preserved in their outer part. The species is dioecious; the specimen was a female.

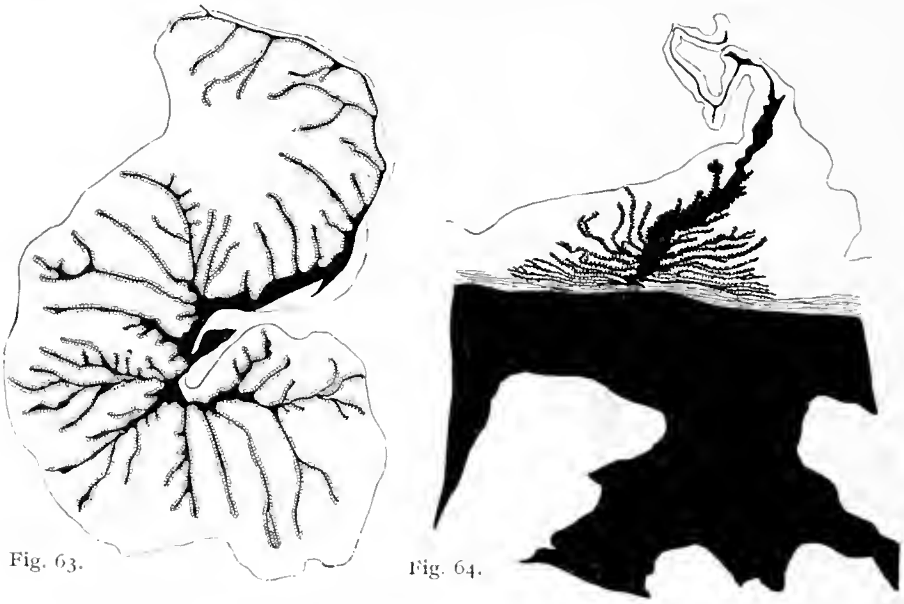


Fig. 63. Fig. 64.

Textfigs. 63—64. *Edwardsia vegae.* Transverse section of pennon (fig. 63) and of parietal muscle (fig. 64).

Edwardsia finmarchica n. sp.

Pl. 1, figs. 10, 12.

Diagnosis: Physa well-developed, perforated by apertures. Scapus-periderm thin. Nemathybomes very small, but numerous, scattered over the whole surface of the scapus, not discernable to the naked eye. Nematocysts of the nemathybomes (26) 36—48 (62) × 3—3.5 (4) μ, those of the capitulum 10—12 μ, those of the tentacles 22—26 × 2.5—3 μ, those of the actinopharynx 30—35 × 2.5—3 μ. Spirocysts of the tentacles 14—17 μ long. Tentacles 16—26 (or more?). Longitudinal pennons of the mesenteries very strong; in transverse-sections elongated; in the reproductive region with about 50, not very high folds which are rather richly branched. The outer lamellar part of the mesenteries attached close by the outside of the pennons. Parietal muscles in the reproductive region not very strong, trianguloid, with comparatively few folds. The parietal muscles are not at all or only very slightly expanded on the column.

Colour in preserved state: Scapus ochreous-coloured.

Dimensions of a well-preserved specimen with extended tentacles. (Pl. 1, fig. 10): Length of the column 3.2 cm, largest breadth 0.45 cm. Physa and capitulum 0.4 cm each.

Occurrence: Norway Finmark (Goës and Malmgren) 5 sp. Tromsö 20 fms. (Goës and Malmgren 3 sp. littoral (Kier) 3 sp.

Exterior aspect: The physa is ampullaceous in extended state and perforated by apertures, the number of which I have not been able to determine with certainty. In a specimen I observed such apertures in 7 compartments. Probably they are arranged in a ring round a central aperture. The specimen from Finmark, mentioned by myself as *E. clavata* (1893, p. 16), belongs to *E. vitrea*. The scapus is provided with a thin periderm in which there are ochreous-coloured incrustations. The nemathybomes are very small, but numerous and scattered. The scapus seems to be smooth, because the nemathybomes only rise a little or not at all over the surface, in contracted as well as in expanded individuals. The proximal part of the scapus is almost round, the distal part polygonal, probably on account of the contraction. The capitulum is short. The number of the tentacles varies considerably. Of 5 examined specimens one had 16, two 22, one 23 and one 26 tentacles, arranged in two or three cycles. The oral disc is small, the actinopharynx short. A ventral siphonoglyphe is present.

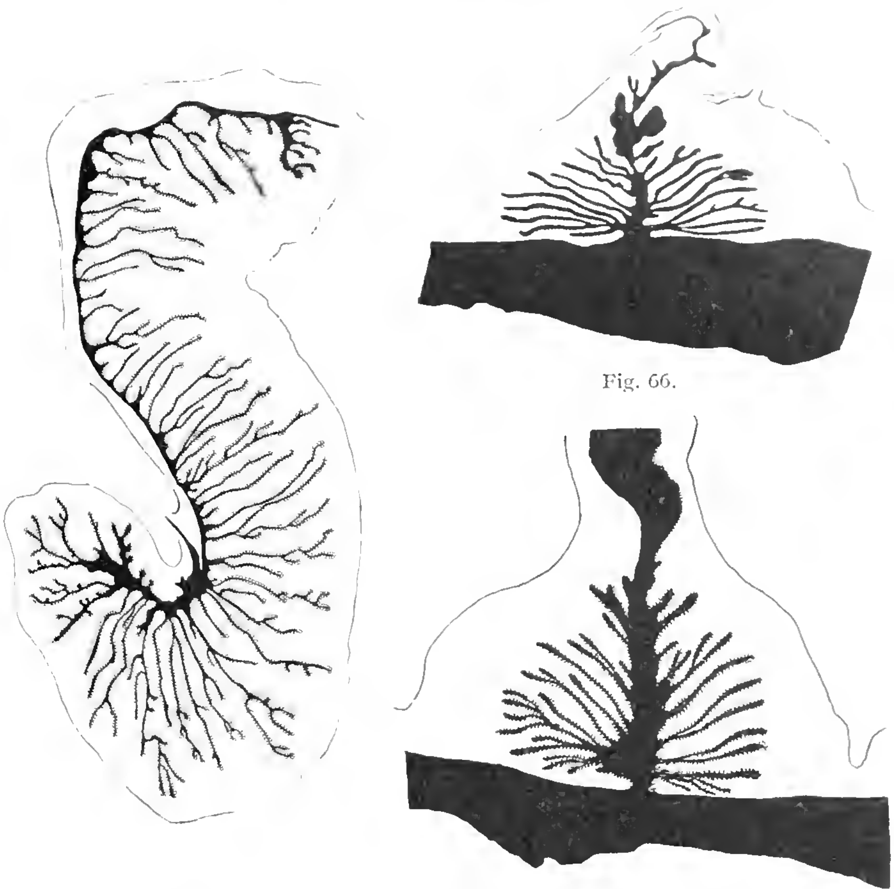


Fig. 66.

Fig. 65. Fig. 67.

Textfig. 65—67. *Edwardsia finmarchica*. Transverse section of pennon (fig. 65) and of parietal muscle (fig. 66) in the reproduction tract. Fig. 67 Transverse section of parietal muscle in the lower part of the actinopharynx.

Anatomical description: The nematocysts of the physa are 12—14 μ in length. The apertures are surrounded by circular muscles. The numerous nematocysts of the nemathybomes vary considerably in size, they are commonly 31—44 μ long, sometimes shorter, down to 26 μ, sometimes longer, unto 62 μ. The ectoderm of the capitulum is rather thick, with sparse nematocysts, 10—12 μ long. The high ectoderm of the tentacles contains numerous nematocysts (22—26 × 2.5—3 μ) and spirocysts (14—17 μ long). The ectodermal longitudinal muscles of the tentacles are rather well-developed. The ectoderm of the actinopharynx is high and provided with several ridges; its nematocysts are numerous, 30—35 × 2.5—3 μ in size. The ectoderm of the siphonoglyphe contains very few nematocysts and glandcells; its cilia are longer than in the other part of the actinopharynx.

The imperfect mesenteries in the uppermost part of the column are rather strong. The longitudinal muscle pennons (textfig. 65) of the "Edwardsia-mesenteries" are very strong, and in transverse-sections through the upper part of the reproductive tract elongated with about 50 folds. These latter are of ordinary length and rather richly branched, especially in the inner and outer parts (several specimens sectioned). Between the larger folds there are smaller ones (textfig. 65). The outer lamellar part of the mesenteries is commonly attached close by the outside of the pennon, sometimes a little more inwards. The parietal muscles are, in comparison with the pennon, not particularly strong; in transverse-sections through the reproductive tract often trianguloid (textfigs. 66, 67) with the longest folds next to the outside. There are not many folds, and they are only a little ramificated; further upwards (textfig. 67) they are more numerous, but never reach the number of folds in *E. vitrea*. The parietal muscles are not at all, or only very slightly expanded on the column. Typically ciliated tracts are present. The species is dioecious.

Remarks: The species is probably nearly allied to *E. sipunculoides*, but differs from this species in longer nematocysts in the nemathybomes and more richly branched muscle pennons.

Genus **Isoedwardsia** Carlgr.

Diagnosis: Edwardsiinae with the column divisible into two regions, capitulum and scapus. Proximal part of the body rounded and, as the other part of the scapus, furnished with nemathybomes. Nematocysts of these latter long and thin. Nemathybomes scattered or arranged in several lines. Scapus with a more or less well-developed cuticle. Nematocysts in the cuticle-lacking ectoderm of the capitulum small. Tentacles 16 or more. Only one feebly developed ventral siphonoglyphe?

This genus, characterized by myself in a few words (1900, p. 26), is distinguished from the nearly related genus *Edwardsia* by the absence of any trace of a physa, while a physa is always present in *Edwardsia*, even if it is sometimes rather small. The ectoderm of the rounded, proximal part of *Isoedwardsia* is therefore furnished with a cuticle which is wanting in this part of *Edwardsia*. Both genera are also differentiated from each other in this respect that the physa never contains nemathybomes in *Edwardsia*, while in *Isoedwardsia* the most proximal part of the body has nemathybomes. Possibly the presence of discontinuous, ciliated streaks which are very distinct in *I. mediterranea* n. sp. also is of systematic importance and characteristic of the genus, but till now we know too little about the occurrence of this structure to be able to use it as a genus character. The type of the genus is *I. ingolfi*. Besides this species I have in the Mediterranean found another one which I will call *I. mediterranea*. It is possible that the latter has been described before as an *Edwardsia*, though at present it cannot be identified with any before known species. The cuticle is much thicker in *I. ingolfi* than in *I. mediterranea*; in the former the muscle-pennons show about 30 folds in the reproductive regions, in the latter about 70. In another paper I will describe a third species, dredged at the Easter Island.

Isoedwardsia ingolfi n. sp.

Pl 1. Figs. 36, 37.

Diagnosis: Cuticle very thick, especially in the proximal part of the body, ectoderm of the scapus thin, also in the proximal part. Nemathybomes numerous, scattered on the scapus. Nematocysts in the nemathybomes 50—60 × 4—5 μ, in the tentacles 31—36 × 3 μ, in the actinopharynx 41—46 × 3—4 μ. Tentacles 16. Longitudinal muscle-pennons of the mesenteries in the reproductive region strong, with about 30, often ramificated folds. Outer parts of the mesenteries issuing not far from the middle of the pennon, Parietal muscles in the reproductive region in transverse-sections oval, with rather richly ramificated folds. Their expansion on the column is inconsiderable.

Colour in preserved state: scapus dirtily ochreous-yellow shading off into grey.

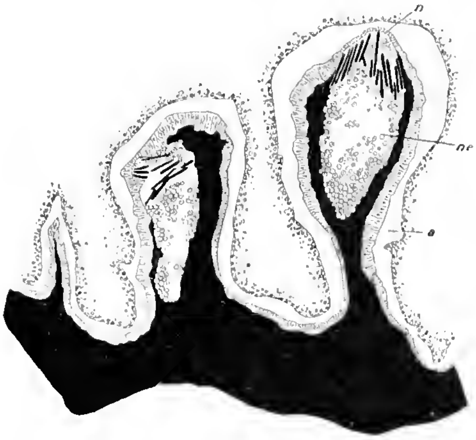


Fig. 68.

Fig. 69.

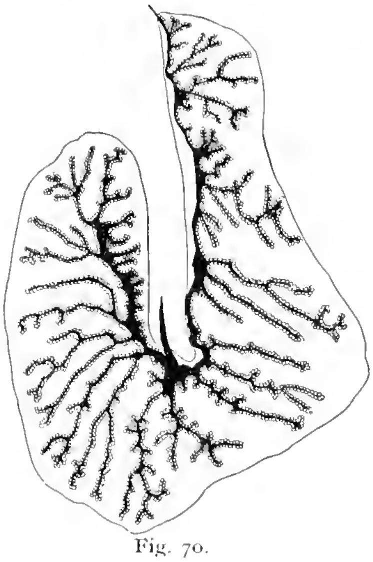


Fig. 70.

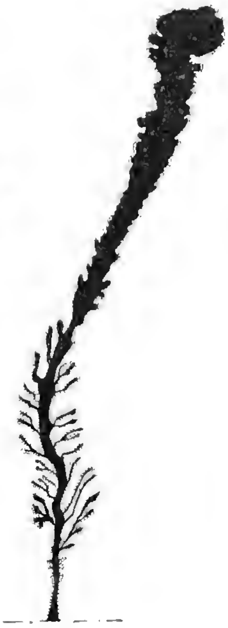


Fig. 72.

Fig. 71.

Textfigs. 68—72. *Isoedwardsia ingolfi.*
Fig. 68: Section of a portion of scapus in its proximal part. Fig. 69: Section of a portion of scapus in the middle of the aboral body-end. Fig. 70: Transverse section of a pennon in the reproductive region. Fig. 71: Transverse section of a parietal muscle in the reproductive region. Fig. 72: Transverse section of a mesentery in the proximal part.

Dimensions: Spec. 1) Length 1.1 cm., largest breadth, a little above the proximal part of the animal. 0.5 cm. Length of capitulum 0.5 cm. Sp. 2) Length 2.1 cm, largest breadth 0.6 cm (Pl. 1, fig. 36).

Occurrence: 60°37′ N. 27° 52′ W. 799 fms. Temperature of the bottom 4.5° (Ingolf-Exp. St. 78) 2 sp.

Exterior aspect: No physa. The most proximal part of the column is rounded, broader than the other part of the body and totally cuticle-clad (Pl. 1, fig. 36). Scattered nemathybomes appear also in the most proximal end which is more solid than the other part of the body. The proximal end imperceptibly fuses into the other part of the scapus, the cuticle of which is also strong. In all places on the scapus there are scattered nemathybomes which are especially distinct in the smaller, more extended specimen. The longitudinal furrows, corresponding to the insertions of the mesenteries, are rather distinct on the scapus. The capitulum is smooth, transparent, without a cuticle and with distinct longitudinal furrows where the mesenteries insert. The tentacles are badly preserved and stick together, conical, on the larger specimen very extended lengthwise (Pl. 1, fig. 37); 16 in number. The oral disc and the actinopharynx are very macerated.

Anatomical description: The distal parts of the animal are very badly preserved, so that I cannot give any exact description of the structure of the actinopharynx, tentacles or mesenteries of these parts. The ectoderm of the scapus is, in comparison with the mesogloea, very thin, especially in the proximal parts; gradually the ectoderm increases in thickness towards the distal end. Outside the ectoderm there is a very characteristic layer which reaches a considerable thickness, especially in the proximal body-end (textfigs. 68, 69 *a*). In these places this layer is many times thicker than the ectoderm and sometimes almost as thick as the mesogloea from which it only differs a little in structure. While in the homogeneous ground-substance of the mesogloea we rather commonly find fibrillae, but only rarely cells — the part of the mesogloea turned to the endoderm is stained more intensely with borax-carmin and haematoxylin than the outer part which remains almost unstained — the layer outside the ectoderm is more homogeneous, though fibrillae and cells also here exceptionally appear, and is only weakly stained with the above-mentioned colouring matter. This layer outside the ectoderm much recalls the so-called sub-cuticle of the Zoantharia, and this likeness is still more conspicuous, in as mush as a thin, brownish cuticle, to which extraneous bodies are sticking, occurs outside the homogeneous layer in *Isoedwardsia* as well as in Zoantharia, thus forming the outside of the surface of the body. Towards the distal part of the scapus this "sub-cuticular" layer is thinner and does not in its most distal part attain the thickness of the ectoderm.

The nemathybomes are of about the same structure as in *Edwardsia* (textfigs. 68, 69 *ne*); they contain numerous, rounded, somewhat irregular bodies, surrounded, as it seems, by a refractive, thick membrane. The nematocysts (*n*) which in the scapus appear only in the nemathybomes and attein a size of 50—60 × 4—5 μ, are sometimes a little curved, with the basal part to the spiral thread a little translucent. On the reproduced sections, especially on the textfigure 69, they are obliquely sectioned. The ectoderm of the capitulum is higher than that of the scapus and on one specimen sticking to the tentacles. The ectoderm of the tentacles contains numerous, thick-walled nematocysts (their size 31—36 × 3 μ). The spirocysts of the tentacles are of variable length, the longest about as long as the nematocysts in the same part, but about twice as broad. The nematocysts of the actinopharynx are numerous, 41—46 μ long and 3—4 μ broad. The longitudinal muscle-pennons are in the reproductive region, in transverse-sections, elongated with about 30, not densely packed, very often ramificated folds. The larger folds are of ordinary height and almost all of about equal size, the lower folds are sparse (textfig. 70). The parietal muscles are in transverse-sections in the reproductive region oval, with shorter folds in the inner and the outer parts. The folds are often ramificated, numerous and spreading apart (textfig. 71). As to the filaments they are not well preserved in the distal part, but in good condition in the reproductive region. It seems as if they are like those of *I. mediterranea*, in which the ciliated streaks are discontinuous. Inside the glandular streaks which contain numerous nematocysts, but rare gland-cells, there is, in this species, a well differentiated part, an intermediate streak with rare nematocysts and numerous gland-cells. The reproductive organs were in the one, particularly examined specimen, testes with well developed spermatozoa.

Subfam. Milne-Edwardsiinae.

Diagnosis: Edwardsiidae without nemathybomes in the scapus. Nematocysts in the ectoderm of the scapus scattered or in heaps. Physa absent, indistinct or feebly developed. Nematocysts of the capitulum of almost the same size as those of the scapus. Inner tentacles longer than the outer ones; commonly hexamerously arranged.

This subfamily corresponds to the family Milne-Edwardsiidae, proposed by myself (1893, p. 11), and is easily distinguished from the subfamily Edwardsiinae by the absence of nemathybomes. Also the arrangement of the tentacles is another one, at least in the genus *Milne-Edwardsia*, but probably also in *Paraedwardsia* as I have been able to state the same arrangement in *P. sarsii* as in *Milne-Edwardsia*. The tentacles are namely commonly hexamerously arranged, and the inner tentacles are larger than the outer ones (textfig. 11), so this is another agroupment than that of the genus *Edwardsia*. Concerning the number of siphonoglyphes I can ascertain that several species have only one, a ventral one. Whether this is characteristic of the whole subfamily, remains to be confirmed.

This subfamily does not seem as rich in species as the subfamily Edwarsiinae. Very likely the number of *Milne-Edwardsia*-species will increase, when all Edwardsiidae have been subject to a more detailed examination. There is no doubt that several species, described as *Edwardsiella* and *Edwardsia*, belong to this subfamily. Thus, according to my examination, the *Edwardsia timida* Quatr. is a *Milne-Edwardsia*, *M. dixonii*, (verified by myself on material received from Dixon). Besides this, it is not improbable that one part of the forms, described and reproduced by Andres 1883 as varieties of *Edwardsia claparedii*, are in fact *Milne-Edwardsia*- or *Paraedwardsia*-species. In the subfamily I included two genera *Milne-Edwardsia* and *Paraedwardsia*, of which the latter is furnished with "*Halcampa*-papillae", the former not.

Genus **Milne-Edwardsia** Carlgr.

Diagnosis: Milne-Edwardsiinae with the column divisible into a lower, greater part which is invested with a rather well-developed, sometimes very thick cuticle and an upper minute part, capitulum, without cuticle. A weak physa also sometimes present. Scapus without nemathybomes and "*Halcampa*-papillae". Nematocysts in the ectoderm of the scapus either scattered or arranged in groups, comparatively short, in proportion to the breadth. Nematocysts of the capitular ectoderm commonly large and mainly distributed on the ridges of the capitulum. Capitulum more or less polygonal. Tentacles 12 or in several cycles, hexamerously arranged, the inner longer than the outer ones (always?). Only one, ventral siphonoglyphe (always?).

In a certain respect the diagnosis of this genus, published in this paper, is a little more explicit than the original one. The hitherto known species of this genus are: *M. loveni* Carlgr., *M. carnea* (Gosse), *M. polaris* Carlgr., *M. nathorstii* Carlgr. and *M. dixonii* Carlgr. (nov. nomen pro "*Edwardsia timida* Quatr." described by Dixon). It is also possible that *Edwardsia lineata* Verr. will be included in this genus. The species described below are easily distinguished from each other.

Milne-Edwardsia loveni Carlgr.

Pl. 1. Figs. 32, 33.

Milne-Edwardsia loveni n. sp., Carlgren 1892, p. 456, textfig. 3, 1893, p. 17, textfigs. 3, 4. Pl. 1, figs. 6—8, Pl. 2, figs. 1—4, Pl. 10, fig. 3.

— — — Carlgr. Arndt 1912, p. 123.

Diagnosis: No physa. Proximal part of the body of variable appearance, on account of the habits of the animal. Scapus more or less polygonal, with a very strong, often rugous, easily deciduous cuticle. Nematocysts of the scapus scattered, mainly arranged on the ridges, in the lower part about 24 μ long, in the upper 38—48 × 6 μ. Capitulum distinctly polygonal with sharp ridges. Nematocysts mainly on the ridges 22—30 × 4 μ. Nematocysts of the tentacles about 22 × 4 μ. Number of the tentacles to about 30—40. Nematocysts of the actinopharynx partly 17—19 μ, partly 24—29 × 3 μ. Longitudinal muscle-pennons strong, in the upper part of the reproductive organs with about 20—30 folds.

Colour: Mouth, actinopharynx and reproductive organs brick-red; tentacles and capitulum flesh-coloured. Mesenteries and scapus inside the cuticle of the same colour as the tentacles, but paler, sometimes white. Cuticle of the scapus grey, shading off into brownish-yellow.

Dimensions: Length of the body to about 3,5 cm, of which the capitulum is a fourth part. Largest breadth to about 0,5 cm. Length of the tentacles about 0,35 cm. Actinopharynx one half or two thirds of the length of the capitulum.

Occurrence: Sweden. Bohuslän. Väderöarne about 50 fms. in dead *Lophohelia* (Loven, Olsson, Carlgren, Auriwillius and others). Kosterfjord. Sneholmen 60—120 fms. (Auriwillius) Ramsö S. Koster 60—120 fms. (Auriwillius).
Norway. Drontheim fiord. Skarnsund 100—220 m in dead *Lophohelia* and *Paragorgia* (Oestergren, Mortensen 1911), Rödberg 150—200 m (Oestergren and Arwidsson) 100 fms. on "*Duva rosea*" 200—400 m (Arndt). Mosterhavn 150 fms. on *Lophohelia*, Selsövig 100 fms. (G. O. Sars). Finmark. North Cape on a *Brisinga* 350 fms.

Exterior aspect: The body is extended and more or less irregularly curved, because the animal commonly lives in the dead calyces of *Lophohelia*. No physa is developed, the proximal end now broad, now pointed. The scapus is invested with a firm, very thick, almost coriaceous, irregularly folded cuticle, not equally wide, but here and there irregularly thickened, sometimes thicker than the capitulum, and in the distal part sometimes with 8 pronounced longitudinal furrows (Pl. 1, fig. 33), corresponding to the insertions of the mesenteries. These furrows are prolonged downwards, but becoming less distinct. The cuticle of the scapus is easily deciduous, in the distal part often thinner than in the proximal part. The capitulum shows 8 high ridges, each placed midway between two insertions of the mesenteries. If the capitulum is strongly contracted, the ridges appear like distinctly outlined, folded ribbons (Carlgren 1893, Pl. 1, fig. 8). The most distal part of the capitulum is thinner than the other part of it. The tentacles are between 30—40 in number, in younger specimens fewer, hexamerously arranged, in three or four cycles, short, cylindrical; the inner tentacles a little longer than the outer ones. The oral disc is small, with radial furrows corresponding to the insertions of the mesenteries. The actinopharynx is short, with 8 longitudinal ridges and as many longitudinal furrows. The siphonoglyphe is ventral, indistinct, about twice the breadth of the other longitudinal furrows in the actinopharynx.

Anatomical description: The scapus-ectoderm is high, especially in the proximal part and on the ridges, and several times thicker than the mesogloea; also in the distal parts it is higher than the mesogloea. The nematocysts are few in number between the ridges, on these latter very numerous but scattered and do not seem to form any such groups as in *M. carnea*. They are most frequently a little curved, with rather indistinct basal part to the spiral thread which follows the whole length of the capsules, and they are 36—48 × 6 μ in size. Further down there are also smaller capsules, about 24 μ long. The cuticle of the scapus is very thick, the outer part of it is rather easily loosened from the underlying, thinner substitutive-cuticle, and is a little incrusted. The ectoderm of the capitulum is in the ridges high, with numerous nematocysts, 22—30 μ long and 4 μ broad; in the furrows lower, with very few nematocysts (textfig. 75). The mesogloea is much thicker on the ridges than in the furrows, where it is rather thin. The endodermal circular muscles are weak and form no sphincter. The ectoderm of the tentacles contains very numerous nematocysts, about 22 × 4 μ in size, and spirocysts of variable length; the largest are of about the same size as the nematocysts. The ectoderm of the actinopharynx is high on the ridges and many times higher than the mesogloea, with comparatively rare nematocysts, partly smaller, 17—19 μ long, partly larger, 24—29 × 3 μ, and numerous gland-cells. The nematocysts are mainly arranged on the ridges; in the furrows they are very few. The siphonoglyphe is only a little differentiated from the other part af the actinopharynx. The mesogloea is a little thickened on the insertions of the mesenteries and ends in a thin lamella.

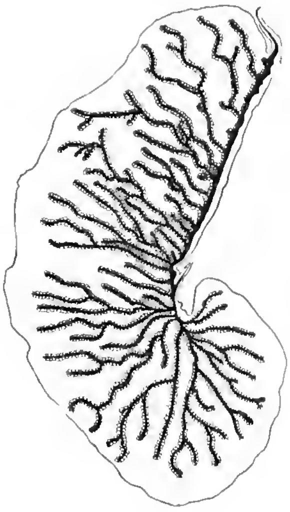


Fig. 73.

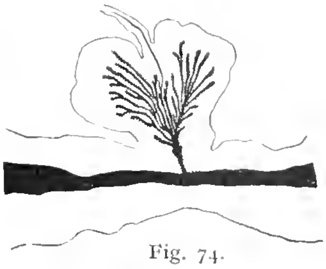


Fig. 74.

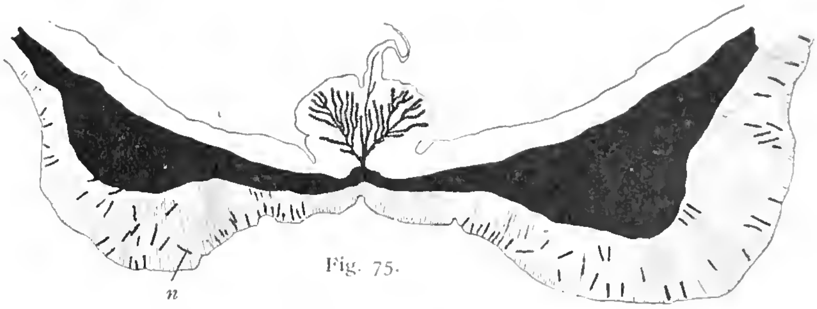


Fig. 75.

Textfigs. 73—75.
Milne-Edwardsia loveni.
Fig. 73. Transverse section of pennon in the upper part of the reproductive tract.
Fig. 74. Transverse section of a portion of capitulum with a parietal muscle.
Fig. 75. Transverse section of a portion of the capitulum *n*: nematocysts.

The weak, imperfect mesenteries are rather thick. The longitudinal pennons of the 8 perfect mesenteries are in the reproductive region provided with 20 to 30 folds which are of about equal height and rather much ramificated (textfig. 73). The outer lamellar part of the mesenteries issues very close by the outer edge of the pennous. The parietal muscles (textfigs. 74, 75) are well developed, with thin folds of a characteristic appearance. They appear fan-shaped on transverse-sections; the lamellar part of the mesenteries issues from the base of the fan. The ciliated streaks are present, though not long. The animal is dioecious.

Biology: The animals live in dead coral-branches of *Lophohelia* and *Paragorgia*, sometimes on other Octo-corals or on *Brisinga*. In contradistinction to the genus *Edwardsia* they do not show any reactions to light or to shade.

Remarks: This species has before been described by me in detail (1893, p. 17); I have here completed the description mainly with regard to the stinging capsules. Concerning further details I refer to this work.

Milne-Edwardsia carnea (Gosse) Carlgr.

Edwardsia carnea n. sp. Gosse 1856, p. 219. Pl. 9, figs. 1—4.
— — Gosse, Gosse 1858, p. 418, Gosse 1860, p. 259, Pl. 7, figs. 5—6, Pl. 12, fig. 3, Hincks 1861, p. 363, Haddon 1889, p. 328, Pl. 33, fig. 15, Pl. 36, figs. 5—6. Bourne 1916, p. 25, textfig. 2.
Edwardsiella — — Andres 1883, p. 99, Pennington 1885, p. 178.
Milne-Edwardsia — (Gosse) Carlgren 1892, p. 456, figs. 4—6.

Diagnosis: Real physa absent. The proximal part of the animal can, however, serve as a sort of physa when the cuticle is loosened. Scapus not polygonal, with a rather well-developed, easily deciduous cuticle. The ectoderm of the scapus with nematocysts mainly arranged in larger and smaller groups, its nematocysts 29—34 (37) × 7—8 μ. Capitulum distinctly polygonal, the ridges however not as high as in *M. loveni*. Nematocysts of the capitular ectoderm 26—46 × 7 μ, those of the tentacles partly 18—24 × 5 μ, partly 27 × 7 μ. Number of tentacles from about 18 to 32. Nematocysts of the actinopharynx partly typical, 17—20 × 3 μ, partly so, with distinct basal part to the spiral thread 22—29 × 5 μ. Longitudinal muscle-pennons weaker than in *M. loveni*; in the reproductive regions commonly with only 12 folds and never more than 20.

Colour: Cuticle of the scapus brownish-yellow. "Physa" and scapus rose-red. Capitulum translucent, flesh-coulored. Each capitular ridge has a fine line of opaque white or light pale-yellow with a dilute spot of the same colour near the base. Tentacles translucent, flesh-coloured, sometimes with alternate bands of stronger colour, often pale opaque-yellow at the base. This colour forms a spot on each side of the tentacles. Oral disc transparent with a cream-coloured star. Mouth as well as actinopharynx scarlet-red (Gosse) — Cuticle of the scapus dirtily yellowish-brown. Capitulum, scapus and "physa" flesh-coloured, translucent. Capitulum has on the middle or a little below a more or less opaque white annulus of rectangular spots, separated by a small flesh-coloured part from the pale whitish insertions of the mesenteries. These spots are sometimes prolongated as very pale lines on the rather strong capitular ridges, Tentacles flesh-coloured with a little tinge of rose-colour, especially conspicuous when the tentacles are contracted. The outer part of the oral disc is opaque white shading off into yellowish-white; the colour also expands to the middle part of the tentacles as a narrow tongue-shaped spot with the point facing towards the end of the tentacles, and between the tentacles as narrow lines. The inner part of the oral disc is scarlet-red with opaque white streaks. Actinopharynx scarlet-red. Reproductive organs and filaments orange-coloured (Carlgren).

Dimensions: Length of the column 2,5 cm., breadth 0,2 cm (Gosse). A small, expanded specimen shows the following dimensions: Length of the column 1,5 cm, breadth 0,25 cm, length of the tentacles about 0,25 cm (Carlgren).

Occurrence: Sweden, Bohuslän: Gullmarfiord. Flatholmen on the base of *Alcyonium*-colonies (Carlgren), Smedjebrotten on stones overgrown with *Sertularia* (Carlgren), Valbyfiord on the base of *Alcyonium*-colonies (Aurivillius).

Further distribution. S.W. Coast of England. Petit Tor and Orestone in the vicinity of Torquay. South Devon: Tenby South Wales, in the ebb-zone in cavities bored by Saxicava. Plymouth.

Exterior aspect: The body is extended, almost cylindrical and divisible into two regions, scapus and capitulum. Gosse states that a well developed physa is also present. I formerly (1892) adopted this opinion, mainly on basis of the description by Gosse. This so-called physa is, however, — as I afterwards have found out — to be interpreted otherwise, and the more so as also Gosse mentions that the most proximal part of it is sometimes furnished with a cuticle. If we more closely examine the figure of Gosse (1856, Pl. 9, figs. 1, 4) which was to represent the animal with expanded physa, we find that the scapus-cuticle, above the cuticle-lacking most proximal part, forms some distinct, tranversal folds. The presence of these strong folds does not indicate a normal appearance of the proximal body-end, but is rather to be interpreted thus that the "physa" (the most proximal body-end) is not turned out, but the cuticle is in this part loosened and pushed upwards, whereby the above-mentioned folds are formed. The observations of these species, made by me during a long stay at the zoological station of Kristineberg, unmistakably prove this to be the case. The thing is that the animal very easily casts off its scapus-cuticle. This unfastening of the cuticle takes place most easily and frequently in the most proximal part which is mostly in contact with foreign bodies. A physa, at least in the proper sense of the word, therefore, to my mind, does not exist. Besides this, the proximal body-end may expand more or less disc-like when the animal has cast off the cuticle. The above-mentioned specimen altered its form during the time of observation in such a way that, instead of forming a prolongated cylinder, it formed a low cone with enlarged base, attached to the glass. The cuticle of the scapus is rugous, of ordinary thickness and not incrusted. Also the distal part of the scapus-cuticle is loosely connected with the ectoderm of the scapus and forms an almost totally free tube into which the distal part of the animal can be drawn. Consequently the animal is able to contract much more than *M. loveni*. The capitulum is short, without a cuticle, distinctly polygonal and with 8 rather strong, longitudinal ridges which are, however, not as conspicuous as in *M. loveni*. The tentacles are 18—32 in number, the largest number observed by Gosse was 28, by Bourne 32, I have not found any more than 26 myself. According to Gosse the arrangement should be 8 + 8 + 12, in fact they are arranged hexamerously as in *M. loveni* (6 + 6 etc.) in three or four cycles of which the fourth is very incomplete. The tentacles are short, the inner longer than the outer ones. The oral disc is small, with distinct radii. The mouth is placed on a high cone. The actinopharynx is short, with 8 longitudinal ridges and just as many longitudinal furrows. Whether a small ventral siphonoglyphe is present I cannot determine with certainty as the examined specimens were not in every respect well preserved. Probably a siphonoglyphe is present here as in *M. loveni*.

Anatomical description: The ectoderm of the scapus is high, thicker than the mesogloea and contains nematocysts, 29—34 (37) × 7—8 μ in size, often somewhat curved, and large, very numerous gland-cells. The nematocysts are packed together in greater and smaller groups; there are, however, also a few nematocysts between the groups. The ectoderm of the capitulum is in the longitudinal ridges very high (textfig. 79), a little thicker than the mesogloea, but in the furrows thinner. In the ectoderm of the ridges there are numerous nematocysts, 26—46 μ long and almost 7 μ broad, often a little curved, while the ectoderm of the furrows does not contain any such. The mesogloea is thickened in the ridges. The ectoderm of the tentacles is provided with very numerous, smaller nematocysts (18—24 × 5 μ) and some few, a little larger (27 × 7 μ). The spirocysts are of variable size, the largest about 24 μ long. The ectoderm of the actinopharynx is high in the ridges as on the capitulum; in the furrows thinner and provided with numerous, granulate gland-cells. Mainly in the ridges typical nematocysts are found (17—20 × 3 μ) and some such with distinct basal part to the spiral thread and a little broader in the basal end (22—29 × 5 μ. In the probably differentiated siphonoglyphe the gland-cells and spirocysts are few in numbers.


Fig. 76.


Fig. 77.

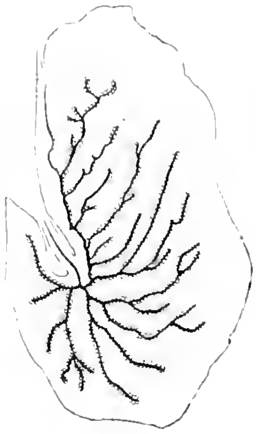


Fig. 78.

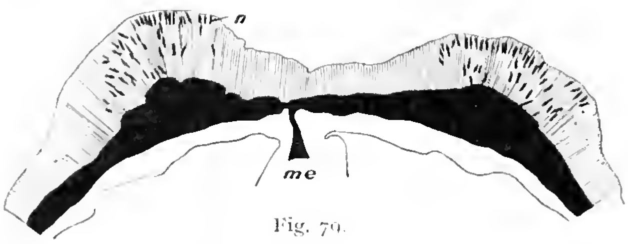


Fig. 79.

Milne-Edwardsia carnea. Fig. 76 Transverse section through a portion of scapus in the reproductive tract. Figs. 77—78. Transverse sections of pennons in the reproductive tract. Fig. 79 Transverse section of a portion of the capitulum, *n*: nematocysts, *me*: mesentery.

The imperfect mesenteries in the most distal part of the body are considerably weaker than in *M. loveni*. The perfect, well-developed mesenteries are as usual in the Edwardsiidae 8 in number, in a specimen I have, however, found only 7 stronger mesenteries and 7 ridges in the actinopharynx (compare the similar discovery by Levander in "*Edwardsia carnea*" = *Paraedwardsia sarsii?*). The folds of the longitudinal pennons are comparatively few in the reproductive region, ordinarily high and only a little ramificated, commonly 12 in number, sometimes many, but never more than 20. The lamellar outer part of the mesenteries issues not far from the outer edge of the pennons (textfigs. 77, 78). The parietal muscles (textfig. 76) are in the capitular region very strong, in transverse-sections triangular or rather fan-shaped, they recall those of *M. loveni*, though they are not as richly folded; in the reproductive region they are a little weaker. Their expansion on the column is not considerable in the most distal part, in the reproductive organs they are a little more expanded, though only as far as to half their breadth. The ciliated streaks are well developed, just as well as the intermediate streaks. The animal is dioecious.

Biology: According to my observations this species as well as *M. loveni* are not sensitive to the effect of light. The animal when kept in an aquarium easily throws off its scapus-cuticle, and thereafter wanders about by means of its proximal end which thus becomes flattened, disc-like (compare above). It can besides attach itself by the sides of its body. The suckers which, according to Gosse, should be found in this species are, however, not present, neither are the "*Halcampa*-papillae", characteristic of *Paraedwardsia*. The attachment which is, however, never firm, is performed exclusively by the secretion of the numerous gland-cells. The animal successively forms a new cuticle. On the biology of this animal Gosse (1860) moreover gives several informations.

Remarks: Haddon (1889) has reproduced some figures of this species. The habitus-figure (Pl. 33, fig. 15) represents a rather badly preserved specimen, the cuticle of which is for the greater part peeled off. Of the anatomical figures of the species only one, showing the parietal muscles, is of use to the identification which I can determine by a study of Haddon's sections. Though I have not been able to make more exact measurements of the stinging capsules I have, however, ascertained that the nematocysts of the scapus of Haddon's specimens were of the same appearance as those of the Swedish representative of the species, and arranged in groups. The Swedish form is also identical with the British one; on the other hand, the species which Appellöf (1893) has described as *E. carnea* is a *Paraedwardsia* (compare *P. sarsii*). Gosse's figures of the species are rather good, especially the uncoloured ones. I have myself reproduced some figures of anatomical details, one of these is here once more reproduced.

Milne-Edwardsia polaris n. sp.

Diagnosis: The most proximal part of the body without cuticle, physa-like. Scapus with rather feebly developed cuticle, with comparatively few nematocysts (14—22 × 2, 5—3.5 μ), arranged in groups which sometimes are placed in shallow sinkings in the mesogloea. Capitulum polygonal. Its ectoderm with nematocysts, 14—17 μ long. Tentacles 12. The ectoderm of the tentacles with comparatively few spirocysts, 12—19 μ long, and nematocysts, 15—22 × 2,5 μ in size. Nematocysts in the ectoderm of the actinopharynx numerous, 16—24 × 2, 5—3 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections through the upper part of the reproductive region with about 12—15 folds, branched in the outer parts of the pennons and sometimes also a little in the inner parts. The outer parts of the mesenteries issue not far from the outer side of the pennons. Parietal muscles somewhat feeble, with a few, sometimes rather thick folds. The parietal muscles are considerably expanded on the column.

Colour: in alcohol: Scapus ochreous-yellow or dirtily-yellow.

Dimensions in contracted state: length to about 1,5 cm, breadth to about 0,5 cm.

Occurrence: East-Greenland. Fame Isl. Scoresby Sound 70 50′ N. 22 33′ W. 5—8 m mud (Sw. Greenl.-Exp. 1899, N. 31, 2 sp.).

East Spitzbergen King Charles Land. Jena Isl. at N.E. Cape about half a league from land, in front of a great glacier. Coarse-grained, blue clay with a few, small stones. 36 m (Roemer & Schaudinn 1898, St. 31, 1 sp.).

West-Spitzbergen, Ice-fiord, Temple bay, 43—45 m. Compact, greyish-red clay.

Temp. at the bottom 2,5° (Sw. Spitzb.-Exp. 1908, St. 51, 2 sp.) Temple bay, Biona's haven, 30 m. Compact greyish-red clay with stones. Temp. at the bottom 3,78° (Sw. Spitzb.-Exp. 1908, St. 56, 2 sp.). Spitzbergen without distinct locality (Sw. Spitzb.-Exp. 1898).

Exterior aspect: The physa, if present, is small, in as much as only the most proximal part of the column is devoid of a cuticle. On the scapus there are 8 shallow, longitudinal furrows, corresponding to the insertions of the mesenteries and particularly distinct in the distal part. In contracted state of the animal the involved part of the scapus is polygonal. The cuticle of the scapus is, in comparison with the other *Milne-Edwardsia*-species, feebly developed and sometimes here and there lost. In the specimen collected by Roemer and Schaudinn there are fragments of yellowish-brown particles and small grains of sand sticking to the undermost part of the scapus. I have not been able to observe any of the "*Halcampa*-papillae" which exist in the genus *Paraedwardsia*, and therefore the gland-cells have probably served as organs of attachment. The capitulum is short, in the proximal part polygonal, in the distal part in transverse-sections more round. Probably this difference is due to a various state of contraction of the different parts. The tentacles are not more than 12, on one specimen I observed that the two tentacles projecting from the ventro-lateral compartments are smaller than the others. The oral disc is inconsiderable, the actinopharynx is short and furnished with 8 longitudinal ridges at the insertions of the mesenteries; between the ridges there are deep longitudinal furrows. An indication of a ventral siphonoglyphe seems to be found (the specimens were, however, not so well preserved that I can state this with certainty).

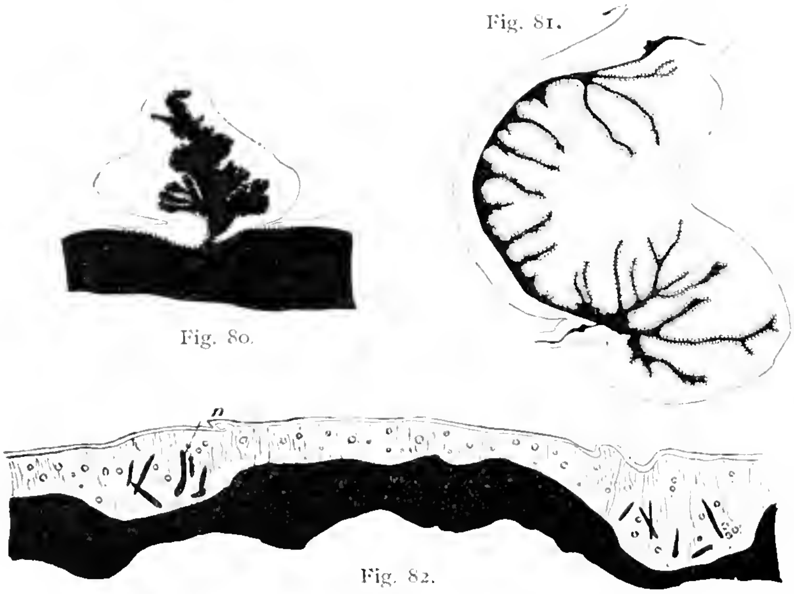


Fig. 81.

Fig. 80.

Fig. 82.

Textfig. 80—82. *Milne-Edwardsia polaris.*
Fig. 80: Transverse section of a parietal muscle in the upper part of the glandular tract. Fig. 81: Transverse section of a pennon in the same tract. Fig. 82: Section of scapus with groups of nematocysts (*n*).

Anatomical description: The ectoderm of the scapus is now thin, now more thick, especially in the parts containing nematocysts. The cuticle is weak, especially in comparison with that of *M. loveni* and *carnea*. The nematocysts which in the scapus-ectoderm reach a size of (14) 17—22 × 2, 5—3 (3,5) μ are here a little numerous and packed together in groups, scattered between the insertions of the mesenteries and, on account of the thickening of the ectoderm, sometimes sunk a little down in the mesogloea (textfig. 82). The mesogloea is of about the same thickness as the ectoderm, the endoderm is however thinner. The high ectoderm of the capitulum contains nematocysts, 14—17 μ long, arranged on the ridges. In the parts of the involved capitulum which are the most closely pressed together the mesogloea forms high ridges between the insertions of the mesenteries, in the other parts the mesogloea is more equally thick. The nematocysts of the tentacles reach a size of 15—22 × 2,5 μ, the spirocysts are about 12—19 μ long. The high ectoderm in the actinopharynx-ridges contains nematocysts, 16—24 × 2,5—3 μ in size. The mesogloea of the actinopharynx is thin, still a little thickened in the ridges.

The longitudinal pennons of the mesenteries are rather well developed, with about 13 to 15 folds in the regions of the ciliated streaks and of the reproductive organs. The folds are in the inner and especially in the outer parts very little ramificated and high, while in the middle of the pennons they are short and not branched (textfig. 81). The outer lamellar part of the mesenteries issues from the pennons rather close by the outside. The parietal muscles are not strong, with a few, short, broad folds, supported by thickenings of the mesogloea; on the other hand they are considerably expanded on the column (textfig. 80). The filaments of the mesenteries were badly preserved, so that I cannot give any information of their appearance. The animal is dioecious.

Remarks: This species is rather interesting, as in some respects, concerning the arrangement of the nematocysts, it may be regarded as a previous stadium of the genus *Edwardsia*. If we imagine the nematocysts and their mother-cells in the column of *M. polaris* to be wholly enclosed in the mesogloea and the supporting cells reduced, we have a nemathybome. The genus *Edwardsia* cannot, however, directly descend from *Milne-Edwardsia*, because the arrangement of the tentacles in *Edwardsia*, compared with that of *Milne-Edwardsia*, shows that both genera are developed, each in its own direction.

Milne-Edwardsia nathorstii n. sp.

Diagnosis: Proximal end rounded without distinct physa. Scapus with a well developed cuticle. Nematocysts of the scapus-ectoderm concentrated in small groups containing only some few capsules, 29—36 × 3,5—5 μ in size. Tentacles 12. Their ectoderm with very close spirocysts of variable size, the greatest spirocysts reach a size of 34—36 × 5 μ. Nematocysts in the ectoderm of the tentacles not numerous, 31—36 × 3,5—5 μ. Nematocysts of the actinopharynx 34—36 × 5 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections through the upper part of the reproductive region with some few, about 10, low folds, supplied with short, secondary folds. The lamellar outer parts of the mesenteries issue not far from the middle of the pennons. Parietal muscles not strong, with rather few folds, but they are considerably expanded on the column, where they have comparatively high folds.

Colour in alcohol: Scapus dirtily-yellow.

Dimensions in contracted state: Length of the column about 1 cm, breadth 0,15 cm.

Occurrence: East-Greenland. Scoresby Sound, Hurry's Inlet, 70°43′ N. 22°29′ W. 30 m mud (Sw. Greenl. Exp. 1899, N. 455, 456) 9 sp.

N. of Spitzbergen 81°20′ N. 20°30′ E. 1000 m (Roemer & Schaudinn, 1898, St. 41) 1 sp.

Exterior aspect: As all specimens were contracted, with the distal part involved, and only of small size, I cannot give any complete information of the exterior of the species. The description is made after an examination of the specimens from Greenland.

The proximal part is rounded and fusing into the middle without distinct outline. No distinct physa is present. The scapus is provided with a sometimes thin, sometimes thick, but translucent, often irregularly wrinkled cuticle, to the outside of which small grains and a great number of detritus-particles are attached. Under low magnifying powers small papilliform elevations are to be seen, which are, however, not regularly arranged, they are as yet only thickenings of the ectoderm as may easily be ascertained on sections (textfig. 83). The capitulum is short, not thickened between the insertions of the mesenteries. The tentacles are 12 in number, probably arranged in two cycles; the oral disc is inconsiderable. The actinopharynx is short and furnished with 8 longitudinal ridges. Whether a ventral siphonoglyphe is present or not I cannot decide with certainty.

Fig. 83.

Fig. 85.

Fig. 84

Textfigs. 83—85. *Milne-Edwardsia nathorstii.*
Fig. 83: Transverse Section of a portion of the scapus (compare text!) Fig. 84: Transverse section of a perfect mesentery in the reproductive tract. Fig. 85: Transverse section of parietal muscle.

Anatomical description: The scapus-ectoderm is as a rule not high, here and there it is, however, thickened, cushion-like. In these thickenings the nematocysts are accumulated (textfig. 83 *n*). They are, however, not numerous, but the groups still must be regarded as weak batteries of nematocysts. The size of the nematocysts is 29—36 × 3,5—5 μ. The scapus is covered with a folded cuticle, now thin, now thick. If the cuticle (textfig. 83 *c*) is thick, it resembles the same layer in *Isoedwardsia;* it is only a little stained, or not at all so, with borax-carmine which is easily absorbed by the mesogloea. The mesogloea is thinner than the ectoderm. In the endoderm of the column I have observed large nematocysts. Whether these latter are normal components of the endoderm I cannot with certainty decide. The circular muscles of the column are weak. The ectoderm of the capitulum is thicker than the mesogloea. The ectoderm of the tentacles is high and contains very numerous, closely packed spirocysts of variable size. The largest are of the same kind as those of the column, but more sparse and 34—36 × 3,5—5 μ in size. The ectoderm of the actinopharynx is high in the ridges; the rather numerous nematocysts show a distinct basal part to the spiral thread and reach a size of 34—36 × 3,5—5 μ.

The number of the mesenteries is 12 of which only 4 are weak off-shoots in the most distal part. The longitudinal muscle-pennons of the 8 "*Edwardsia*-mesenteries" are not strong in the reproductive region and show in transverse-sections about 10 low folds, all of about equal height or gradually shortened in the inner parts, and provided with secondary branches. The lamellar part of the mesenteries issues from about the middle of the pennon (textfig. 84). The endoderm of the pennons is high between the actinopharynx and the reproductive region, with numerous vacuoles on the side where the folds are; on the opposite side, however, it has no such vacuoles, but densely packed nuclei. The parietal muscles (textfig. 85) expand rather far on the column in the reproductive region and still farther in the distal end of the column (textfig. 85). The filaments are of usual appearance, the ciliated streaks short. The animal is dioecious. One examined species was a male, another a female. The nematocysts in the ectoderm of the scapus of the specimen, taken by Roemer and Schaudinn, were a little smaller (24—27 × 3,5—4,5 μ) than those of the type-specimens. As far as I can see from the structure of the badly preserved specimen it belongs to *M. nathorstii*. The longitudinal pennons and the parietal muscles are of the same appearance as those of the type.

Genus **Paraedwardsia** Carlgr.

Diagnosis: Milne-Edwardsiinae with no physa or only a weakly developed one. Scapus with a more or less well developed cuticle and with scattered "*Halcampa*-papillae". Nematocysts of the scapus-ectoderm scattered, with a tendency to arrange themselves in groups; they are comparatively broad, in proportion to their length. Nematocysts of the scapus and of the capitulum of about the same size. Inner tentacles longer than the outer ones, now hexamerously, now octomerously(?) arranged. A weak ventral siphonoglyphe present (always?).

This genus which was characterized by myself in a few words in 1905 is distinguished from the nearly related *Milne-Edwardsia* by having on the scapus "*Halcampa*-papillae" which are absent in *Milne-Edwardsia*. Concerning the structure of these papillae, also occurring in other Actiniaria-genera, I refer to the genus *Halcampa*. Whether the tentacles always are arranged hexamerously I cannot confirm. In the type *P. arenaria* the number of the tentacles appears to be 16, but whether they are arranged 6 + 6 + 4 or 8 + 8 is difficult to decide as the state of preservation of the tentacles was not good. Probably the tentacles of this species are distributed according to the latter type. It also remains to verify the presence of a ventral siphonoglyphe in this species. *P. sarsii* (Düb. & Koren) belongs to this genus besides the type *P. arenaria* Carlgr.

Paraedwardsia arenaria Carlgr.

Pl. 1. Fig. 15, 16.

Paraedwardsia arenaria n. sp. Carlgren in Nordgaard 1905, p. 158.

Diagnosis: No distinct physa. The most proximal part of the body, however, probably without "*Halcampa*-papillae. Scapus with a somewhat thick cuticle? (periderm) and with scattered "*Halcampa*-papillae" to which grains of sand are attached. Ectoderm of the scapus with scattered nematocysts partly 17—22 × 3 μ, partly 26—29 × 4 μ. Nematocysts in the capitular ectoderm partly 14 × 2 μ, partly about 24 × 2,5 μ. Capitulum and scapus in preserved state with 8 indistinct longitudinal furrows. Tentacles 16, probably in two cycles. Nematocysts of the tentacles about 24 × 2 μ, spirocysts to about 28—40 μ long. Nematocysts of the actinopharynx partly 20—22 × 2 μ, partly 31—36 × 3 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections rather elongated with about 25—30, somewhat richly ramificated folds in the inner and especially in the outer parts. Inner folds of about equal height, considerably lower than the outer folds. Lamellar outer parts of the mesenteries attached to the outer part of the pennons. Parietal muscles well developed, recalling two fans, one on each side of the main-lamella of the mesogloea. The expansion of the parietal muscles on the column the ordinary one.

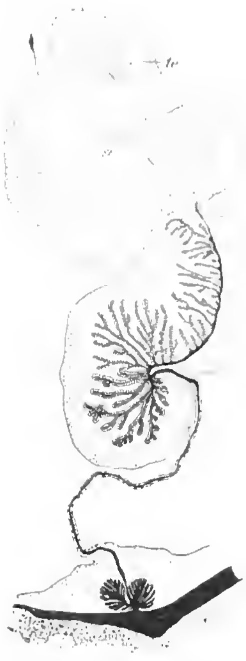
Colour in preserved state: the specimens from the Gunhild-Expedition and from Skierstad have an ochreous-yellow scapus with deep black, in the proximal part very numerous grains, which are so densely packed that they almost completely cover the yellow periderm. The scapus of the Bergen-specimen is dirtily-ochreous-yellow; the capitulum and the tentacles are slate-gray.

Dimensions in preserved state: 1) One Gunhild-specimen (Pl. 1, fig. 15). Length 3,6 cm, largest breadth 0,5 cm. The other Gunhild-specimen: Length 3,3 cm, largest breadth 0,8 cm. Bergen-specimen 1: Length almost 3 cm, largest breadth, a little above the proximal end, 0,5 cm. Length of the tentacles in expanded, preserved state 0,3—0,35 cm. Bergen-specimen 2: Length almost 2 cm, largest breadth 0,3 cm.

Occurrence: Norway. Finmarken. Skierstadfiord 330 m (Nordgaard 1900 2 sp.). Herlöfiord
130 fms. (Appellöf 2 sp.), 9 miles N. of Jäderen 140 fms (G. O. Sars 1 sp.).
Skagerrak 370 fms. clay (Gunhild-Expdition 1879, St. 10, 2 sp.).

Exterior aspect: A distinct physa seems to be absent. True enough the proximal end is a little different in appearance from the other part of the scapus, but the presence of fragments of a periderm in the most proximal part (Pl. 1, fig. 16) of a Gunhild-specimen indicates that we not have to do with such a regular physa as that of the genus *Edwardsia*. The periderm of the most proximal part of the body seems, however, to be very easily dropped, and the "*Halcampa*-papillae" are probably absent, or at least so sparse that this part appears as having no papillae. A distinct boundary line between the most proximal part and the other part of the scapus is, however, not to be seen. Excepting the most distal part of the scapus, where the papillae are sparse, these latter are found in great numbers on the other part of the scapus (Pl. 1, fig. 15). To the papillae numerous grains of sand are attached, as in *Halcampa*. Besides this the scapus is covered with a yellowish, rather thin periderm, possibly formed only by a stiffened product of the secretion of the gland-cells. Whether there is a regular cuticle I cannot with certainty decide, I have therefore used the vaguer term of periderm here. The capitulum is short, smooth, without a cuticle and with translucent insertions of the mesenteries. In the contracted state of the animal, longitudinal furrows, corresponding to these insertions, are visible in the capitular region, as well as in the proximal part of the body. The number of tentacles is 16, probably arranged 8 + 8. They are rather long and conical. Whether the inner tentacles are longer than the outer ones I cannot with certainty decide, but it is possible that it is so. The difference between the sizes of the tentacles in the two cycles is, at any rate, inconsiderable. The oral disc is small, the actinopharynx short and furnished with longitudinal furrows. Whether a ventral siphonoglyphe is present is doubtful, the sectioned specimens were not well preserved, as regards the actinopharynx.

Anatomical descriptions: The most proximal part of the body is provided with a high ectoderm, containing numerous gland-cells and nematocysts, partly smaller, about 17—19 μ, partly larger, about 24—26 μ. The ectoderm of the scapus is rather high, with numerous, scattered, typical nematocysts, partly smaller, 17—22 × 3 μ, partly larger, 26—29 × 4 μ. In the papillae which show the same structure as those of *Halcampa*, the ectoderm is low, and the cells of another structure than that of the other parts (compare the family Halcampidae). The scapus hardly seems to form a regular cuticle, but by the secretion of the gland-cells particles of mud and foreign bodies are glued together so as to form a thin membrane, covering he scapus (compare above!). The mesogloea is stratified, of ordinary thickness and sometimes tapering into papilliform off-shoots. When the scapus is expanded the "*Halcampa*-papillae" are not distinct, and their position is only indicated by their structure which is different from that of the other parts of the scapus. The scapus-endoderm is of about the same thickness as that of the ectoderm. The capitular ectoderm is high, higher than the mesogloea and contains numerous nematocysts, partly larger 24 × 2,5 μ, partly smaller about 14 × 2 μ. On maceration-preparations of the capitulum I have also observed spirocysts. As, however, I did not find any spirocysts on sections through the same region, it is probable that the spirocysts belonged to the tentacles, and were stuck to the capitulum which is invaginated with the tentacles. The mesogloea of the capitulum is more fully developed in the middle of the compartments than on their sides. The ectoderm of the tentacles contains numerous nematocysts, 24 μ long and 2 μ broad, and very numerous spirocysts of a length of unto 28—40 μ. The high ectoderm of the actinopharynx is furnished with numerous nematocysts, partly larger, about 31—36 × 3 μ, partly smaller, 20—22 × 2 μ.



Textfig. 86. *Paraedwardsia arenaria*. Transverse section of mesentery.

The 8 imperfect mesenteries are short and thick. The longitudinal muscle-pennons on the 8 perfect "*Edwardsia* mesenteries" appear rather elongated on transverse-sections in the reproductive region (textfig. 86) and with about 25 to 30 folds. These latter are rather much ramificated, especially in the outer parts. The more central folds are of almost equal height and considerably lower than the folds nearer to the outside. In the region of the ciliated streaks and off the actinopharynx the folds are lower and more concentrated. The parietal muscles are well developed (textfig. 86) with several folds of fan-shaped appearance on each side of the main-lamella of the mesogloea. The parietal muscles are rather considerably expanded on the column, but they do not reach as far as the parietal muscle-pennons extend. The ciliated streaks, the streaks between these latter, and the middle streak are well developed. In the lower parts of the filaments there are also boundary streaks, furnished with vacuoles along their outside. The animal is dioecious. Two specimens, examined more in detail, were males (Textfig. 86 *te:* testes).

The anatomical description of this species is principally based on the specimens from the Gunhild-Expedition.

Paraedwardsia sarsii (Düb. & Koren) Carlgr.

Pl. 1. Figs. 8, 9 Pl. 4 Fig. 7.

?*Lecythia brevicornis* n. sp. M. Sars 1829, p. 27, Pl. 1, fig. 10.
? — — Sars, Sars 1833, p. 226, Pl. 10, fig. 5, 1835, p. 3, Ehrenberg 1834, p. 73.
Edwardsia sarsii Düb. Düben and Koren 1847, p. 267.

Edwardsiella sarsii Sars, Andres 1883, p. 101.
?*Edwardsia carnea* Gosse, Levander 1892, p. 292, fig.
Edwardsia carnea Gosse, Appellöf 1893, p. 4, Pl. 1, Pl. 2, figs. 6—9, Pl. 3, figs. 12—18, 20—23, 1895, p. 7, 11. Grieg 1897, p. 4, 9, 12.
Milne-Edwardsia carnea Grieg 1913, p. 143.

Diagnosis: A small, not vesicular, physa present. Scapus-circumference round, with distinct longitudinal furrows, but with a thin periderm, scattered "*Halcampa*-papillae" and scattered nematocysts partly 17—22 × 3,5—4,5 μ, partly 8—12 μ long. Capitulum polygonal with 8 rather distinct longitudinal ridges and with nematocysts partly smaller, 10—14 × 1,5—2 μ, partly larger, about 24 μ in size. Tentacles from 20 to more than 30, the inner ones longer than the outer ones and hexamerously arranged, with nematocysts 19—22 × 2 μ and spirocysts to about 28 × 5 μ in size, in the ectoderm. Typical nematocysts in the ectoderm of the actinopharynx partly 14—22 × 1,5—2 μ, partly 24—29 × 2,5—3,5 μ, besides nematocysts with distinct basal part to the spiral thread 22—24 × 3,5—5 μ in size. A hardly differentiated ventral siphonoglyphe. Nematocysts in the endoderm of the column, tentacles, and actinopharynx numerous, 34—43 × 5 μ. Longitudinal pennons of the mesenteries in the reproductive regions on transverse-sections rather elongated with about 15—20 somewhat ramificated folds. Inner folds of rather equal height, considerably lower than the outer folds. The lamellar part of the mesenteries attached to the outer part of the pennons. Parietal muscles in the reproductive region well developed, rather richly ramificated and on transverse-sections of a rounded appearance, in the other parts considerably weaker and arranged more in the shape of a fan. The parietal muscles are considerably expanded on the column.

Colour: Physa uncoloured. Scapus brownish-yellow. Capitulum and tentacles translucent, uncoloured. Oral disc and actinopharynx red (Appellöf 1893). According to Sars (1829) the colour of his *Lecythia brevicornis* was: Scapus dirtily-green, opaque. Capitulum and tentacles hyaline, shading off into pale red. Mouth and actinopharynx dark red.

Dimensions: Length to 3,5 cm, breadth 0,3 cm (Appellöf). Length of *Lecythia* about 0,8 cm (Sars).

Occurrence: Norway. Bergen on *Saxicava pholadis* (*Lecythia* M. Sars) Bergen, Manger (M. Sars, Schaudinn). Radöfiord N. of Bergen, Alvarströmmen Bergen 30—40 fms. sand and mud (Appellöf). Hardanger fiord. Straumastein 100—200 m, Eikevik 50—150 m (teste Grieg). Herlöfiord, Dalstöbugten 6—12 fms. mud (Appellöf). Ulvesund Lestholmen, Skarebugten 60—100 m shelly sand mixed with clay (teste Grieg). Vaagsfiord Holnaesviken 40—100 fms. sand (teste Grieg). Vaagsfiord, Southern point of Skavöen to Tomberviken (teste Grieg). Korshavn (G. O. Sars).

Exterior aspect: The most proximal part of the animal is modified into a small, not ampullaceous, physa which is commonly involved, according to the statement of Appellöf. The scapus is on transverse-sections rounded, without longitudinal furrows, but with a thin periderm which is sometimes a little wrinkled on preserved specimens, on account of the contraction of the column. If the animal is wholly expanded the insertions of the mesenteries are visible (according to Appellöf). This author declares that the scapus is quite smooth. The scapus is in fact provided with scattered "*Halcampa*-papillae" to which small grains are sometimes attached in the proximal parts of the scapus (textfig. 87, Pl. 1, figs. 8, 9). The capitulum is polygonal and has 8 rather elevated longitudinal ridges between the insertions of the mesenteries. The tentacles of *Lecythia* are (according to Sars) 20, 25—26 in number, those of *carnea*, according to Appellöf, some 20 to some 30. I have observed 24—28 tentacles myself. The inner tentacles are longer than the outer ones, all short and of about the length of the capitulum, conical and hexamerously arranged in at least 3 cycles. Appellöf says that there are only 2 cycles of tentacles present. The oral disc is inconsiderable. The actinopharynx is short, with 8 longitudinal furrows and the same number of longitudinal ridges. A feebly developed ventral siphonoglyphe seems to be present.

Anatomical description: The physa is devoid of a periderm. The ectoderm contains numerous nematocysts, 8—15 μ long. The scapus-ectoderm is high and covered with a thin periderm. Its nematocysts are numerous and of two dimensions, partly comparatively broad 17—22 × 3,5—4 μ, partly smaller, thinner and about 8—12 μ long. The mesogloea is of about the thickness of the ectoderm or thinner and almost homogeneous. The endoderm is a little lower than the ectoderm and contains numerous nematocysts (text fig. 89, 92 *n*), 34—38 × 5 μ in size and often a little curved; these endodermal nematocysts make a characteristic feature of this species. I have observed such capsules also in the endoderm of the tentacles and of the actinopharynx. (Their size is 36—43 × 5 μ). The capitular ectoderm is high and provided with nematocysts which are smaller in the proximal parts (10—14 μ long), in the distal part, on the other hand, unto twice that length. In the furrows they are sparse, on the ridges numerous. According to Appellöf there are nerve-cells and nerve-fibrillae in the capitular ectoderm. The capitular ridges arise from the thickenings of the mesogloea. The ectoderm of the tentacles contains rather sparse nematocysts, 19—22 × 2 μ in size, and numerous spirocysts unto 28 × 5 μ in size. The ectoderm of the actinopharynx is high with scattered typical nematocysts partly smaller 14—22 × 1,5—2 μ, partly larger, 24—29 × 2,5—3,5 μ. Besides these, there are also nematocysts with distinct basal part to the spiral thread and somewhat broad in the basal end. Their size is 22—24 × 3,5—5 μ. The ectoderm of the siphonoglyphe is only a little differentiated from the other ectoderm of the actinopharynx, but it is provided with longer cilia than this part. Appellöf has not found any differentiation of the actinopharynx.

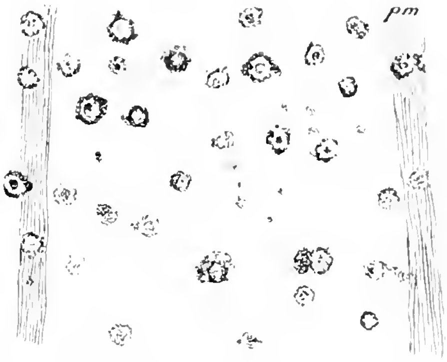


Fig. 87. *Paraedwardsia sarsii*. Arrangement of the "*Halcampa*-papillae" between two mesenteries. *pm*: parietal muscles.

The weak imperfect mesenteries in the most distal part are rather well developed. The longitudinal muscle-pennons of the 8 perfect "*Edwardsia*-mesenteries" are in the reproductive region provided with 15—20 folds (textfig. 88) which are a little ramificated, mainly in the outer part. The inner folds of the pennon are considerably lower than the outer ones, and the pennon itself, on transverse-sections, rather elongated in the reproductive region (textfig. 88). The lamellar outer parts of the mesenteries are attached to the pennon in its outer part. In the endoderm of the mesenteries large nematocysts of the same structure as those in the endoderm of the column here and there occur. The parietal muscles[1] are in the reproductive region strong with numerous folds and on transverse-sections of a rounded appearance (textfig. 92), in the capitular tract considerably weaker and arranged more or less in the shape of a fan (textfig. 90, 91). The part of the parietal muscles which expands on the column is considerable and as broad as the parietal muscle-pennon itself. The mesenterial filaments have a typical appearance. The animal is dioecious.

Biology: The animal lives unattached, mainly on sand (Appellöf) or on stones, or attached to shells? (*Lecythia* according to Sars).

Remarks: Whether Sars's *Lecythia brevicornis* is identical with Appellöf's *Edwardsia carnea* is very difficult to decide; on the other hand the species described by Appellöf is the same species as *Edwardsia Sarsii* Düb. & Koren, which I have been able to substantiate on specimens belonging to the Museum of Christiania and labelled "*Edwardsia sarsii* Düb. & Koren, Bergen, Manger, Sars". As to *Lecythia* it is possible that Sars's description alludes to the species later on described by Gosse as *Edwardsia carnea*; in reality Sars's figure and description of this species and its occurrence on *Saxicava* more recall *Edwardsia carnea* Gosse than *Paraedwardsia carnea* (Düb. & Koren). As it is, however, hardly possible to decide these

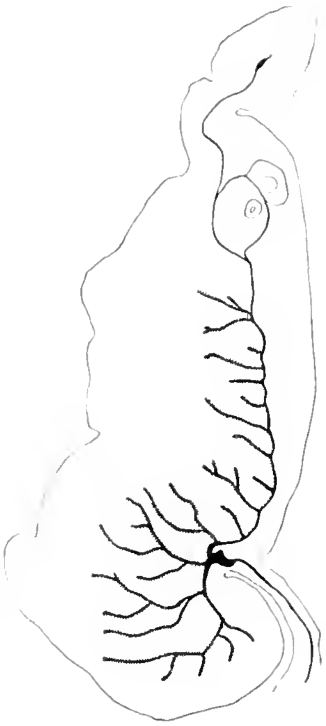


Fig. 88.

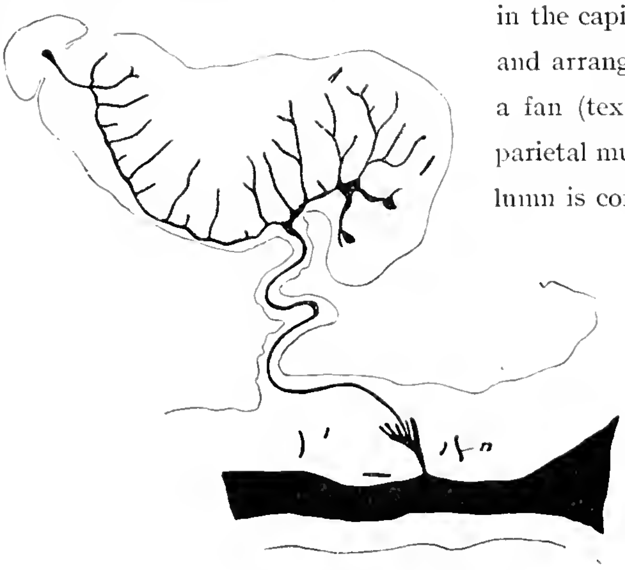


Fig. 89.

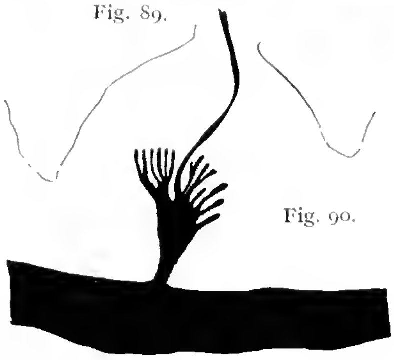


Fig. 90.

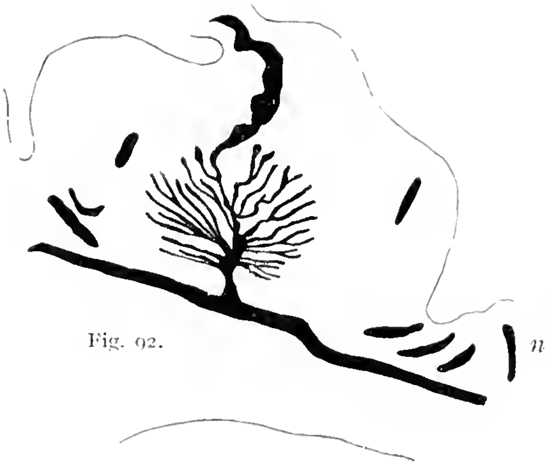


Fig. 92.


Fig. 91.

Textfig. 88—92. *Paraedwardsia sarsii*. Fig. 88: Transverse section of pennon in the reproductive tract. Fig. 89: Transverse section of a mesentery in the uppermost part of the cnido-glandular tract (in the capitular region). Fig. 90—92: Transverse section of parietal muscles in the capitular region (figs. 90, 91) and in the reproductive tract (fig. 92).

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[1] Appellöf (1891, p. 21) states that the parieto-basilar muscles are absent in *E. carnea*. This is certainly not the case as the part of the parietal muscles on the opposite side of the pennons corresponds to the parieto-basilar muscle (compare Carlgren 1905, p. 517—518).

questions without examining Sars's type-specimen, if it exists, it may be more suitable totally to disregard the genus *Lecythia*, the more so as any diagnosis of the genus never was given by Sars. There, is, however, no doubt that *Lecythia* is identical with one or other of the genera *Milne-Edwardsia* and *Paraedwardsia*, proposed by myself. Of the latter genus I have had an opportunity of examining the specimens determined as *Edwardsia sarsii*, further the specimens in the Museum of Berlin (Schaudinn's sp.), those from Korshavn and Appellöf's specimens. Appellöf (1893) has given a description of the outer as well as the inner organisation of the species; on several points his description is completed here, especially as regards the nematocysts — Appellöf does not mention any nematocysts in the capitulum or in the ectoderm of the tentacles — and the occurrence of the "*Halcampa*-papillae" which are also overlooked by Appellöf; I made the section-series from the specimens from Bergen, Manger, from Appellöf's specimens, and from those from Korshavn. The text-figures, reproduced here, refer to the first-mentioned ones.

Fam. *Limnactiniidae* nov. fam.

Diagnosis: Athenaria without tentacles or sphincter. Perfect mesenteries 8—10 (or more?).

Concerning the position of the family and the reduction of the tentacles see my remarks to *Limnactinia leavis*.

Genus **Limnactinia** nov. gen.

Diagnosis: Limnactiniidae with the column not divisible into regions. Column smooth, without cuticle or "*Halcampa*-papillae." Proximal body-end rounded as a physa, perforated by apertures. Ectoderm af the oral disc very thickened, containing numerous spirocysts. Distal part of the column with spirocysts. No siphonoglyphes. Perfect mesenteries 8 to 10 with reproductive organs. Rather few imperfect mesenteries.

Of this genus I know two species, *Limnactinia laevis*, described below, and another one dredged by the Swedish Antarctic-Expedition at South Georgia.

Limnactinia laevis nov. sp.

Pl. 1. Figs. 13, 14.

. . . . nov. sp. Carlgren 1893, p. 23, Note.

Diagnosis: Proximal body-end with a central aperture surrounded by a cycle of 8 (-10?) apertures. Nematocysts in the proximal part of the column partly 14—18 μ long, partly 24 × 4 μ, in the distal part 11—14 μ in size. Spirocysts of the column 16—20 μ long. The most distal part of the column with a weak longitudinal muscle-layer. Ectoderm of the oral disc extraordinarily high with very numerous spirocysts, 19—36 μ long, and very sparse nematocysts, 11—14 μ long. Ectoderm of the actinopharynx with nematocysts 24—26 × 4 μ in size. 8 "*Edwardsia*-mesenteries" or 10 (8 + 2 dorsolateral) mesenteries perfect; the two ventrolateral mesenteries of the first cycle always imperfect. 2 (dorsal) to 4 (dorsal and lateral) mesenteries of the second cycle present. Longitudinal muscle-pennons of the perfect mesenteries in the reproductive region with 9—15 high folds, branched mainly in their outer parts. Outer lamellar part of the mesenteries attached close by the outer edge of the pennons. Parietal muscle with a few, thick folds. The expansion of the parietal muscles on the column is considerable. Several marginal stomata. Ciliated streaks discontinuous.

Colour: opaque white to yellowish-white with dirtily-yellow reproductive organs and filaments. In the distal part of a contracted specimen I observed brownish spots, discernible from the surface. Probably they belong to the uppermost part of the column or to the oral disc.

Dimensions: Two specimens from Gullmar fiord were 2,7 resp. 2 cm in length, and 0,2 in breadth. The length of the specimen from Kal fiord was 1,3 cm, its largest breadth 0,3 cm.

Occurrence: Sweden. Bohuslän. Gullmar fiord, Skår, Lindholm, between Lysekil and Kristineberg 30—70 fms. clay (Carlgren 1893) 5 sp.

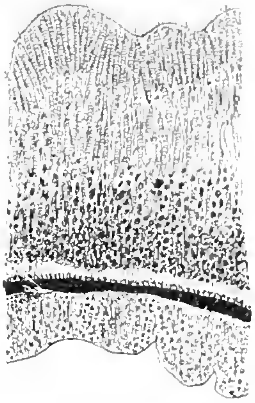
Norway. Finmark. Kal fiord 80 m. clay (Goës and Malmgren 1861).

Exterior aspect: The body (Pl. 1, figs. 13, 14) is elongated and quite smooth, without a cuticle and provided with shallow, though distinct, longitudinal furrows corresponding to the insertions of the mesenteries. It is not divisible into regions. The proximal part is ampullaceous or pointed, according to the state of contraction. In the centre of this part there is an aperture surrounded by a cycle of apertures arranged as those of *Halcampa* (Carlgren 1893, textfig. 7). In one examined specimen the cycle contains 8 apertures, one in each "*Edwardsia*-compartment." It is possible that the number of apertures is 10, if 10 mesenteries are perfect. As far as I can see there are no tentacles. The animals having been dredged in deep water were not in full vigour in the aquaria. I have, therefore, only once observed a wholly expanded specimen. In this one I was not able to find any tentacles. Two other specimens were examined under strong magnifying power with the same results. I at first supposed that the tentacles were invaginated, as it is often the case in *Halcampoides*, or that they had been thrown off as in Bolocera, but soon discovered that there was nothing in the organization to support that supposition. The study of two serial sections, of which one is complete, likewise proved that there are no tentacles. The structure of the oral disc also indicates that the distal end of the animal is transformed. The oral disc is namely very much thickened and forms a high wall, provided with radial furrows, corresponding to the insertions of the mesenteries. The actinopharynx is short, in comparison with the length of the body. It is devoid of siphonoglyphes, gonidial tubercles and aboral prolongations.

Anatomical description: For anatomical examination I have sectioned series of two whole specimens. Of two others one has been transversely sectioned in the proximal part, the other one in the distal part. The specimen from Kal fiord I have sectioned longitudinally in the distal part, transversely in the tract of the actinopharynx and below the actinopharynx.

The wall of apertures in the proximal body-end is in structure similar to that of the *Halcampa* (Carlgren 1893 a). The three layers of the column are all of about the same thickness; in the distal part the ectoderm is, however, thicker than the other layers. In the ectoderm of the column the two common types of stinging capsules are found, in addition to large homogeneous, and smaller granulate gland-cells. The nematocysts are in the proximal part rather numerous and about 14—18 μ long, in the distal part a little more sparse and shorter (11—14 μ); the spirocysts, on the other hand, reaching to a length of about 16—20 μ are numerous in the distal part, in the proximal part very sparse, only here and there appearing. In the ectoderm of the column I have besides found somewhat larger nematocysts (24 × 4 μ), sometimes with a distinct basal part to the spiral thread. The uppermost part of the column is provided with distinct, though weak longitudinal muscles, forming a continuous layer in the tract where the spirocysts are common, but soon disappearing. A nerve-layer with nerve-cells is present and is the most developed in the uppermost part of the column. The mesogloea of the column is composed of alternate layers of longitudinal and circular fibrillae. The endodermal circular muscles form no special sphincter, but are rather well developed; in the proximal part, close by the proximal end, they are a little stronger than in the other parts. The muscle-folds are besides of different appearance, according to the state of contraction. The tract, corresponding to the region of the tentacles and the oral disc in other Actiniaria, is provided with a remarkably high ectoderm, several times higher than that of the column. The outer parts of this ectoderm consists, as a transverse-section through the oral disc shows (textfig. 93), almost exclusively of extraordinarily numerous, very closely packed spirocysts, 19—36 μ long; only exceptionally nematocysts appear, 11—14 μ long. The inner parts of the ectoderm are very deeply stained with the carmine of borax. Here we see the mother-cells of the spirocysts, and spirocysts in development. The nerve-layer is not very distinct, on account of the immense number of stinging capsules. The radial muscles of the oral disc are weak and its mesogloea thin. The ectoderm of the actinopharynx is several times thicker than the mesogloea, here and there sending out irregularly placed tongues towards the lumen of the actinopharynx.

The nematocysts of the actinopharynx ectoderm are broader in the basal end than in the distal one, and the basal part to the spiral thread is perceptible; their size is about 24—26×4 μ. Also in the actinopharynx there are longitudinal muscles, though weak, but distinct, especially in the aboral part. The actinopharynx is provided with several longitudinal ridges and furrows. I have not observed any siphonoglyphe.


Textfig. 93. *Limnactinia laevis.* Transverse section of oral disc.

The mesenteries are partly perfect with longitudinal pennons, reproductive organs and filaments, partly imperfect without such organs. The number of perfect mesenteries variates from 8 to 10. In three examined specimens only the 8 "*Edwardsia*-mesenteries" were perfect (textfig. 94—95); in two larger specimens, provided with well developed reproductive organs, also the fifth couple was perfect (textfig. 96); thus the number and the arrangement of the mesenteries were in conformity with those of *Pentactinia* (Carlgren 1900). Four (2 dorsolateral and 2 ventrolateral) or two (ventrolateral) imperfect mesenteries together with the 8 resp. 10 perfect "*Edwardsia*-mesenteries" form the first cycle of six pairs of mesenteries. An imperfect second cycle of weak mesenteries, not projecting over the surface of the endoderm, is present. In one specimen only two pairs of mesenteries, one in each dorsolateral exocoel, were developed; in the other specimens there were 4 pairs in the dorsolateral and the lateral exocoels. In the ventrolateral exocoels I have never found any mesenteries. The arrangement of the muscles is the same as in other elongated Athenaria. The longitudinal pennons are strong, the high folds, however, rather few, in the upper part of the reproductive region about 9—15; they are mainly branched in their outer parts. The parietal muscles as well as the muscles of the imperfect mesenteries are provided with short and coarse folds. The expansion of the parietal muscles on the column is considerable and often extends far sideways from the folds of the parietal muscles. Below the pennons the parietal muscles are as usual more elongated, form no folds and are attached

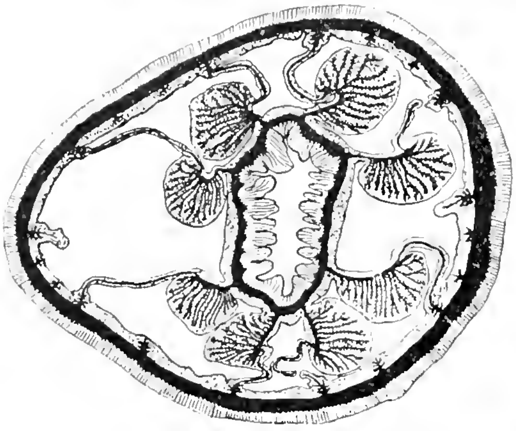


Fig. 94.

Fig. 97.

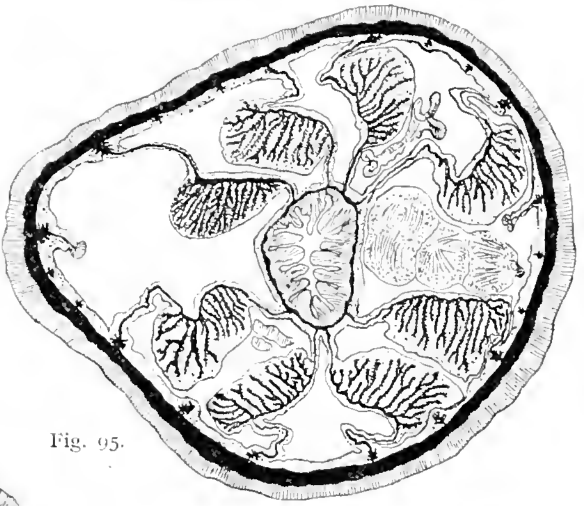


Fig. 95.

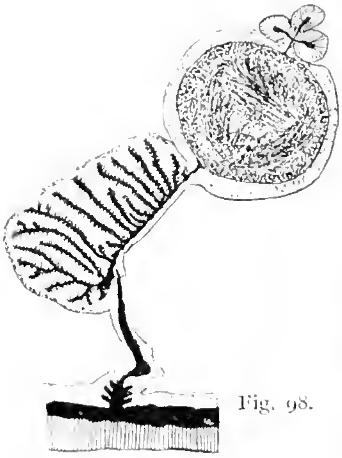


Fig. 98.

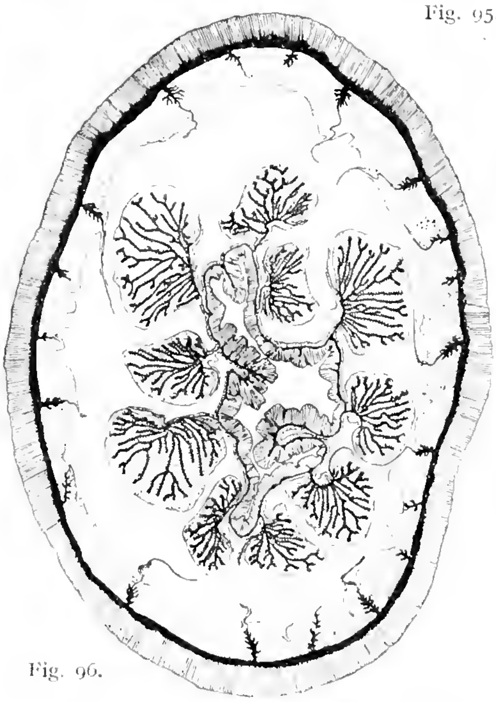


Fig. 96.

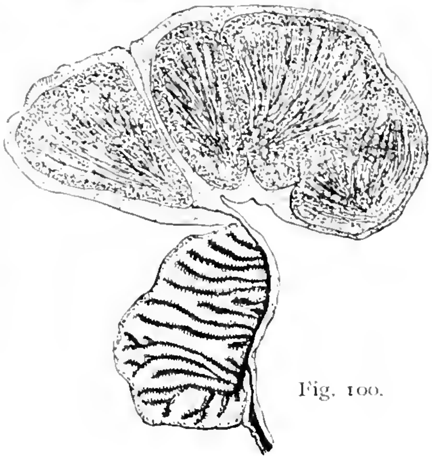


Fig. 100.

Fig. 99.

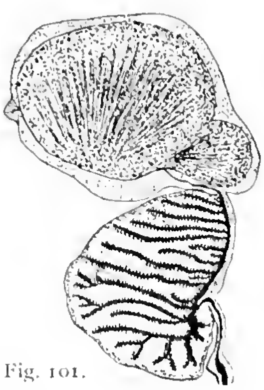


Fig. 101.

Textfigs. 94–101. *Limnactinia laevis.*
Fig. 94. Transverse section of a specimen with 8 perfect mesenteries in the upper part of the actinopharynx. — Fig. 95. A similar section of the same specimen in the lower part of the actinopharynx. — Fig. 96. Transverse section of a specimen with 10 perfect mesenteries. — Figs. 97–101. Transverse sections of a mesentery in the reproductive tract. If we indicate the first section (fig. 97) with 1, the following sections are the fourth, the eighth, the sixteenth and the twenty-third.

to the mesogloea as an even lamella. The fifth couple viz. the ventral mesenteries of the dorsolateral pairs, project as imperfect mesenteries a little over the surface of the endoderm; in this state they carry very undeveloped filaments, but no reproductive organs, figs. 94, 95. The mesenteries of the sixth couple, viz. the ventral mesenteries of the ventrolateral pairs, are always very weak and only a little stronger than the mesenteries of the second cycle.

The ten stronger mesenteries are provided with stomata. As in *Scytophorus antarcticus* there are several stomata distally placed in each perfect mesentery, they do, however, seem to be less numerous (unto

4 in each mesentery). Commonly they are found in the middle or in the outer rim of the mesenteries. In the section reproduced in the textfigure 96 the stomata have been hit, and the mesenteries thus discontinued. The filaments appear only on the 8 to 10 perfect mesenteries. The ciliated streaks are very long, but discontinuous as in *Scytophorus antarcticus* and *Isoedwardsia mediterranea*, and thus divisible into several portions along the middle streak. The textfigure 97 shows a transverse-section through a mesentery with a testes follicle and a rather well developed middle streak; a little farther down, towards the proximal end, we find rather well developed ciliated streaks (textfig. 98) which are still more distinctly seen on the following transverse-section (textfig. 99). In a transverse-section still farther down (textfig. 100) we meet several testes follicles, but only a rather inconsiderable middle streak. In the following sections we again find the middle streak (textfig. 101). The filaments are, as for the rest, of usual structure, and the cnidoglandular tract thicker than the middle streak. Three examined specimens were males, a fourth one a female. The reproductive organs were well developed, especially in the specimens with 10 perfect mesenteries.

Biology: The animal lives on clay bottom, and on account of its particular structure it might very well have the habits of a worm. Probably it pushes deep down into the clay, for it is worth noticing that I have observed the animal only one summer when we used a deep-going dredge, constructed by Professor Tullberg, at the zoological station of Kristineberg, and never during the many others summers I spent at the station. With its proximal end it is able to penetrate into the clay as the Edwardsids and Halcampids; but also the distal end possibly serves as a boring organ. As the tentacles are wanting, the animal must take its food in another way than the other Actiniaria, it is therefore possible that it feeds upon detritus-particles in the clay, though I have not found any such in its coelenteric cavity. It is besides reasonable to suppose that the strongly thickened oral disc with its numerous spirocysts ("Klebkapseln") has undertaken the function of the tentacles as capturing apparatus.

The occurrence of a really tentacle-lacking Actiniaria is thus established. True enough, R. Hertwig (1882, 1888) has believed himself to have discovered forms, among the Actiniaria from the Challenger Expedition, which were tentacle-lacking or with very reduced tentacles, but these observations have appeared not to be correct. The tentacle-lacking Actiniaria, described by R. Hertwig, are namely to be referred to forms having thrown off their tentacles (Mc. Murrich 1893, Carlgren 1899), and those with strongly reduced tentacles, provided with large stomidia, to forms, the state of preservation of which leaves a great deal to be desired. (Compare *Sicyonis crassa*). In the cases where the bad preservation of the animals has made it impossible to perform a control-examination we may resort to a similar kind of explanation. In some cases recorded by Hertwig — as far as I remember especially of *Polyopis* — it is possible that the tentacles were invaginated before they were macerated. In the genus *Halcampoides* it namely often happens that some tentacles, rarely all, become invaginated on preservation. In the latter case, when all tentacles are invaginated, it looks as if they are wanting, and only large stomidia remaining. Very small tentacles we find in some Discosomids, especially in *Discosoma Unguja*. Here the tentacles, arranged in radial rows, do not reach the surface of the oral disc, but are indicated by invaginations in the mesogloea of the oral disc.

Systematic remarks. I have placed this family among the Athenaria because of the structure of its proximal end and of that of its mesenteries. The presence of ectodermal muscles and of spirocysts in the uppermost part of the column would possibly make this species entitled to a position among the Protactininae, but as a similar distribution of the ectodermal muscles and the spirocysts also occurs in the genus *Halcampa*, though these organs do not reach as far down in the latter species as in *Limnactinia laevis*, I think that we may, at least provisionally, place it with the Athenaria. It is, besides, possible that the presence of the ectodermal muscles in the column is a secondary feature arisen in connection with the manner of living of the animal. In the second species of the genus I have not found any ectodermal muscles in the column, but only spirocysts.

Fam. *Halcampoididae*.

Diagnosis: Athenaria (Abasilaria) generally with elongated body and with proximal body-end physa-shaped or flattened. No sphincter or a very weak endodermal one. Tentacles always present, commonly with more than 8 perfect mesenteries (in *Synhalcampella*[1] only the "*Edwardsia*-mesenteries" perfect). No acontia. Ciliated streaks present, rarely discontinuous.

To this family which is identical with the Halcampomorphidae, proposed by myself, I refer, as above mentioned (p. 21), *Halcampoides* Dan., *Aethelmis* Lütk., *Phytocoetes* Ann. and *Halcampella* Andr., the last genus under the supposition that the type, as yet not examined in detail, *H. endromitata* Andr., has no mesogloeal sphincter[1]; further *Scytophorus* R. Hertw., *Pentactinia* Carlgr., *Harenactis* Torrey, *Siphonactinopsis* Carlgr., *Mesacmaea* Andres (the last genus under the same supposition as *Halcampella*). *Peachia* Gosse, *Eloactis* Andres, *Haloclava* Verrill, and finally also *Polyopis* R. Hertw. may be placed to this family (compare below). I have above (p. 19-20) more amply discussed the correctness of placing *Peachia*, *Eloactis* and *Haloclava* in one particular family. On account of the arrangement of the tentacles — the shorter are off-shoots of the endocoels — we might possibly establish a sub-family Peachiinae for these genera, and bring together the others in a sub-family Halcampoidinae with the endocoel-tentacles of the first order longer or as long as the other tentacles. The column is smooth in *Halcampoides*, *Aethelmis*, *Phytocoetes*, *Harenactis*, *Siphonactinopsis*, *Mesacmaea* and *Peachia*; in *Halcampella*, *Scytophorus* and *Pentactinia* furnished with "*Halcampa*-papillae"; in *Eloactis* with low, rounded papilliform thickenings, mainly composed by the ectoderm, and in *Haloclava* with longitudinal lines of ampullaceous papillae in the distal part of the body-wall. The papilliform thickenings of *Eloactis*

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[1] Probably *Halcampella endromitata* has no sphincter. To judge from the arrangement of the mesenteries, this species seems to agree with *Halcampella maxima* and with a new species *H. robusta*, not as yet described by me. They have no sphincter, and the very weakly developed imperfect mesenteries only occur in the most distal part of the body. A schematic figure, placed at my disposal by Dr. Andres, namely shows that in *H. endromitata* only 12 mesenteries are developed below the actinopharynx. In contradistinction to this, the imperfect mesenteries are developed along the whole body in the genus *Cactosoma*, which within the family Halcampidae corresponds to *Halcampella* within the Halcampoididae. Concerning the *Halcampella Oustromovi*, described by Wyragéwitch (1905), its systematic position is dubious. Its very little size (the animal was 2—3 mm long), its inconsiderably developed reproductive organs and its other structural features, indicate that the species has not yet gained its definitive size. W. declares that it has no sphincter; it is, however, possible that it was overlooked by him, because of the littleness of the animal. Below the actinopharynx there are unto 32 mesenteries developed, which seem to indicate that we possibly have to do with a *Cactosoma*.

If we do, however, so far see good to accept the statement of W., concerning the sphincter, it is necessary to propose a new genus for *H. Oustromovi*. The new genus, *Synhalcampella*, may be characterized as follows.

Halcampoididae with the column divisible into three regions, physa, scapus and capitulum. Physa without apertures. Scapus probably with "*Halcampa*-papillae." No sphincter. Tentacles more than 12, rather short, dactyliform. Siphonoglyphes probably indistinct, without a conchula. 2 pairs of directives. Only the "*Edwardsia*-mesenteries" perfect, with pennons (only the 2 lateral couples of mesenteries fertile and with filaments). The 5th and the 6th couples and the mesenteries of the younger cycles weak, without pennons along the whole or almost the whole length of the column.

and the papillae of *Haloclava* are to be regarded as slight stinging batteries (compare these genera!). A ventral siphonoglyphe only occurs in *Peachia*, *Haloclava*, *Eloactis*, *Pentactinia*, *Harenactis*, *Siphonactinopsis*, *Mesacmaea* and *Scytophorus*; in the last genus it is rather slightly differentiated. The other genera have either no siphonoglyphes or 2 not very distinct ones. A biradiate, hexamerous arrangement of the mesenteries we find in *Halcampoides*, *Acthelmis*, *Halcampella* and *Harenactis*, though also here traces of the bilateral development often appear, in as much as the 5th and 6th couples of the mesenteries of the first cycle are weaker than the others of the same cycle. *Scytophorus* is furnished with 7 pairs of mesenteries with apparently one pair of directive mesenteries, the ventral one. In *Mesacmaea* which has not been anatomically examined in details, 7 pairs of stronger mesenteries seem to be found, according to Andres's notes which have been placed at my disposal. The ventral directive mesenteries belong to the stronger mesenteries, while the dorsal directives are weaker and in size like the mesenteries of the second order. In another work I will give a more minute account of Andres's notes. *Pentactinia* has 10 pairs of mesenteries; the ventrolateral pairs of the second cycle are not developed. *Peachia*, *Eloactis* and *Haloclava* also have 10 pairs, but here the dorsolateral mesenteries of the second cycle are absent. Finally *Siphonactinopsis* is furnished with 20 pairs of mesenteries. Reproductive organs are developed on all mesenteries in *Halcampoides*, *Scytophorus*, *Siphonactinopsis*, *Mesacmaea* (according to Andres's notes), *Eloactis* and *Haloclava*. Ciliated streaks are present on all examined species. As to *Harenactis* Torrey (1902) has not given any minute informations concerning its filaments. In *Scytophorus* the ciliated streaks are discontinuous and found in several different portions along the middle streak. According to Torrey cinclides[1] occur in *Harenactis* and according to Annandale (1915) in *Phytocoetes*. I have also found cinclides in *Eloactis*. Spirocysts seem to be absent in the tentacles and oral disc of *Eloactis* and *Haloclava*.

To this family also the genus *Polyopis*, proposed by R. Hertwig (1882), may probably belong. Unfortunately a controlling of Hertwig's investigations of the already at the date of his investigation very deformed specimen is no more possible, as there is not much left of the specimen now, and what remains has probably once been exsiccated. Therefore I must restrict myself to some general reflections on Hertwig's description. Concerning the reduction of the tentacles his statement may be admitted with the greatest reservation. It is possible that the animal has thrown off its tentacles, another eventuality is that the tentacles have been torn off or contracted so strongly that they project only as low walls. It was namely proved by a control examination of *Liponema* (Mc. Murrich 1893, Carlgren 1899) — a genus devoid of tentacles, according to Hertwig — that the tentacles had been thrown off. R. Hertwig's statement that *Sicyonis* has very short papilliform tentacles with large stomidia, is also incorrect. True enough, the tentacles of *Sicyonis* are short, but they are not so reduced as Hertwig thinks, and the large stomidia are nothing but artificial products due to the bad preservation of the tentacles, as I will afterwards prove. Finally we might presume that the tentacles of *Polyopis* had been invaginated in the coelenteric cavity before the maceration (comp. p. 79). I, for my part, do not think that the tentacles of *Polyopis* have been reduced, at any rate not in such a way as described by Hertwig. Be this as it may, the rounded proximal body-end and the absence

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[1] Stephenson (1920, p. 447) also names the apertures in the physa or proximal end cinclides. Though the walls, surrounding the cinclides and the apertures in the physa or proximal end, are of about the same structure, I think that it is most practical to retain the name of cinclides in its original extent.

of a sphincter indicate that the genus may be placed to the family Halcampoididae. The openings in the actinopharynx also seem peculiar to me and may require a control examination. Hertwig declares that the number of mesenteries is 36; if we narrowly examine his figure 11 B, Pl. 11, which represents the aboral body-end seen from the gastral side, we find some ridges corresponding to the basal part of the mesenteries. Judging by the ridges I cannot but find that the animal has 20 pairs of mesenteries, 8 stronger and 3 weaker pairs in 4 compartments. I do not see a single reason for the necessity of establishing a distinct family for this so imperfectly known genus. If we are to keep the family Polyopiidae, there is no doubt that its place is with the group Athenaria. Possibly *Polyopis* is related to *Siphonactinopsis*, as both are provided with 20 pairs of perfect mesenteries.

Genus **Halcampoides** Dan.

Diagnosis: Halcampoididae with elongated body. Column not distinctly divisible into regions, with 2 cycles of apertures in the rounded, physa-shaped proximal body-end, smooth, without "*Halcampa*-papillae" or spirocysts in the ectoderm, without a cuticle. No sphincter. Tentacles 12, rather long, cylindrical, not bulbously swollen in the apex. Siphonoglyphes 2 somewhat indistinct, without a conchula, 2 pairs of directive mesenteries. Only 6 pairs of mesenteries, all perfect and fertile. Ciliated streaks of typical appearance.

Stephenson (1918 a, p. 10) has placed *Halcampoides* and *Halcampella*, viz. Hertwig's species *Halcampella maxima* in a genus *Halcampoides*. This arrangement does not seem very suitable to me, as *Halcampoides* with its smooth column and its indistinct region-division is essentially differentiated from *Halcampella*, which shows a distinct division in regions of the column and is furnished with "*Halcampa*-papillae." If *Halcampoides* should be connected with another genus, it would be with *Acthelmis* to which it is indubitably very nearly allied. Stephenson's species, *Halcampoides aspera* also ought to be named *Halcampella aspera*, under the supposition that the type *H. endromitata* has an endodermal sphincter. If the spincter is mesogloeal in the type-species, Hertwig's *Halcampella* to which also *Halcampoides aspera* belongs, should have a new name, for which, in that case, I would propose *Epihalcampa* (compare p. 80).

Halcampoides purpurea (Stud.) Carlgr.

Pl. 1, figs. 34, 35. Pl. 2, figs. 11, 12.

Halcampoides purpurea n. sp. Studer 1878, p. 545. Pl. 5, figs. 20 a, b.

— — Stud. Andres 1883, p. 315. Haddon 1889, p. 336. Kwietniewski 1896, p. 586, Pl. 25, figs. 1—4. Appellöf 1896, p. 13.

Halcampoides abyssorum n. sp. Danielssen 1890, p. 93, Pl. 5, fig. 1, Pl. 15, figs. 4—11, Pl. 16, figs. 1—3. Mc. Murrich 1913, p. 969.

Aegir frigidus n. sp. Danielssen 1887, Pl. 2, figs. 1, 5, 6, 11. 1890, p. 151, Pl. 5, fig. 4, Pl. 18, figs. 5—10, Pl. 19, figs. 1—4.

Fenja mirabilis n. sp. Danielssen 1887, Pl. 1, Pl. 2, figs. 2—4, 1890, p. 144, Pl. 17, figs. 1—14, Pl. 18, figs. 1—4.

Halcampa clavus Quoy a. Gaimard. R. Hertwig 1882, p. 82, Pl. 3, figs. 1, 4, 10, Pl. 12, figs. 8, 9, 11, Pl. 13, figs. 2, 4, 7. Tizard and Murray 1881, p. 674. Haddon 1889, p. 336. Pax 1910, p. 304, 1914, p. 585—586.
Halcampoides clavus (Quoy a. Gaimard? Hertwig) Appellöf 1896, p. 13, Pl. 1, 2.
Halcampomorphe clavus (R. Hertwig) Carlgren 1893, p. 38 (1900, p. 1170).
Halcampoides elongatus n. sp. Carlgren in Stephens. 1912, p. 58 (8).
Halcampa septentrionalis n. sp. Pax 1912, p. 312, 1914, p. 586.
Halcampa kerguelensis n. sp. R. Hertwig 1888, p. 28, Pl. 2, fig. 5. Appellöf 1896, p. 14.

Diagnosis: Nematocysts in the ectoderm of the column partly larger, 19—36 × 3—4 μ, partly smaller, (10) 12—24 × 1,5 μ; in that of the tentacles 22—38 × 2—3 μ; in that of the actinopharynx partly smaller, 12—14 × 1,5 μ, partly larger 27—46 × 3—4 (5) μ. Nematocysts with discernible basal part to the spiral thread 20—24 × 4—6 μ. (concerning the nematocysts of forma *mediterranea* compare below). Spirocysts in the ectoderm of the tentacles of variable size from 14 × 1,5 μ to 40 × 4—5 μ, some capsules sometimes larger. Column with 12 longitudinal furrows corresponding to the insertions of the mesenteries. Longitudinal muscle-pennons in the upper part of the reproductive region with very numerous, high, often (especially in large specimens) rather richly ramificated folds. Outer lamellar part of the mesenteries attached close to the outer edge of the pennons. Parietal muscles strong, well limited, with in the outer parts low, in the inner ones high folds which in large specimens are from somewhat to very richly ramificated. Marginal stomata present.

Colour: Purple-coloured, tentacles brownish (*purpurea* teste Studer). — Column pale rose-red. Oral disc and tentacles intense crimson, the disc a little paler than the tentacles (*Aegir* teste Danielssen). — Column flesh-coloured with lighter longitudinal stripes, anterior part pellucid, oral disc pellucid with rose-coloured rays shading off into violet. Tentacles light red, at their base with a brownish-violet patch extending stripe-like along the adoral side right up to the point (*Fenja* teste Danielssen). — Column rose-red, posterior extremity with a faint violet play of colour, oral disc rose-red. Tentacles dark red, shimmering faintly crimson (*Halcampoides* teste Danielssen). — Column yellowish-white with a play of rose-colour, distal part greyish to whitish-yellow. Tentacles brown, more or less shading off into green. — Column yellowish-white with a play of reddish-violet, here and there with darker stripes. Distal part and the tentacles as the preceding specimens (two specimens from Greenland teste Arwidsson). — Proximal part of the column reddish-yellow, distal part bluish-violet. Tentacles flesh-coloured (a preserved specimen from the Ingolf-Expedit.) — Column flesh-coloured shading off a little into brown (a spec. from Bohuslän). — Column ochreous-coloured, the distal part more pale (a preserved specimen from Ireland, *elongatus*).

Dimensions: in expanded state to 4,5 cm (teste Studer). — Length of the body 7 cm, largest breadth 2,4 cm (a very large preserved spec. from the German Tiefsee-Expedition). — Length of the body 1,5—2 cm, breadth 0,5—1 cm (*clavus* in preserved state teste Hertwig). — Length of the body 1,5—2,5 cm, largest breadth 0,7—1 cm (*kerguelensis* in preserved state, teste Hertwig). — Length of the body 10 cm., largest breadth 1,5 cm. Length of the tentacles 1 cm (a preserved spec. from Naples). — Length of the body 7 cm, breadth 1,5 resp. 1,2 cm (*Fenja* and *Halcampoides* in expanded state, teste Danielssen). —

Length 5,5 cm, largest breadth 0,9 cm (a spec. from the Ingolf-Exp. in preserved state). — Length 3,6 cm, largest breadth 2,5 cm (a spec. from Scoresby Sound). — Length 3 cm, breadth in the distal part 0,7 cm. (*elongatus* from Ireland).

Occurrence: West-Greenland. Davis Strait 65°11′ N 53°35′ W 48 fms. green clay (Ingegerd and Gladan-Exp. 1871), Nordre Stromfiord (Nordmann St. 2) Godthaab 100 fms. Ammondsen.

East-Greenland. Scoresby Sound, Hurry Inlet (Greenland-Exp. 1900 Soren Jensen), Cape Dalton 9—11 fms. (Greenland-Exp. 1900, Soren Jensen), Fame Isl. 5—8 m, mud, 70°50′ N. 22°33′ W. 1/8 23—28 m (Sw. Greenland-Exp. 1899), Cape Stewart 13—18 m, mud, stones, algae (Sw. Greenland-Exp. 1899), Franz Joseph fiord. Outer part of the Myskoxe fiord 220 m (Sw. Polar-Exp.), Mackenzie bay, N. of Franz Joseph fiord 1—35, m, mud and sand (Sw. Polar-Exp. 1900), Greenland without locality.

NE. of Iceland. 65°33′ N. 10°28′ W. 492 fms. Temperature at the bottom ÷ 0,3° (Ingolf-Exp. St. 107).

Faroe Channel. 60°29′ N. 8°19′ W. 374 fms. Temp. at the bottom ÷ 0,5° (Knight Errant-Exp. 1880 *septentrionalis*) 61°08′ N. 9°28′ W. 820 m (Thor-Exp. 1904 St. 78).

W. of Northern Norway 66°41 N. 6°59′ E. 640 m, coarse-grained clay. Temp. at the bottom ÷ 0,9° (Norw. North Atl.-Exp. 1877, St. 124), 68°21′ N. 10°40′ E. 836 m. Sand and clay. Temp. at the bottom ÷ 0,7° (Norw. North Atl.-Exp. 1877, St. 164). (Norw. North Atl. Exp. 1877, St. 173—174), 71°25′ N. 15°41′ E. 1134 m, clay. Temp. at the bottom ÷ 1° (Norw. North Atl.-Exp. 1877, St. 200).

Behring Sound. 2 miles N. of the winter-haven of Vega. 12 fms., stones and sand (Vega-Exp. 1878) NW. of Behring Sound 66°58′ N. 171°35′ W. 21 fms. (Vega-Exp.).

Sweden. Bohuslän. Outer part of the Gullmar fiord. Bonden (Carlgren 1895, 1 sp. *elongatus*).

Further distribution: Ireland. 21 miles E. 1/4 N. of Clare Island light house 21 fms. (Helga-Exp. 1 sp. *elongatus*).

The Mediterranean. Naples (Lo Bianco, 1 sp. probably from deep water). Antarctis. Kerguelen 6—100 fms. mud (Gazelle-Exp. *purpurea*), Betsy Cove 49°16′ S. 70°12′ E. 25 fms. Christmas Harbour 120 fms. (Challenger-Exp. *clavus*) London river 110 fms., Cumberland bay 105, 127 fms. (Challenger-

Exp. *kerguelensis*) 48°57'8 S. 70°06' E., 88 m (German Tiefsee-Exp. 1898). South Georgien 54°22' S. 36°28' W. Kocktopf bay 22 m, clay and algae (Sw. South Polar-Exp. 1902, N. 33), 54°11' S. 36°18' W. Cumberland bay 252 – 310 m, gray clay with stones. Temperature at the bottom 1,45° (Sw. South Polar-Exp. 1902 N. 34), Graham region about 64°3' S. 56°37' W. 360 m? Clay. (Sw. South Polar-Exp. 1902, St. 6).

Exterior aspect: The body is either cylindrical or oval, according to the state of contraction. Very expanded specimens reach a considerable length, and also in very contracted specimens the length is much larger than the breadth. The column, secerning a mucus-membrane, shows no distinct division in regions. The proximal part is rounded, physa-shaped and perforated by apertures which are, at least in larger specimens, 24 in number and arranged in two cycles. No central pore is present, which was also stated by Appellöf (1896) of the specimens collected by Danielssen. Studer declares that *purpurea* is furnished with only one aboral pore, an opinion which is adopted by Kwietniewski. This is, however, not the case, as I have been able to prove on the type-specimen. The aboral "pore" is nothing but a lowering, caused by the contraction of the proximal body-end. When the ectoderm is pencilled away here, it is distinctly seen that no central pore is present in the middle of the proximal end, — the presence of such a pore is besides impossible, because of the coalescence of the mesenteries in the centre. On the other hand, I have, in several compartments, found 2 radially placed pores. It admits of no doubt that *purpurea* resembles *abyssorum* and *clavus*, as regards the arrangement of the pores. The column is furnished with mostly distinct longitudinal furrows corresponding to the insertions of the mesenteries, and lacks each trace of papillae; its ectoderm forms no cuticle. The tentacles of the adult specimens, which are short in proportion to the length of the body, are 12 in number, cylindrical, sometimes pointed, according to the state of contraction, and all of the same size. In a small specimen from Cumberland bay, 0,7 mm long and 0,2 mm broad, without reproductive organs, the number of tentacles was only 8. The tentacles all may be invaginated, so that the ectoderm is turned inwards, thus we may find now one or two, now almost all or all the tentacles invaginated. In the latter case the animal seems to be without tentacles, and on the margin of the oral disc only crateriform openings, surrounded by walls, are to be observed. The tentacles sometimes show shallow longitudinal furrows, sometimes a deeper furrow appears on the middle of the tentacles — also observed by Appellöf. In *H. clavus* Hertwig has seen a longitudinal furrow both on the inside and the outside. Any greater importance in systematic respect I cannot ascribe to these furrows, as they are most probably due to an irregular contraction of the tentacles. The oral disc is broad and radially sulcated. The siphonoglyphes are not distinctly differentiated from the outer part of the actinopharynx and lack gonidial-tubercles and aboral prolongations. The actinopharynx is short, of about the length of the tentacles and provided with 12 high longitudinal ridges, extending directly into the middle streak of the filaments. On the actinopharynx of the preserved specimens numerous transversal folds are also to be observed.

Anatomical description: The ectoderm of the column is high with numerous gland-cells. The nematocysts are of two different kinds here, in the actinopharynx of three kinds, one of which has a discernible basal part to the spiral thread; in the tentacles there is only one kind of nematocysts. The size of

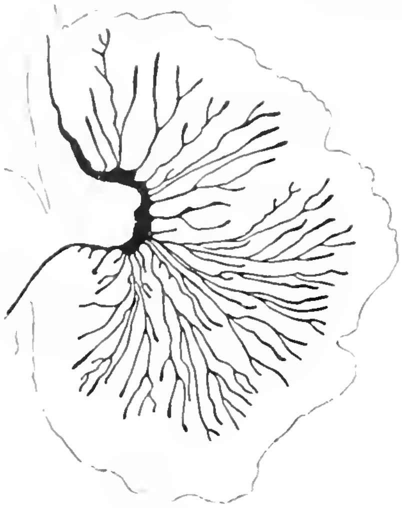

Fig. 102.

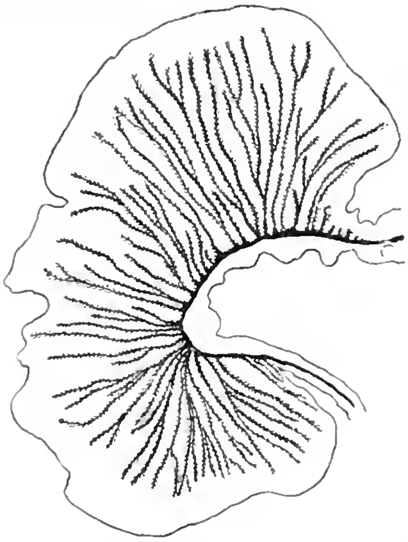

Fig. 103.

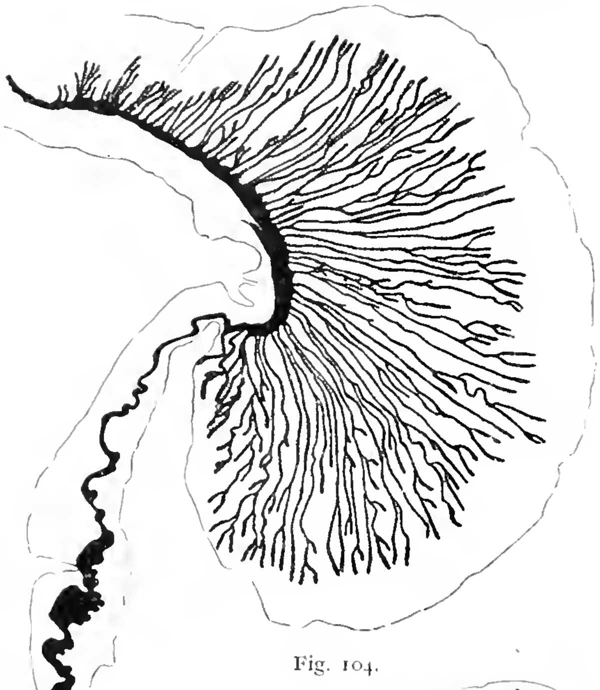

Fig. 104.

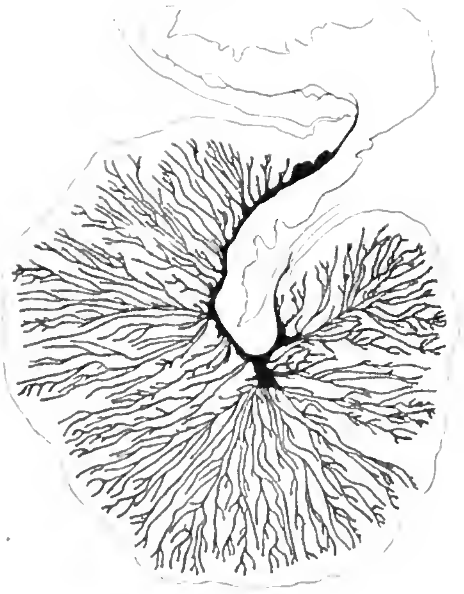

Fig. 105.

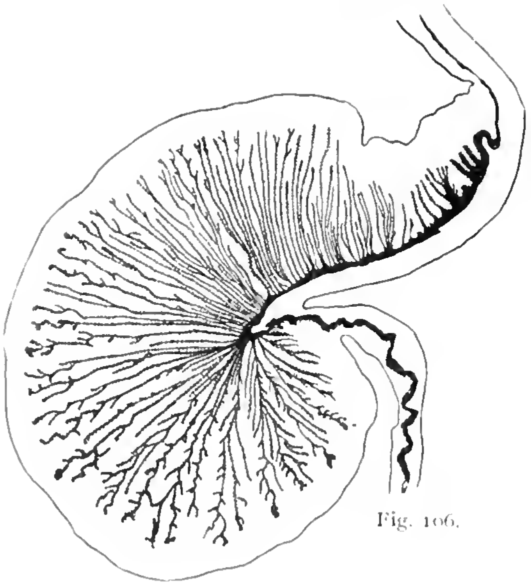

Fig. 106.

Fig. 107.

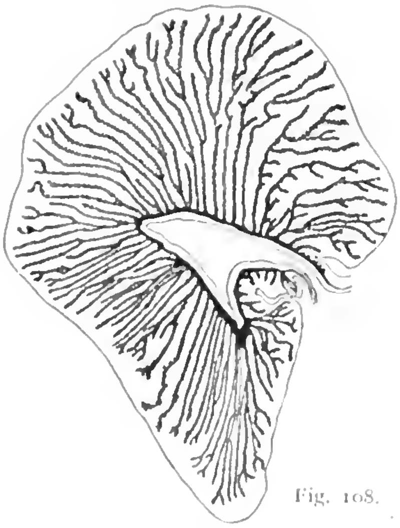

Fig. 108.

Textfigs. 102–108.

Halcampoides abyssorum.

Transverse sections of pennons. Figs. 102–103 from small, not sexually ripe specimens (fig. 102 spec. from Bohuslän, fig. 103 spec. from Ireland), fig. 104 from a large specimen from Scoresby Sound, fig. 105 from the large specimen from Naples. Fig. 106 from the very large spec. from the German Tiefsee Exp., figs. 107–108 from two specimens of *H. "kerguelensis"*. The five last sections have been taken in the upper part of the reproductive region.

the spirocysts and the nematocysts of several specimens I have given below in μ, a. typical nematocysts, aa. nematocysts with discernible basal part to the spiral thread, b. spirocysts.

	Column		tentacles		actinopharynx		
	a	*a*	*a*	*b*	*a*	*a*	*aa*
1)	29—31 × 4 μ	17—20 × 1,5 μ	30—38 × 3 μ	—38 × 4 μ	30—40 × 4(5) μ	19—22 × 1,5	27—34 × 5 μ
2)	27—36 × 3—4	14—19 × 1,5	29—35 × 2,5	14 × 1,5—34 × 4	—	—	
3)	29—36 × 3—4	17—24 × 1,5	26—31 × 2—2,5	—36 × 4-5	31—37 × 3—4	17—22 × 1,5	29—31 × 5—6
4)	19—26(36) × 3—4	13—17 × 1—1,5	26—29 × 2,5	—37 × 4-5	27—30 × 2,5—3	12—14 × 1,5	20—24 × 5
5)	26—31 × 3—4	14—17 × 1,5	—	—	—	—	
6)	24—30 × 3—4	14—17 × 1,5	24—31 × 2—2,5	—26 × 4	31—37 × 3	17—22 × 1,5	22—26 × 5
7)	24—29 × 3	14—17 × 1,5—2	24—31 × 2,5	19 × 1,5—36 × 4	34—41 × 4,5	19—23 × 1,5	29—31 × 5
8)	22—25 × 2,5—3	12—19 × 1,5—2	26—34 × 2,5	19 × 1,5—36 × 4,5	31—41 × 4	12—17 × 1,5	31 × 5
9)	21—26 × 3	(10) 12 × 1—1,5	22—25 × 2	17 × 1-1,5—38 × 5	31—38 × 4	22 × 1,5	29 × 5
10)	28—32	—	28—32	—36	36	—	
11)	—	14—16	24	—	—	22—24	26—31 × 6
12)	—	19—22 × 1—2	19—23 × 1,5—2	19 × 1,5—37 × 4	26—34 × 3—4	22—24 × 2	34—38 × 6—7

1) sp. from Scoresby Sound, size see above! 2) sp. from Hurry Inlet, length about 4 cm, breadth 3 cm. 3) sp. from NW. of Behring Sound, length 3,8 cm, breadth 1,2 cm. 4) sp. from the Ingolf-Exp. size see above! 5) a small specimen from Hurry Inlet, breadth 0,3 cm. 6) sp. from Scoresby Sound, length 1,8 cm, breadth 1 cm. 7) sp. from the German Tiefsee-Exp., size see above! 8) sp. from the Graham region, length 4,5 cm, largest breadth 1,3 cm, length of the tentacles 1,4 cm. 9) *kerguelensis.* 10) *clavus.* 11) *elongatus,* size see above! 12) sp. from Naples. The dimensions of the nematocysts of the specimen 9 are only approximate, as they refer to old measurements from 1897.

If we disregard the specimens 11 and 12, in the column of which I have not found any large nematocysts, the other specimens do very well agree. The nematocysts of the specimen from Naples, however, are a little different in size, wherefore we might possibly consider it as a distinct variety to which also *elongatus* probably belongs (compare below!). The nematocysts of the column are few in the middle part of the body, in the distal part numerous. The mesogloea is of ordinary thickness. The endodermal circular muscles are not very much developed and form no separate sphincter. The sphincters which are mentioned by Hertwig in *clavus* and the distal sphincter, which Appellöf stated to be present, are nothing but local phenomena of contraction. The ectoderm of the tentacles is very high, the ectodermal muscles a little ramificated, but low, and the mesogloea of ordinary thickness; the endoderm is the thinnest layer. The ectoderm of the actinopharynx contains numerous, large, typical nematocysts, while the other nematocysts are few or very rare. It is devoid of ectodermal muscles. The siphonoglyphes are but slightly differentiated, as regards their histologic structure.

There are 6 pairs of mesenteries, of which 2 pairs of directives; they are all perfect and fertile. In younger specimens the 8 "*Edwardsia*-mesenteries" are stronger than the other mesenteries, what has been observed by Hertwig as well as by Appellöf, and what also I confirm. The longitudinal muscle-pennons are very strong, with high, and especially in older specimens, very ramificated folds in the reproductive region. In younger specimens the folds are less numerous in the reproductive regions or in the part where such folds are afterwards developed, but they are thicker than in older specimens. Thus the pennons of the "*elon-*

gatus"-specimens, reproduced in the textfigures 102—103, which were not sexually ripe, show fewer folds than the pennons of ripe *kerguelensis*-specimens (textfigs. 107—108), and the pennons of these latter specimens have considerably thicker folds than those of the larger ones from Greenland (Scoresby Sound), the Mediterranean and Kerguelen (Germ. Tiefsee-Exp.) (textfigs. 104—106). The conformity between the pennons of these latter specimens, and between these and the pennons of *purpurea*, is very great, and the pennons of these three forms (textfigs. 104—106) are on their inside furnished with low folds which were also traceable on the other reproduced sections, excepting the first one which has been taken from the youngest specimen. The outer lamellar part of the mesenteries is in all specimens attached close to the outer edge of the pennons. The parietal muscles, which are not expanded on the column, are strong and distinctly outlined in the reproductive region. In the textfigures 109—118 I have reproduced these muscles of several specimens from different localities. However varying their appearance may seem to be, it is common to them all that the folds of the muscles are weaker on the outside than on the inside. In the younger, not sexually ripe specimens the parietal muscles are extended and the folds not ramificated or only inconsiderably so. The extended form is distinctly conspicuous in *elongatus* (textfigs. 109, 113), but also in young specimens from Scoresby Sound, (textfig. 111, length and breadth of the animal about 0,5 cm — textfig. 110, length of the animal about 1,5 cm, breadth 0,45 cm). The parietal muscles of the Ingolf-specimen (textfig. 116) and those of the specimen from Naples (textfig. 115), of which the former are devoid of reproductive organs, the latter has such, are more broad than they are long, while the others are rather expanded. The parietal muscles of the largest specimens are the most richly ramificated, figs. 112, 115, 117, 118. Below the reproductive region, where the parietal muscles begin to fuse into the longitudinal muscle-pennons they are more expanded, as seen on the section from the Naples-specimen in textfig. 114. We thus find that the appearance of the parietal muscles in the reproductive specimens varies considerably in the reproductive region; in younger specimens the folds are less numerous, more thick and a little ramificated, in older ones more numerous, more thin and richly ramificated. In younger specimens the parietal muscles are besides more radially extended while in older ones they are more concentrated, a memento that we are not uncritically to put up new species, only on basis of a different appearance of the parietal muscles. The ciliated streaks are well developed and the intermediate streaks well differentiated. The median streak forms a direct prolongation of the longitudinal ridges of the actinopharynx. The cnido-glandular tract is very long. In several specimens I have observed a small oral stoma. Also a marginal stoma is present. The species is dioecious.

Remarks: As this species has played a certain part in zoogeographical respect I have above given a more than usually detailed description of its anatomy. I also would advise a stricter analysis of its rather intricate synonymy. The Antarctic forms are the first to be discussed. As regards *Actinia clavus* Quoy and Gaim. which several authors have placed in the genus *Halcampa*, it is evidently not identical with *Halcampa clavus* R. Hertwig, which Pax 1912, after having examined some types of Quoy and Gaimard, was willing to place together with the species of these authors. The difference in their anatomy is namely considerable. The presence of a single deep siphonoglyphe in the species of Quoy and Gaimard is enough to prove that we have to do with quite another genus than that of Hertwig. Andres (1883) has a more correct understanding of its systematic place as he names the former *Philomedusa* (*Bicidium*) *clavus*, which name also

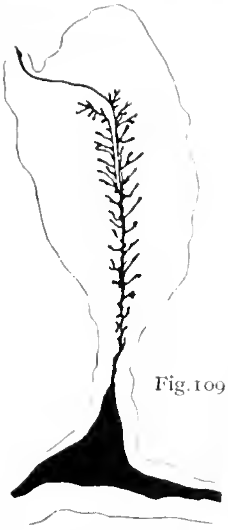
Fig. 109

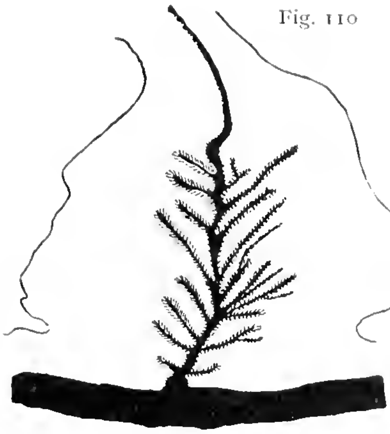
Fig. 110

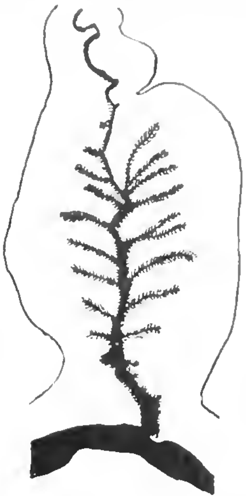
Fig. 111

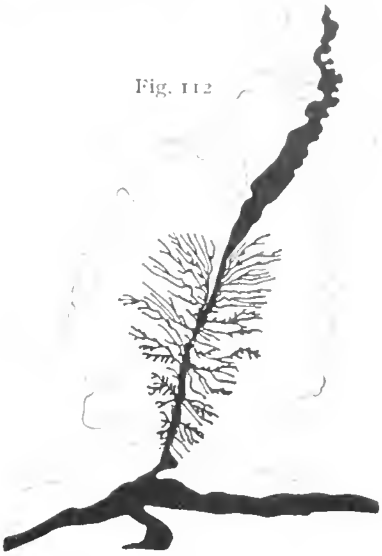
Fig. 112


Fig. 113

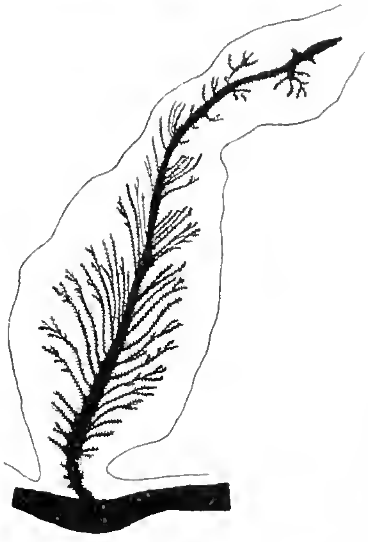
Fig. 114

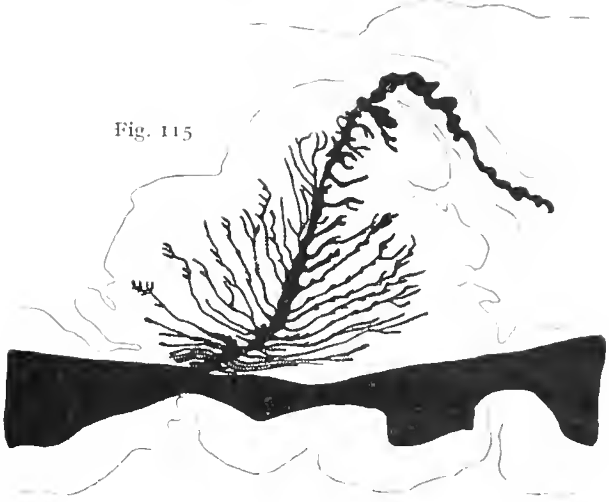
Fig. 115


Fig. 116

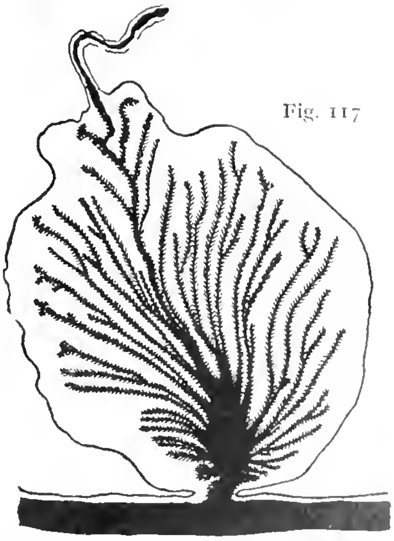
Fig. 117

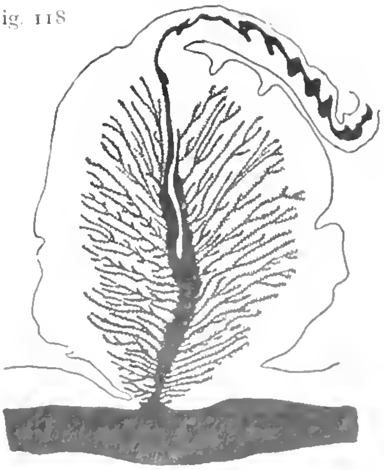
Fig. 118

Textfigs. 109—118.
Halcampoides abyssorum.
Transverse sections of parietal muscles (Figs. 112, 115, 117, 118 in the reproductive tract).

Figs. 109—111, 113, 116 from not sexually ripe specimens (fig. 109 spec. from Bohuslän, fig. 110 spec. from Scoresby Sound fig. 111 spec. from the same locality, fig. 113 spec. from Ireland). Figs. 112, 114, 115, 117, 118 from adult specimens. The section fig. 112 is the outer part of the mesentery reproduced in fig. 104. Fig. 114 spec. from Naples. The section has been taken close below the reproductive tract. Fig. 115 spec. from Naples; fig. 116 spec. from the Ingolf exp. Section in the uppermost part of the cnido-glandular tract; fig. 117. The section is the outer part of the mesentery, reproduced in fig. 107 spec. from Challenger Exp. = *H. kerguelensis* Hertw.; fig. 118 the very large spec. from the German Tiefsee Exp.

Mc. Murrich (1913, p. 969) adopts. That the species of Quoy and Gaimard is a larva of *Peachia* (= *Bicidium*) is very probable; I will, however, make the reservation that this species possibly may be the larva of a *Haloclava* or of an *Eloactis*. Unfortunately the figure given by Pax[1], is of so small dimensions that we cannot form a clear conception of the relation between the longitudinal pennons and the parietal muscles (compare below the conditions in *Peachia* on one side, *Haloclava* and *Eloactis* on the other), nor of the structure of these latter. Judging by the figure the arrangement of the muscles rather seems to indicate that the species belongs to one of the two latter genera. This might be very easily decided by an examination of the apices of the tentacles and their nematocysts. There is no doubt that the type of Quoy and Gaimard belongs to some one of the above-named three genera.

Hertwig's *Halcampa clavus*, on the other hand, certainly is a species of *Halcampoides*. Concerning this species Haddon (1889, p. 336) has suggested that it is identical with Studer's *Halcampa purpurea*, to which Kwietniewski (1896, p. 588) objects, while Mc. Murrich (1913, p. 969) thinks that it may possibly be a larva of *Halianthella* (*Edwardsia*) *kerguelensis* (Stud.). The latter view is, to my mind, quite untenable, as there are pores in the physa of Hertwig's species, but no such in *H. kerguelensis*. Furthermore reproductive organs are developed in *H. clavus*, and therefore it cannot be a larva. Besides this, Hertwig has not observed any mesogloeal sphincter in his species, and he could not possibly have overlooked the well developed sphincter of *H. kerguelensis*. On the other hand, Haddon is, as far as I can see, quite correct in his opinion that *H. purpurea* and *clavus* of R. Hertwig are one and the same species. It is true that Kwietniewski emphasizes that *H. purpurea* is furnished with a single pore in the physa, while *clavus* has several such, but, as regards *purpurea* (compare above!), I do not think that this observation by Kwietniewski is exact, as the physa of both forms is perforated by several pores. The difference in size between the 8 "*Edwardsia*-mesenteries" and the 4 other mesenteries in *H. clavus*, in contradistinction to the uniform development of all mesenteries in *purpurea*, seems to me to be of little importance as also in the Northern forms I have found the 2 youngest couples, at least of younger individuals, to be weaker than the other mesenteries (Compare also Appellöf 1896, p. 13). *Halcampa clavus* of Hertwig and *H. purpurea* therefore to my mind are identical species.

A third Antartic species, *Halcampa kerguelensis* Hertw. also seems to me to be identical with *H. purpurea*. It is true that Hertwig has pointed out some characters which might serve to distinguish *clavus* from *kerguelensis*, but on closer critical inspection I come to the conclusion that these characters are insignificant. The slightly different structure of the pennons is probably connected with the different size of the specimens, furthermore the transverse-sections of the pennons of *H. kerguelensis*, reproduced by Hertwig, is in no wise typical. Such an arboriform shape of the middle part of the pennon I have never observed, although I have sectioned a couple of specimens (compare textfigs. 107, 108). The two sphincters which Hertwig describes in *H. clavus* do not deserve this name; to my mind, they are, as I have above suggested, only indifferentiated circular muscles concentrated through the contraction of the column in these parts. Also the different appearance of the actinopharynx in both species is certainly connected with a different state

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[1] Pax (1914, p. 585) seems to adopt the opinion that the species of Quoy and Gaimard is a *Peachia*. He declares that he has proved this species to be a *Peachia*, which to my mind does not appear from his account.

of contraction, and the longitudinal furrows of the tentacles of *clavus* have no doubt arisen by an accidental, irregular contraction (compare above!). The longitudinal pennons of *H. kerguelensis* are not so richly ramificated as in *Halcampa purpurea*, and the folds are thicker than in the latter species which I have above proved to be identical with *H. clavus*, but this diversity is, in my opinion, due to the different age of the specimens (the specimens of *kerguelensis* were considerably smaller than those of *purpurea*). I therefore think that Hertwig's *H. clavus* and *kerguelensis* and Studer's *H. purpurea*, all dredged at Kerguelen, are the same species.

If we now turn to the Northern and Arctic Halcampoides-species, Appellöf (1896) has shown that *Fenja mirabilis* and *Aegir frigidus* are identical with *H. abyssorum*, a view which is correct, as far as I can see from Appellöf's description. In addition to Danielssen's species we have to recollect *H. septentrionalis*, a name proposed by Pax for *Halcampa clavus*, described by Tizard and Murray, from the channel of the Faroe Islands and, according to Haddon (1889, p. 336), identified by R. Hertwig as his *H. clavus*. As this form has been dredged in the cold area, it is very probable that it is identical with *abyssorum* (I have never seen this form myself); there is no reason to give a new name to this form, and Mc. Murrich (1913, p. 969) is of the same opinion. Finally we have to mention *Halcampoides elongatus*, a species which I have characterized in a few words (in Stephens 1912, p. 8) as having weaker and more elongated parietal muscles than *H. abyssorum*. As I have, however, afterwards found (compare above, textfigs. 110—111) that the parietal muscles in young, not adult specimens of *abyssorum* are provided with sparser folds and are more elongated in the part belonging to the reproductive region than in older specimens, I think that the supposed differences in the structure of the parietal muscles of *elongatus* and of *abyssorum* are connected with a disparity of age — the specimens of *elongatus* were young, not adult specimens, and I am probably not mistaken, if I place *H. abyssorum*, *septentrionalis* and *elongatus* together in a single species, *H. abyssorum*.

The question now remains, whether *Halcampoides purpurea* and *H. abyssorum* are identical or not. Almost all authors occupying themselves with this question, as Haddon, Mc. Murrich and Pax, have regarded the Antarctic and Arctic species of *Halcampoides* as distinct species — in fact no author has examined more than a few of the above-named species, but entirely founded his statements on descriptions from literature. Appellöf (1896) is the only author who has proposed Hertwig's *H. clavus* and Danielssen's *Halcampoides abyssorum* to be the same species; still R. Hertwig has identified *H. clavus* with the species signified as *H. septentrionalis*. With an interrogation-mark Appellöf has also put up *H. clavus* Quoy and Gaim. as synonymous with the former as well as with *Halcampa purpurea*. On the other hand, he keeps *Halcampoides kerguelensis* as a distinct species. After the account given above — I have had an opportunity to examine all species excepting *H. septentrionalis* — I do not doubt that they are all identical or, on all accounts, so nearly related that no specific character can be pointed out for them. The species therefore ought to be called *Halcampoides purpurea* (Stud.) Carlgr.

Thus we find here a species occurring now in deeper, now in more shallow water, common to the Arctic as well as the Antarctic regions, but, according to earlier accounts, absent in the intermediate waters. The latter account is, however, probably not correct; I am inclined to think that the species is to be regarded as a cosmopolitan, though it has its largest distribution in the cold area. The occurrence of the species in the

Mediterranean namely indicates its cosmopolitism. It is true that the nematocysts differ a little in size and occurrence from those of the Arctic and Antarctic specimens, but this difference is not so considerable as to make us want to put up a new species; it is possibly a separate race or variety (*mediterranea*) to which the not sexually ripe specimens, taken at the coasts of Bohuslän and Ireland, probably belong.

Genus **Acthelmis** Lütken.

Diagnosis: Halcampoididae without sphincter. Column expanded, smooth, without papillae, not divisible into regions or indistinctly so. Tentacles more than 12, not swollen in the apices. Siphonoglyphes absent or very feebly developed. 6 pairs of perfect, fertile mesenteries with longitudinal pennons. Sterile, imperfect mesenteries without pennons, in one or several cycles.

Lütken has for *Actinia intestinalis* Fabr. proposed the genus *Acthelmis*, but never given any diagnosis of the latter. In the Arctic regions there are two species, the only hitherto known. Probably the genus *Charisea*, described by Torrey (1902), is synonymous with *Acthelmis*, though this author places this genus to the family Actiniidae. The body-shape of *Charisea* namely indicates that the genus has no distinct pedal disc, and the figures given by Torrey of the muscles of the mesenteries and his description of the rest of the genus agree well with the above diagnosis of *Acthelmis*. It may besides be that the species *C. saxicola* is identical with anyone of the here described species of *Acthelmis*.

Acthelmis intestinalis (Fabr.) Lütken.

Pl. 1. Figs. 6—7.

Actinia intestinalis n. sp. Fabricius 1780, p. 350, figs. 11 A—C. Andres 1883, p. 588. ? Fleming 1828, p. 498, ? Sars 1835, p. 3. ? Johnston 1847, p. 219, textfig. 49. ? Landsborough 1852, p. 247. ? Norman 1868, p. 318.

A. (*Acthelmis*) *intestinalis* Fabr. Lütken 1875, p. 186.

Actinocereus intestinalis. Blainville 1830, p. 294, 1834, p. 328.

Diagnosis: Column in the proximal end rounded or sometimes flattened. Division into regions indistinct. Nematocysts of the column and tentacles 14—17 × 2—3 μ. Spirocysts of the tentacles unto 22 × 3 μ. Tentacles 18—26 with feebly developed longitudinal muscles. Nematocysts with distinct basal part to the spiral thread 17—22 × 4—5 μ in the ectoderm of the actinopharynx. 2 indistinct siphonoglyphes. Pairs of mesenteries 6 + 6 + 12, the latter cycle more or less perfect. Folds of the longitudinal pennons high, but not very numerous (on transverse-sections through the upper part of the reproductive region about 20, through the lower part about half the number) and ramificated mainly in the outer part. The lamellar outer part of the mesenteries issuing from the outmost end of the pennon. Parietal muscles weak, but expanded, with few, scattered, short and thin folds. Mesogloea in the parietal muscle-region thin. Expansion of the parietal muscles on the body-wall inconsiderable. Longitudinal muscles of the imperfect mesenteries of about the same structure as the parietal muscles of the perfect mesenteries, but a little stronger. Well developed ciliated streaks.

Colour: transparent yellowish-white, the proximal part with paler longitudinal lines (**Fabricius**).

Dimensions: Length in preserved state unto 2,8 cm, breadth 0,25 cm. Length of the tentacles about 0,25 cm.

Occurrence: West-Greenland. Godhavn (**Olrik**), Ritenbenk (**Andersen**), Egedesminde (**Traustedt**, **Olrik**).
Greenland without distinct locality (**Holböll**). On stones or shells at the shore, also on sand (**Fabricius**).

Further distribution: Shetland Islands (**Fleming**) (?Perhaps not this species).

Exterior aspect: In extended state the body is expanded and cylindrical; in very contracted state often broader in the proximal and distal ends. (Pl. 1, figs. 6, 7). Distinct pedal disc absent. It is true that the proximal end of some of the examined species is flattened disc-like, but a distinct outline between the most proximal part and the other part of the body is never to be observed. The proximal part is mostly a little involved in the preserved specimens, but never swollen as a physa generally is. The column is smooth, without papillae, divisible into two from each other very little differentiated parts, a longer scapus and a shorter capitulum; sometimes these regions seem to be separated from each other by a fold, recalling a fossa, which is probably due to the contraction of the body. The scapus seems to be able to generate a thin membrane which, however, may be a mucus-secretion. According to **Fabricius** the tentacles are 18 in number; in 6 species, examined by myself, the number varied from 24 to 26. The tentacles, arranged in three cycles, may be perfectly covered by the column; they are short, conical, not thickened in the apices and almost all of about equal length, the outer tentacles are only a little shorter than the inner ones. The oral disc is inconsiderable, with shallow, radial furrows. The actinopharynx is short, in the preserved specimens folded and supplied with two weak siphonoglyphes devoid of aboral prolongations.

Anatomical description: The ectoderm of the "scapus" is very high and provided with numerous mucus-cells and very sparse nematocysts (14—17 × 2—3 μ in size). The ectoderm of the capitulum differs from that of the scapus only in this respect that the mucus-cells are very sparse here. The mesogloea of the column is thin and fibrillated. The endodermal circular muscles are a little stronger in the above-named fold, but not forming any distinct sphincter there. The longitudinal muscles of the tentacles are weak, the spirocysts of the tentacles are very numerous and of variable length, to about 22 × 3 μ in size. The typical nematocysts are sparse and of the same length as in the column. The ectoderm of the actinopharynx contains very numerous mucus-cells and numerous nematocysts with distinct basal part to the spiral thread. They are widened in the basal end and 17—22 × 4—5 μ in size. The wall of the nematocysts in the tentacles and in the actinopharynx is comparatively thin. In the siphonoglyphes the mucus-cells are very sparse and the nematocysts absent or very sparse.

The mesenteries are hexamerously arranged, in three cycles. Of these cycles the latter is more or less perfect and only present in the distal part of the body. Thus the mesenteries of the third cycle of a specimen were developed in the dorso-lateral and the lateral exocoels, but not in the ventro-lateral exocoels. Besides this, the mesenteries of the third cycle end at a different level, even the mesenteries of one pair. Only the first 6 pairs are perfect and provided with pennons. Judging by the unequal size of the filaments the ventral mesenteries of the ventrolateral pairs are the younger, the dorsal mesenteries of the same pairs the older. The muscle-pennons are provided with high, mainly in the outer parts ramificated folds. In the upper part of the reproductive region, at some distance from the actinopharynx, there are, in transverse-section, about 20 folds (textfig. 119); in the lower part of the reproductive region they are less numerous (textfig. 120). The outer lamellar part of the mesogloea of the mesenteries issues from the exterior border of the pennon. The parietal muscles are but slightly developed. On the pennon-side the short and sparse folds of the parietal muscles merge into the longitudinal muscles of the pennon, now there are some rather close folds not far from the pennons, now some higher folds are developed in the middle part of the lamellar region of the mesenteries between the column and the pennon (fig. 119). On the side of the mesenteries opposite to the pennon the parietal muscles form some sparse folds (textfig. 120), further upwards the folds are still sparser, until at last they disappear, and a straight muscle-lamella remains. In the region of the ciliated streaks the parietal muscles are of the same appearance (textfig. 119). The mesenteries of the second cycle are weak, and their muscles with the sparse folds recall on transverse-sections the parietal muscles of the mesenteries of the first cycle in the lower part of the reproductive region (textfig. 121). The mesenteries of the third cycle are still more weakly developed. On transverse-sections I have observed one stoma in the vicinity of the actinopharynx. The mesenterial filaments are provided with well developed ciliated and intermediate streaks. Only the first 6 perfect mesenteries have reproductive organs.

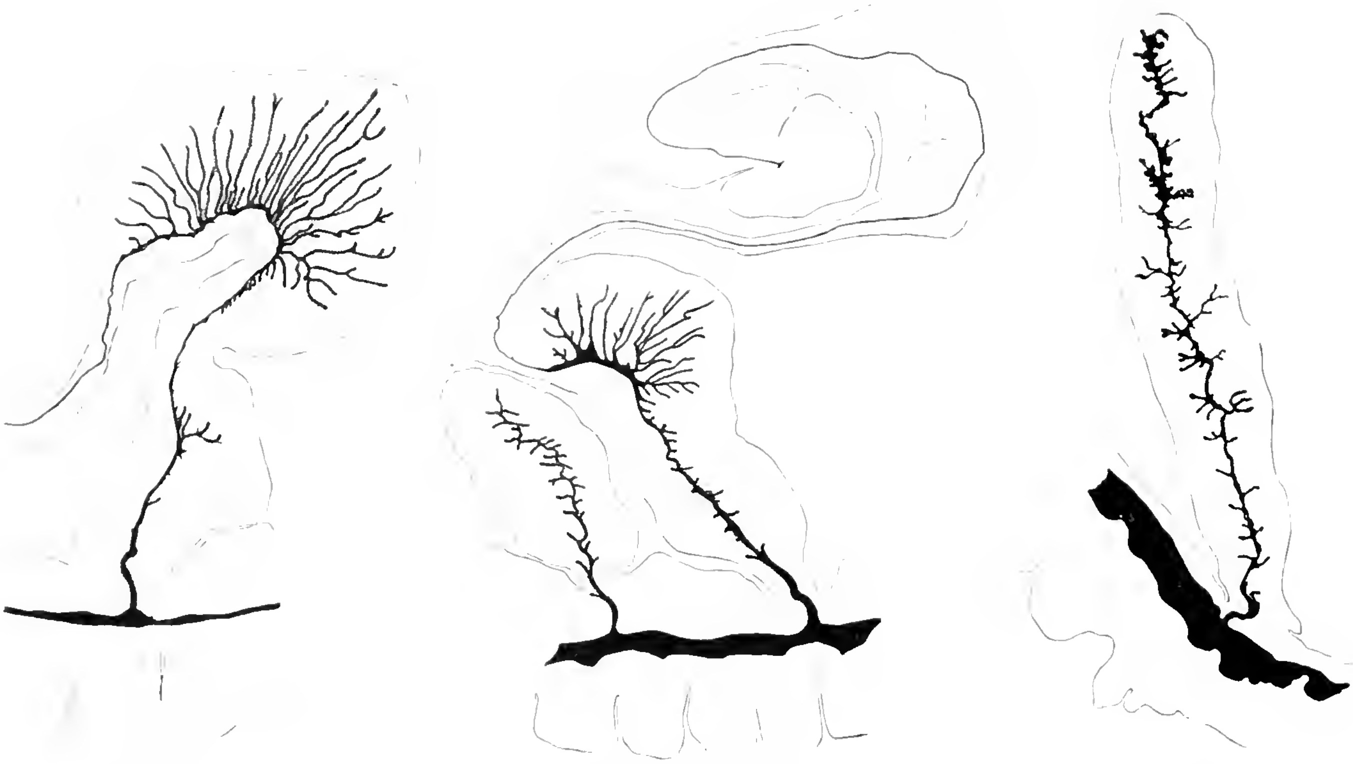


Fig. 119 Fig. 120 Fig. 121

Textfigs. 119–121. *Æthelmis intestinalis.* Fig. 119: Transverse section through a perfect mesentery in the uppermost part of the reproductive tract. Fig. 120: A similar section farther down through mesenteries of the first and second order. Fig. 121: A similar section of a mesentery of the second order.

Remarks: The Greenlanders call this species "Kettuperangsak" (Fabricius).

Acthelmis schaudinnii n. sp.

Diagnosis: Column thicker and more robust than in *A. intestinalis*, and, according to the different state of contraction, cylindrical or oval. Column not divisible into distinct regions. Typical nematocysts of the column 14 × 2 μ, those of the tentacles 22—26 × 2—4 μ, those of the actinopharynx 20—23 × 1,5—2 μ. Nematocysts with indistinct basal part to the spiral thread, widened in their basal end, in the tentacles 24—26 × 1,5—2 μ, in the actinopharynx 24—29 (36) × 5—(6) μ. Number of tentacles about 34. Longitudinal muscles of the tentacles weak. Siphonoplyphes? Pairs of mesenteries 6 + 6 + an imperfect third cycle; the folds of the pennons high and rather much ramificated, more numerous than the former species, in the reproductive region about 20—30. Insertions of the lamellar part of the mesenteries as in *A. intestinalis*. Parietal muscles weak with large, not numerous, low folds. Mesogloea in the region of the parietal muscles thick. Expansion of the parietal muscles as in the former species. Muscles of the mesenteries of the second cycle, although stronger, recalling the parietal muscles of the first cycle.

Colour?

Dimensions: Species from Great fiord: length 1,3 cm, largest breadth 0,6 cm, length of the tentacles about 0,3 cm. — A specimen from New-Zembla: length 0,8 cm, breadth 0,5 cm.

Occurrence: Spitzbergen. Great fiord Cape Blanck 77°49′ N. 20°3′ E. 65 m (Romer & Schaudinn 1898) 1 sp.
New-Zembla Besimennaja Bay, clay, 4—5 fms. (Nordenskiöld-Exp. 1875) 4 sp.

Exterior aspect: All the specimens were more or less contracted, the proximal as well as the distal ends were drawn in. According to the state of contraction the individuals were cylindrical or more fusiform, the diameter in proportion to the length is, however, in this species considerably larger than in *A. intestinalis*. The column does not seem to be divisible into regions, and its surface is smooth. The insertions of the mesenteries were rather distinct and corresponding to weak longitudinal furrows on the column, which are conspicuous on the involved distal part. The number of tentacles in the specimen from Great fiord was 34. The tentacles were hexamerously arranged and short, as in the former species. The oral disc is inconsiderable. The actinopharynx is of about twice the length of the tentacles, and longitudinally and transversely sulcated. I cannot with certainty decide whether siphonoglyphes are present or not, they are, at all events, weakly developed, if present, and form no aboral prolongations.

Anatomical description: The ectoderm of the column is provided with scattered nematocysts, partly typical, always of equal breadth and about 14 × 2 μ in size, partly widened in the basal end and larger, 24—26 × 5 μ; the ectoderm also contains very numerous mucus-cells. The ectoderm is thicker than the mesogloea, especially in the specimens from New-Zembla. The endodermal circular muscles of the column are weak and form no sphincter. The longitudinal muscles of the tentacles are weak and endodermal, the nematocysts of the ectoderm are 22—26 × 1,5—4 μ in size, — the breadth variates considerably, so that it is probable that there are two different sizes of capsules. The spirocysts are unto 30 (36) μ long. The radial muscles of the oral disc are weak. The ectoderm of the actinopharynx is high, with numerous nematocysts. The straight, riblike nematocysts, reaching a size of 22—24 × almost 2 μ, are the most numerous, those which are a little widened in the basal end and show a small, discernible basal part to the spiral thread, are somewhat sparser, their size is commonly 24—29 × 5 μ, rarely unto 36 × 6 μ. Besides these, I have here found sparse, sometimes a little curved, nematocysts of about 29 × 3 μ in size.

The mesenteries are hexamerously arranged in three cycles, 6 + 6 + 12, the latter cycle is imperfect. There are two pairs of directive mesenteries. The first six pairs are perfect and provided with well developed filaments with ciliated streaks. The six pairs of the second cycle are imperfect and of full body-length like the mesenteries of the first cycle, at least several of the mesenteries of the second cycle bear distinct, although not long, filaments. The mesenteries of the third cycle are very weak and only rising a little over the endoderm of the column. Only the first six pairs have pennons; the sixth pair — the ventral mesenteries of the ventro-lateral pairs — is the weakest. The longitudinal pennons are much stronger than in *A. intestinalis*. The folds are high and rather richly ramificated. A transverse-section of a pennon in the lower region of the actinopharynx of the specimen from Great fiord is reproduced in the textfig. 122. (The side of the actinopharynx is turned upwards). In the tract of the reproductive organs the folds are very high and partly much ramificated (textfig. 123, transverse-sections of the specimen from Great fiord). The parietal muscles are weak, the folds are thick, few and low, and recall those of the muscles of the mesenteries of the second cycle, though the folds are stronger here. The mesogloea is strongly developed in the parietal muscle-tract as well as in the mesenteries of the second order, wherefore these part in transverse-sections are of a more robust appearance than the corresponding tracts of *A. intestinalis*. (The textfigure 124 shows a transverse-section through a mesentery of the second order of a specimen from New-Zembla). The parietal muscles seem to be sparsely spread over the column. Stomata are probably present in the distal part of the mesenteries. Only the first six pairs of mesenteries bear reproductive organs. The specimen is dioecious.

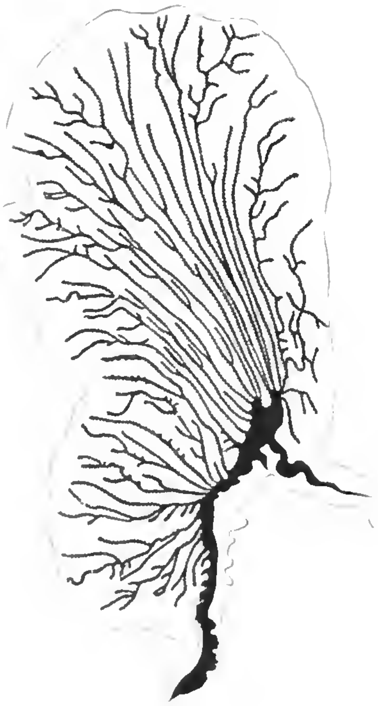


Fig. 122

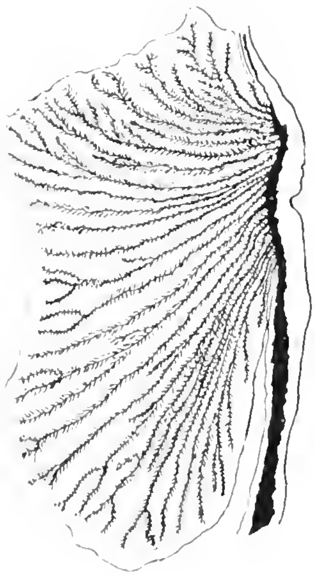


Fig. 123

Fig. 124

Textfigs. 122—124.
Aethelmis schaudinnii.
Fig. 122: Transverse section of pennon in the lower part of the actinopharynx. Fig. 123: A similar section in the reproductive tract. Fig. 124: Transverse section of a mesentery of the second cycle.

Remarks: The state of preservation of the specimens was not good, wherefore the description is not as perfect as desirable. It, however, seems to me that the species is distinctly separated from the former species. In its organisation it moreover recalls *Haliactis arctica* (p. 129), but as I have not observed any acontia here, it is no more to be referred to this latter genus.

Genus **Peachia** Gosse.

Diagnosis: Halcampoididae with a well-developed, rounded, aboral body-end, physa, perforated by very numerous apertures (in twelve longitudinal rows Haddon). Column more or less cylindrical, often of considerable length, smooth, without "*Halcampa*-papillae", indistinctly divided in regions, without spirocysts and sphincter. Tentacles 12, not hemispherically swollen in the apices, the inner (endocoel-tentacles) shorter than the outer (exocoel-tentacles). A single, very deep and well differentiated siphonoglyphe with well-developed aboral prolongation. Oral end of the siphonoglyphe drawn out in a more or less lobated socalled conchula. Pairs of mesenteries 10 (6+4 lateral and ventro-lateral pairs). Only the mesenteries of the first cycle perfect, fertile with filaments and with strong pennons passing into the parietal muscles without distinct outline. Mesenteries of the second cycle with well-developed, almost pennon-like, muscle-bundles in the endocoels.

This genus is evidently most nearly related to *Eloactis* and *Haloclava*. Synonymous with *Peachia* is the genus *Siphonactinia* of Danielssen and Koren, as before pointed out by several authors. In conformity with Haddon (1887, p. 475) I also think that *Peachia* and *Bicidium* are synonymous. This latter genus, living parasitically on medusae, is only distinguished from *Peachia* by the mesenteries of the second order not being developed. These mesenteries seem to originate very late in *Peachia*. I have namely found a specimen of *Peachia* in the clay, the mesenteries of the second order of which were not developed (compare below under *Peachia hastata*). This case seems to be prevailing in *Eloactis*. A specimen of *E. mazelii* from a depth of 40—50 fms., taken in the Hjälte fiord Norway, shows very weak mesenteries of the second cycle in only a single exocoel (compare *E. mazelii* textfig. 142). Furthermore it ought to be remembered that reproductive organs are never found in the genus *Bicidium*, which is probably nothing but a larva-stadium of *Peachia*. The conchula, not always observed in *Bicidium*, also seems to appear very late, and probably alters its form while developing. Under such circumstances it is only with a certain reservation that the form of the conchula may be used as a species-character in *Peachia*.

Mc. Murrich (1893, p. 145) states that *Peachia koreni* has only 8 tentacles. It is, however, probable that the animal was a larval form with undeveloped reproductive organs, as also supposed by Mc. Murrich.

Peachia parasitica (L. Agas.) Verr.

Bicidium parasiticum n. sp. Agassiz 1861, p. 24, 1865, p. 15. Verrill 1864, p. 31, Pl. 1, figs. 14, 15. Mc. Murrich 1913, p. 969. Hargitt 1914, p. 239, fig. 2.

Philomedusa parasitica (Agass.) Andres 1883, p. 324.

Peachia parasitica Verrill 1866, p. 338, 343, 1874, p. 739. Carlgren 1906, p. 83, figs. 7 a, b (a more complete list of the literature is given in the latter work).

Diagnosis: Nematocysts in the ectoderm of the column 25—29 (34) × 3,5 μ, in the tentacles 29—39 × 4—5 μ, in the actinopharynx 29—41 × 4—5 μ, Spirocysts of the tentacles about 17—26 × 2,5 μ. Longitudinal muscles of the tentacles well developed. Conchula with three lobes, in extended state large, in contracted more or less distinct. Muscle-pennons in the mesenteries of the first cycle strong, expanded over almost the whole breadth of the mesenteries. The folds of the pennons rather high, in transverse-sections pectinate. Parietal muscles weak, not expanded on the column. Oral stomata and small marginal stomata present.

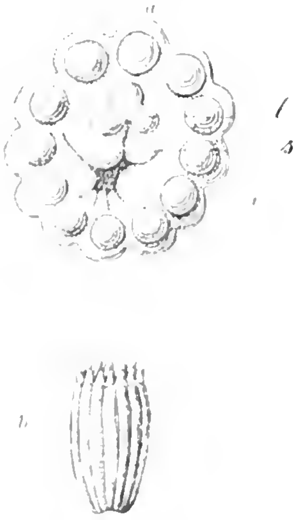
Colour: light purplish brown with bluish iridescence, similar to that of *Cyanea arctica* (Verrill). The largest specimen was brownish, in alcohol.

Dimensions: The largest specimens dissected by myself were 3,5 cm long and 2,5—3 cm broad; the length of the tentacles about 0,9 cm.

Occurrence: West-Greenland Egedesminde (Levinsen 1877) 1 sp., Nordre Stromfiord, St. 9 a (Nordmann) 1 sp., Greenland without distinct locality (Fasting).

Further distribution: North America from Cape Cod to Fundy bay. Nahant Mass. to Eastport Maine (Verrill), Arctic ocean to Cape Cod (Parker) as larva on *Cyanea arctica*, as adult at Eastport Maine (Verrill).

Exterior aspect: The specimens were rather well preserved. The form of the body was more or less egg-shaped, according to a strong contraction of the distal and basal ends. The column is smooth with somewhat distinct longitudinal furrows corresponding to the insertions of the mesenteries; besides these, there are also transversal furrows produced by the contraction of the column. A distinct fossa is present. The tentacles are short, cylindrical, with a porus in the apex, and more or less longitudinally sulcated, according to the state of contraction. The number of the tentacles is 12. In the largest specimen one tentacle was invaginated. The oral disc is not particularly wide. The lobes of the conchula were indistinct in two specimens. In the largest specimen a little protuberance of the conchula is seen near the middle-line on one side; on the other side a similar elevation is probably present, though I cannot confirm it with certainty as the conchula was a little damaged here. In the second specimen the conchula was strongly contracted so that no distinct lobes are visible, in the third specimen it was of the same appearance as on the figure given by Verrill (1864) (Fig. 125 a).



Textfig. 125.
Peachia parasitica.
Fig. 125 *a* seen from the oral disc, *l* conchula, *s* siphonoglyphe. Fig. 125 *b* seen from the side, after Verrill 1864.

The actinopharynx is long, in proportion to the length of the body, and provided with a very well developed siphonoglyphe, the aboral prolongation of which almost equals the length of the actinopharynx. The actinopharynx is longitudinal and transversally sulcated, the transversal furrows are certainly a result of the contraction.

Anatomical description: The ectoderm of the body-wall is high and thicker than the mesogloea. The stratum of nerve-fibrillae and nerve-cells are distinct in the distal part of the ectoderm of the column; in the other parts it is not so much developed. I have measured the nematocysts (*n*) and the spirocysts (*sp.*) in the different regions of two specimens (*a.* specimen from Nordre Stromfiord, *b.* specimen taken by Fasting). They differ considerably in size from those of *Peachia hastata* and *bockii*. The size of the capsules was as follows:

	Column *n.*	tentacles *n.*	tentacles *sp.*	actinopharynx *n.*
in spec. a	25—29 (34) × 3,5—4 μ	32—36 × 4—5 μ	19—26 × 2,5 μ	35—41 × 4—5 μ
in spec. b	25—29 × 3,5	29—39 × 4 (5)	17—22 × 2,5	29—41 (commonly 39) × 5

In the specimen a. the nematocysts were typical with invisible basal part to the spiral thread; in the specimen b. the basal part was discernible. Probably this difference is due to the preservation of the capsules. The nematocysts are numerous in all regions; the spirocysts of the tentacles comparatively few. The endodermal circular muscles of the column are rather strong, but form no sphincter. The ectodermal longitudinal muscles of the tentacles are well developed. The ectoderm of the siphonoglyphe is devoid of nematocysts, and its albumen-cells are few in comparison with those of the actinopharynx, which has no longitudinal muscles. The number of the mesenteries is that typical of *Peachia*. In one specimen one dorso-lateral pair of mesenteries is weak and a little coalesced with the actinopharynx. It is expanded in aboral direction a short distance below the actinopharynx (compare below the description of a young specimen of *Peachia hastata*!) The muscles of the mesenteries mainly are of the same appearance as in other *Peachia* species. The longitudinal muscles, however, form no concentrated pennons in the region of the glandular streak, but are spread over almost the whole breadth of the mesenteries (textfig. 127), wherefore the pennons look more like a ribbon. The folds are rather high and mainly of about equal height, here and there with certain interspaces; there are, however, also lower folds. In transverse-sections the pennon recalls a comb. The pennon merges into the parietal muscles without distinct limit. Below the region of the filaments the pennons are more contracted (textfig. 126). The parietal muscles are weak with few and low folds, on the pennon-side not distinctly differentiated from the pennon, on the opposite side distinctly limited, but not reaching the distal end. They are not expanded on the column. The mesenterial filaments are of typical appearance and only developed in the mesenteries of the first cycle. Stomata are present on the perfect mesenteries. The oral stomata are large, but the marginal stomata very small and placed in the vicinity of the oral disc. I have not observed any reproductive organs in the specimens I have sectioned.

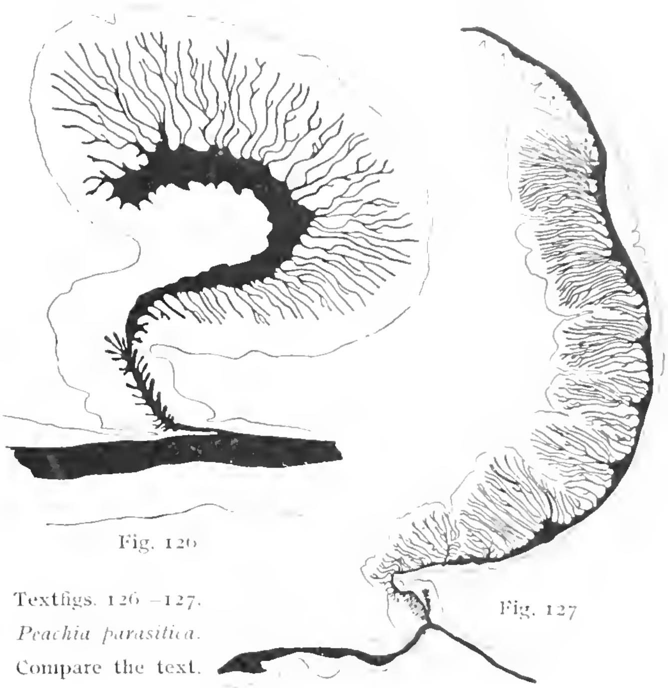


Fig. 126

Fig. 127

Textfigs. 126–127. *Peachia parasitica.* Compare the text.

Peachia hastata Gosse.

Pl. 1, figs. 21—29. Pl. 2, fig. 13

Peachia hastata n. sp., Gosse 1855, p. 267, Pl. 28.

— — Gosse, Haddon and Dixon 1885, p. 399—405, Pl. 16 (in this work synonymy and literature to 1885). Haddon 1889, p. 338—340, 1 textfig. Faurot 1895, p. 94—110, figs. 7, 8, 10—15, Pl. 1, figs. 1—3, Pl. 2, figs. 3, 5, Pl. 3, figs. 3—6, Pl. 5, fig. 6, Pl. 6, fig. 5, Pl. 7, Pl. 9, Pl. 12, textfig. 12. Carlgren 1904, p. 538, textfigs. 2, 4, 1906, p. 81, fig. 6, a—h (Literature of the larvae). Nafilyan 1912, p. 9. Mc. Murrich 1913, p. 967.

Diagnosis: Nematocysts in the ectoderm of the column 12—16 × 2 μ, in the tentacles 17—22 × 2—2,5 μ, in the actinopharynx 19—24 × 2 μ. Spirocysts in the ectoderm of the tentacles 12—19 μ. Longitudinal muscles of the tentacles well developed. Conchula large with 6 to 10 lobes. Pennons of the mesenteries of the first cycle strong, spread over the greater part of the breadth of the mesenteries. Folds high, in the outer part arranged more or less like palisades, in the inner part often ramificated. Parietal muscles weak with only a few folds. Pennons of the mesenteries of the second cycle comparatively strong with high folds. Oral stomata present. Marginal stomata?

Colour: The most distal part of the column, "capitulum" and the "physa" in adult specimens translucent, flesh-coloured or almost salmon-coloured, usually richly splashed with reddish-brown in irregular, longitudinal lines. Tentacles translucent, pinkish or very pale purplish-brown, on the inside with 4—5 more or less distinct W marks and bands. The back of each tentacle has an opaque white spot about halfway between the base and the tip. Oral disc pinkish-white, inter-radial lines with brown and white spots and marks. Conchula flesh-coloured or pale pink, lobes with a brown or deep-red core, usually with a white apical spot. Actinopharynx with twelve dark-brown bands, alternating with broader orange-buff bands, further down the colour is reddish or purple (Haddon & Dixon 1885, p. 401—402; in this work a more complete description of the colour).

Dimensions: Length of the body 2,5 to 10 cm in contracted state, in expanded state unto 20,5 cm. Breadth 1—2 cm (Haddon & Dixon). The length of the tentacles about equal to the diameter of the column.

Occurrence: Denmark. Frederikshavn (Schmidt 1872) 2 large specimens.
Sweden. Gullmar fiord (Theel and Carlgren 1905. Larvae on hydroid-medusae, and a small specimen on the clay in "Bondhalet"), Vinga 50—0 m. Gullmar fiord 75 m. Koster fiord 230—0 m (Björck 1910, Larvae on hydroid-medusae).

Further distribution: North-Sea. Heligoland to British Isles. NW. France. Roscoff, Douarnenez bay, Lannion, Banyuls-sur-Mer.

Exterior aspect: The body is elongated and the column without distinct division in regions. In the expanded state of the animal, physa, capitulum and scapus — according to Haddon and Dixon — are to be distinguished. Any distinct limit, especially between the capitulum and the scapus, hardly existing, it seems to me rather arbitrary to make this distinction. The "physa" is ampullaceous in expanded state and perforated by numerous apertures, arranged in 12 longitudinal rows (Haddon 1889, p. 37[illegible]), it may be perfectly involved. The column is rugose in contracted state, in expanded smooth. According to Haddon and Dixon 1885, p. 401) it is furnished "with numerous minute suckers." I have carefully examined specimens received from Haddon; they were in certain parts of the body strongly expanded, partly in transverse-sections, partly in preparations in toto in glycerine. As far as I can make out there are no "suckers", nor such low elevations as on the column of *Eloactis*. It seems to me that the "suckers", which nowise deserve this name, are nothing but cell-accumulations containing some more supporting cells than the other parts of the ectoderm. By an examination of the surface of the column, in preparations in toto, it is namely clearly seen that the main part of the mucus-cells form an irregular net-work, between which are distributed some more compact parts of the ectoderm, mainly consisting of supporting cells, but also of scattered mucus-cells.

The tentacles are 12, arranged in two cycles, the inner tentacles are shorter than the outer ones and issue from the endocoels, while the latter are exocoel-tentacles, an arrangement distinctly appearing in the larvae, but also visible in the adult animal. Thus I cannot agree with Haddon and Dixon that the tentacles are monocyclic. On the other hand, the description of the arrangement of the tentacles given by Faurot (1895) is exact. (Compare also Carlgren 1904). As to their form they are cylindrical, a little attenuated towards the apex and of about the same length as the diameter of the body. The oral disc is smooth, flattened and provided with radial furrows corresponding to the insertions of the mesenteries. The mouth is wide, in live animals commonly covered by the conchula.

The conchula is strongly developed, consisting of three main lobes, one in the directive plane and two lateral ones. From these smaller lobes tentacle-like prominences issue, so that the total number of lobes varies from 6 to 10 (Haddon and Dixon), according to the age of the animal. In the larvae and young specimens only the main lobes are developed (compare below!). The other part of the siphonoglyphe is very deep, distinctly differentiated from the other part of the actinopharynx, smooth, not wrinkled, and provided with a very long aboral prolongation which is twice as long as the main part of the actinopharynx. This latter is comparatively short, of about the same length as the diameter of the body, longitudinally sulcated, and in contracted state also with transversal folds. On the side of the aboral prolongation of the siphonoglyphe the actinopharynx is continued as narrow lamellae (compare below!).

Anatomical description: The anatomy of the adult species is described by Haddon (1889) and Faurot (1890, 1895). The latter (1895, p. 94) gives a more detailed description of the species, with numerous figures of sections through different parts of the body. Besides this, Sedgwick 1884, p. 43) has published some anatomical details of the species. In some respects the anatomy is, however, imperfectly described. For anatomical examination I have used partly a specimen from Frederikshavn, partly and mainly specimens from Ireland, dredged by Haddon, partly the sections made by Haddon who has placed them at my disposal.

The ectoderm of the column is ordinarily developed, in the contracted state of the animal thick and furnished with numerous mucus-cells, arranged as I have shown above. Its nematocysts are not numerous, and 12—16 × about 2 μ in size. The mesogloea is longitudinally and transversally stratiform as in *Halcampa*, and of ordinary thickness. The endodermal circular muscles are rather well developed, but form no sphincter.

The ectoderm of the tentacles is high and contains numerous, small nematocysts 17—22 × 2 (2,5) μ in size, and very numerous spirocysts, 12—19 μ long. The ectodermal muscles of the tentacles are weak.

The ectoderm of the actinopharynx is thick, folded and provided with nematocysts 19—24 × 2 μ in size, often a little curved, widened in the basal end, and with indistinct basal part to the spiral thread. Besides these, there are, in addition to supporting cells, also mucus-cells here, considerably broader than those of the siphonoglyphe. The ectoderm of the siphonoglyphe is thicker than in the other part of the actinopharynx, and composed of supporting cells with long cilia. At the basis of the ectoderm there are rather numerous, long, granulous glandular cells, which are in communication with the surface of the ectoderm through a narrow duct. At the transition between the siphonoglyphe and the actinopharynx the ectoderm is a little differentiated. The supporting cells carry stronger cilia here than in the other parts of the actinopharynx and the siphonoglyphe, and the nuclei commonly are more elongated, while they are round in the other parts of the actinopharynx and the siphonoglyphe (Pl. 2, fig. 13). Some cells of this zone might, however, be ordinary supporting cells, as round nuclei are also visible here and there. These strongly ciliated ribbons are comparatively broad at the oral side, but gradually become narrower and seem to end at some distance from the lower edge of the aboral prolongation. Probably these strongly ciliated parts are of some particular physiological importance, as they form a boundary between the siphonoglyphe and the other part of the actinopharynx. The mesogloea of the siphonoglyphe is considerably thinner than the ectoderm, but thicker than that of the actinopharynx proper. The endoderm of the siphonoglyphe is strongly vacuolated and very high in the exocoel-parts, in the actinopharynx proper lower and not so rich in vacuoles. A distinct stratum of nerve-fibrillae with few nerve-cells and a weak longitudinal muscle-layer is present in the ectoderm of the siphonoglyphe and the actinopharynx. The conchula with its hollow prominences is built as the siphonoglyphe. The aboral prolongation of the siphonoglyphe also contains parts of the actinopharynx itself. On both sides of the middle part of the prolongation, consisting of the siphonoglyphe, the actinopharynx is namely continued, forming two, in proportion to the plane of the actinopharynx, perpendicular lamellae, the free edge of which are more or less strongly recurvated (figs. 132, 133). The middle part of the prolongation is built as the siphonoglyphe in its upper part, while the ectoderm of the perpendicular lamellae is longitudinally folded as in the actinopharynx, and of the same structure as that; the ectoderm of the recurvated part is smooth, but does not seem to differ in structure from that of the folded part. The boundary zone (fig. 132 a) and the folded part gradually become narrower aborally, and at last disappear (fig. 133). The stratum of nerve-fibrillae, the ectodermal longitudinal muscles and the structure of the endoderm and the mesogloea agree with those of the actinopharynx. In the recurvated lamellae the endodermal muscles seem to be longitudinal, I cannot, however, decide it with certainty as my material has fallen short. Concerning the relation of the aboral prolongation to the filaments compare below!

The number of mesenteries is that typical of *Peachia* viz 6 pairs of perfect and 4 pairs of imperfect mesenteries, the latter in the lateral and ventro-lateral exocoels. Among the perfect mesenteries the ventral directives are the stronger, the dorsal directives the weaker (always?). Below the actinopharynx the inner part of the pennons of the directive pairs is strongly curved towards the endocoels, in the other pairs towards the exocoels. The pennons of the perfect mesenteries are strong, with numerous high folds

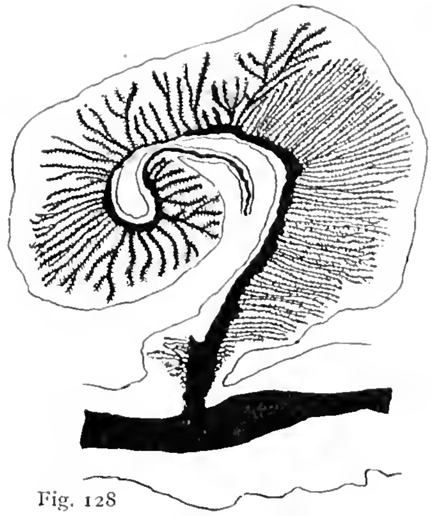


Fig. 128

Fig. 129

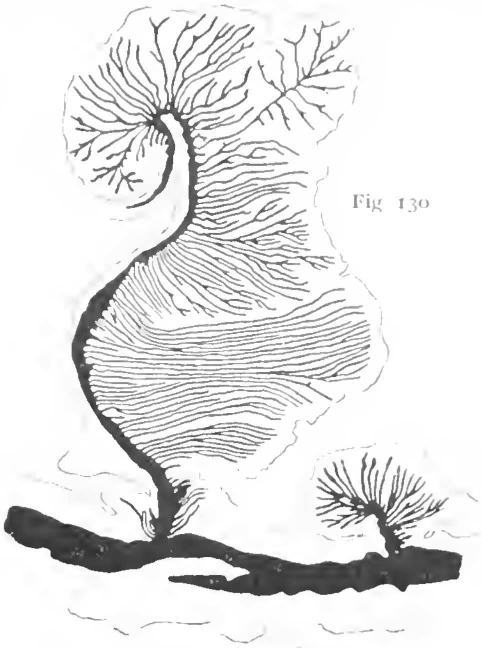


Fig 130

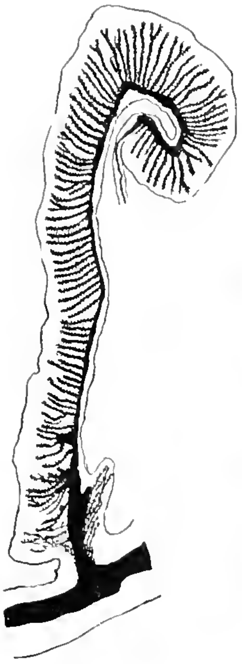


Fig. 131

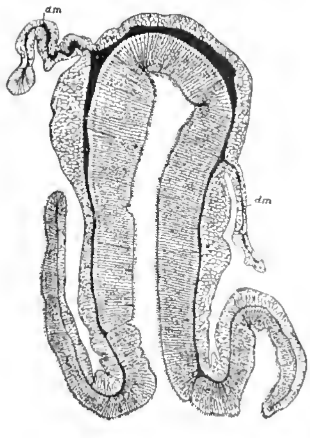


Fig. 133

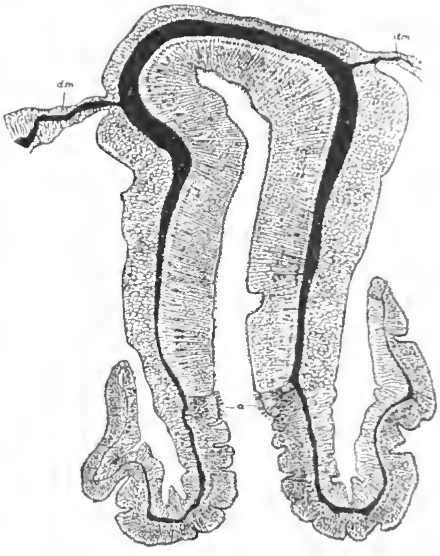
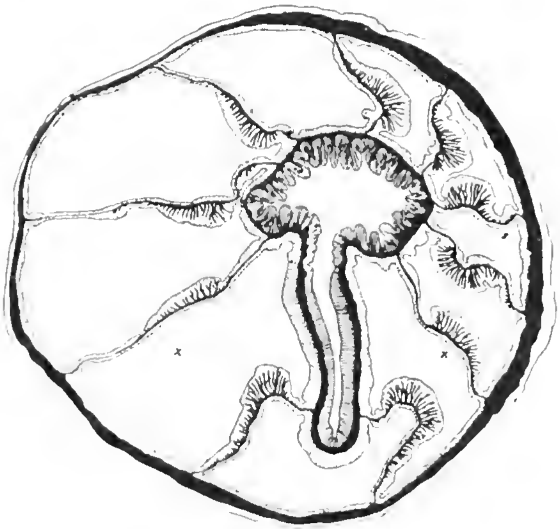


Fig. 132

Textfig. 128—133.
Peachia hastata.
Transverse sections of pennons of perfect mesenteries in the reproductive tract (fig. 128, 130, 131) and in the cnido-glandular tract (fig. 129). In the figure 130 also an imperfect mesentery is reproduced (to the right). The pennon in fig. 130 is from a ventral directive; the pennon reproduced in fig. 131 is from the same section as the mesentery in fig. 130. Figs. 132, 133. Transversal section of the aboral prolongation of the siphonoglyphe, fig. 132 in the upper, fig. 133 in the lower part. Both sections drawn under the same magnification *a* boundary zone *dm* ventral directives.

of very variable appearance. In the textfigure 130, a directive mesenterium and a mesenterium of the second cycle are sketched in the reproductive region, the text figure 128 shows a transverse-section of a perfect mesenterium in the vicinity of the sections reproduced above, and the textfigure 129 a perfect mesenterium in the region of the glandular tract (the last section has been taken from another individium having no reproductive organs). Commonly the inner part of the pennons is more ramificated than the outer part. The longitudinal pennons and the parietal muscles fuse together without distinct limits. The part of the parietal muscles on the opposite side of the pennons is weak, distinctly definite, with the strongest folds on the inside. The mesenteries of the second cycle have produced small pennon-like formations, close to the insertions of the mesenteries. The inner parts of these formations are curved towards the exocoels, the parietal muscles are not particularly differentiated here. The parietal muscles are not spread over the column.

The mesenterial filaments are only present on the mesenteries of the first order. The ventral directive pairs are, however, devoid of ciliated streaks. Below the aboral prolongation of the siphonoglyphe the filament namely begins as a weakly developed, single cnido-glandular streak of inconsiderable dimension, gradually growing thicker and attaining its largest dimensions in the reproductive region. As in certain Zoantharia (for instance *Isozoanthus giganteus*) and in the Ceriantharia the ciliated streaks have probably here fused with the aboral prolongation of the siphonoglyphe and the actinopharynx, though the different parts of the filaments of the prolongation cannot be distinctly traced. Possibly the continuation of the siphonoglyphe and the recurvated part correspond to the ciliated streaks, the folded parts to the cnido-glandular streak. The imperfect mesenteries are devoid of filaments. The ciliated streaks are of typical appearance. Only the mesenteries of the first cycle are fertile. The species is dioecious. The ovae are provided with a covering, decked by spines.



Textfig. 134 *Peachia hastata.*
Transverse section of a young anormal specimen.

Larvae. (Synonymy and literature, compare Carlgren 1906, p. 81).

The larvae of this species, living on several hydroid-medusae, have been anatomically described before by myself and by several other authors, wherefore I do not give any details of its anatomy here. The younger stadia with only 3 couples of mesenteries are disc-like (Carlgren 1906 fig. 6*a*). Somewhat older stadia are a little more rounded, still older ones are more elongated and acuminated in the aboral end, only in the adult animal the body is cylindrical. The exterior aspect of the larvae in different stadia I have shown 1906 (textfig. 6). On the plate 1, figs. 21—29 I have completed the series (all larvae sketched on the same $\frac{6}{1}$ scale). The arrangement of the tentacles I have described before (1904). The first eight visible tentacles are distinctly seen on fig. 25, Pl. 1. On fig. 26 *b*, Pl. 1 two of the younger tentacles are conspicuous. In the older larvae a three-lobed conchula little by little appears, which I have been able to state by feeding larvae during two months in an aquarium. A specimen dredged by myself on the clay (figs. 28, 29, Pl. 1) also had a three-lobed conchula, but only 10 tentacles. This reduced number of tentacles is associated with an abnormal development of the mesenteries (compare below!). The colour of the column of the older larvae was opaque-white, the shades of colour pretty well agree with those of figure 5, Pl. 17 in the work of Haddon and Dixon (1885). Therefore I have no doubt at all that the larvae belong to *Peachia hastata.* With *P. boeckii* they cannot be identical as the colour of *P. boeckii* is another, and this species also in other respects is different from *P. hastata.* That only 3 lobes are developed in the larvae may be referred to the small size of the animals. Evidently these three lobes correspond to the three main lobes of the adult *P. hastata* which later on, as the animal grows in size, develop a few or many secondary lobes.

Concerning the appearance of the mesenteries, those of the 5th and 6th couples seem to originate in the typical places, so that the former form pairs with the dorso-lateral, the latter with the ventro-lateral

"*Edwardsia*-mesenteries." In connection with the appearance of the tentacles these couples arise much nearer to the lateral "*Edwardsia*-mesenteries" than it is otherwise commonly the case in the Actiniaria. An older larva, sectioned in series, shows no filaments on the 6th couple and weak filaments on the 5th couple; the filaments of the dorsal directive mesenteries were a little longer than those of the 5th couple; the ventro-lateral "*Edwardsia*-mesenteries" were provided with the longer filaments; the dorso-lateral "*Edwardsia*-mesenteries" had a little stronger filaments than the dorsal directives. The length of the filaments of the ventral directives was about equal to that of the dorso-lateral "*Edwardsia*-mesenteries", but the former filaments reach about as far down as those of the ventro-lateral "*Edwardsia*-mesenteries."

The abnormally developed specimen with only 10 tentacles, of which I give a transverse-section through the region of the actinopharynx (textfig. 134), had only 10 mesenteries. On one side of the directive plane the mesenteries were typically developed, on the opposite side one pair was totally missing. The mesenteries marked with *x* are provided with weaker filaments than the other mesenteries. The strongly ciliated boundary streak between the siphonoglyphe and the actinopharynx, occurring in adult specimens, is not distinctly differentiated here.

Peachia boekii (Dan. & Koren.) Hadd.

Pl. 1. Fig. 30.

Siphonactinia Boekii n. sp. Danielssen and Koren 1856, p. 88, Pl. 12, figs. 4—6.
— — Dan. & Kor., Milne-Edwards 1857, p. 236. Andres 1883, p. 320, fig. 8.
Peachia — (Dan. & Kor.), Haddon 1887, p. 475. Mc. Murrich 1915, p. 969.

Diagnosis: The nematocysts in the column 14—17 × (1,5)—2 μ, in the tentacles 19—29 × 2—2,5 μ, in the actinopharynx 24—26 × 3,5—4 μ. The spirocysts of the tentacles 14 × 1,5—26 × 2,5 μ. Longitudinal muscles of the tentacles ordinarily developed. Conchula with 3 rectangular, large, flat lobes, more or less pedunculate, according to the state of contraction. Longitudinal pennons very strong with very numerous, high and palisade-like, sparsely ramificated folds. Parietal muscles on the pennon-side strong with numerous, comparatively high folds, only slightly ramificated or not at all so; on the opposite side weak, consisting of few, rather high folds, not expanded upon the column. Oral and marginal stomata present.

Colour: Column yellowish-brown with scattered brown spots. Tentacles brownish-yellow with brownish-red annuli. Conchula shining like mother of pearl (Danielssen and Koren).

Dimensions: Length of the body 2,5 cm, that of the tentacles 1 cm. Length of the conchula 0,9 cm (Koren & Danielssen). On the preserved type-specimen the length of the tentacles was only 0,3 cm.

Occurrence: Norway, Hardanger fiord 80—100 fms. (Koren & Danielssen). According to Grieg the type-specimen was dredged at Utne, at a depth of 376 fms.

Exterior aspect: The column is cylindrical. The only preserved specimen I have seen is furnished with longitudinal and transversal furrows, of which the latter have certainly arisen by the contraction of the animal. I have not observed any elevations of the ectoderm in form of papillae. The number of tentacles is 12. They are short, conical, sometimes a little longitudinally sulcated, probably in connection with the state of contraction, and, according to Danielssen, arranged in a single cycle. Probably there may, however, be two cycles of tentacles as in other *Peachia* species. The little oral disc is provided with indistinct radial furrows. The actinopharynx is long and has numerous longitudinal furrows (Pl. 1, fig. 30). I cannot decide its length in proportion to that of the column, as the proximal part of the specimen was torn off. The siphonoglyphe is very broad and smooth with well developed aboral prolongation. The conchula forms three rectangular, flat lobes (Pl. 1, fig. 30) which are longer than they are broad, and in the apex pressed a little in. On the figures of Danielssen and Koren (Fauna littoralis Norvegiae) it looks as if the conchula, in extended state, would be pedunculate; in the preserved specimen the conchula has no such appearance, but the basal part of each specimen is built as in other threelobed *Peachia*-species.


Textfig. 135.
Peachia boeckii
Compare the text

Anatomical description: Only the distal part of the type-specimen being left, and this piece not being well preserved, I cannot give any complete description of the anatomy of this species.

The nematocysts in the ectoderm of the column are numerous and 14—17 × (1,5)—2 μ in size, those of the tentacles are still more numerous, 19—29 μ long and 2—2,5 μ broad, so are also the spirocysts, reaching a size of 14 × 1,5—26 × 2,5 μ. The nematocysts of the actinopharynx are 24—26 μ long and about 3,5—4 μ broad. In all nematocysts the basal part to the spiral thread is visible. The nematocysts of the actinopharynx are broader in the basal end, the others of equal breadth. The siphonoglyphe is devoid of stinging capsules. The longitudinal muscles of the tentacles form rather high folds, arranged like palisades. The siphonoglyphe is furnished with ectodermal longitudinal muscles which are wanting in the other part of the actinopharynx.

The arrangement of the mesenteries is probably like that of other *Peachia*-species. As I have wished to save the specimen I cannot, however, give any exact informations concerning the arrangement of the mesenteries. The pennons recall those of other *Peachia*-species; the folds are very high and numerous, arranged like palisades and only a little ramificated (textfig. 135, transverse-section of a perfect mesentery in the lower part of the actinopharynx). The parietal muscles on the pennon-side were well developed, those on the opposite side of the pennons, on the other hand, not strong, and containing only a few folds, some of which are rather high. A small oral stoma and a large marginal one are present, at least on the stronger mesenteries. The mesogloea of the column was very thick, in proportion to that of other *Peachia*-species; this fact is possibly connected with the strong contraction of the animal.

Genus **Haloclava** Verr.

Diagnosis: Halcampoididae with a well developed, rounded aboral body-end, physa probably not perforated by apertures. Column cylindrical with 20 longitudinal streaks of ampullaceous papillae in the distal part; indistinctly divided into regions, without spirocysts and sphincter. Tentacles 20, in the apex hemispherically swollen, forming acrospheres. Inner tentacles a little shorter than outer ones. A single ventral siphonoglyphe well differentiated and provided with a well developed (always?) aboral prolongation.

Oral part of the siphonoglyphe without a conchula. 10 pairs of mesenteries (6 + 4 lateral and ventro-lateral), all perfect and fertile. Parietal muscles distinctly differentiated from the longitudinal pennons. Spirocysts in the tentacles and the oral disc absent.

This genus, proposed by Verrill for species of *Eloactis* with ampullaceous papillae on the column, while the true *Eloactis* are devoid of such, is nearly related to *Peachia* and especially to *Eloactis*. From the latter it is distinguished only through the above-mentioned character. The column of *Eloactis* has no ampullaceous papillae, but is a little otherwise differentiated (compare *Eloactis*). Attention is called to the fact that I have not found any spirocysts neither in *Haloclava* nor in *Eloactis*.

Although this genus is not represented in the Arctic and Northern seas, nor has been dredged during the Ingolf-Expedition, I have nevertheless added it here for the sake of comparison with *Eloactis*. The type-specimen was found at the Eastern coast of the United States.

Haloclava producta (Stimps.) Verr.

Actinia producta n. sp. Stimpson, 1856, p. 100.

Halcampa producta, Stimps. Verrill, 1862, p. 30, Pl. 1, figs. 10, 11, 1874, p. 330, 738. Andres, 1883, p. 318. Mc. Murrich, 1891, p. 136, Pl. 9, figs. 2, 3.

Corynactis albida n. sp. Agassiz, 1859, p. 24.

Halcampa albida Agass. Verrill, 1862, p. 29, 1863, p. 57, 1866, p. 338, Andres, 1883, p. 318, Verrill, 1899, p. 41.

Eloactis producta (Stimps.). Mc. Murrich, 1893, p. 141—142. Parker, 1900, p. 750, fig. 4. Hargitt, 1914, p. 245.

Haloclava producta (Stimps.). Verrill, 1899, p. 41, fig. 7.

Diagnosis: Typical nematocysts in the column 17—22 × 2—2,5 μ, in the acrospheres of the tentacles 48—106 × 2 μ, in the other part of the tentacles 13—17 × 2 μ, in the actinopharynx 36—46 × 3,5 μ, and in the acrospheres nematocysts with discernible basal part to the spiral thread 72—98 × 3,5—4 μ. Ectodermal longitudinal muscles in the peduncle very strong. Longitudinal pennons of the mesenteries in the reproductive region rather strong, in transverse-sections reniform, with few, about 10 very ramificated, high folds, all of about equal length. Outer lamellar part of the mesenteries attached close by the outmost end of the pennons. Parietal muscles rather strong, with somewhat numerous, low but ramificated folds, extended in radial direction (small but high), not expanded upon the column. Marginal stomata present.

Colour: Column transparent, yellowish-green (Stimpson). Column whitish, shading off into pale salmon, the base translucent with a bluish tint. Tentacles with brownish, knob-like tips (Hargitt); var. *albida:* Column pale brownish-yellow, tentacles paler, the knobs at the tips dark brown (Verrill).

Dimensions in expansion: length 8 or 10 inches; in contraction: about 3 inches, diameter 0,75 inch. (Verrill). The largest preserved specimen, dissected by myself, was 2,5 cm long, largest diameter of the body 0,85 cm, smallest diameter 0,45 cm, length of the tentacles 0,3 cm.

Occurrence: Eastern coast of the United States from South Carolina to Cape Cod (Verrill), Fort Johnson S. C. Sandy mud, near low-water mark (Stimpson) Woods Hole. — Buzzards bay, Catama bay and in other places about Martha's Vineyard (Hargitt) var. *albida*. Long Island Sound, shores of Nantucket, Martha's Vineyard, Cape Cod. — The specimens examined by myself are from Woods Hole (Mc. Murrich) and from Newport (U. S. F. C.)

Exterior aspect: The proximal part is smooth, and according to the state of contraction, rounded physa-shaped or more flat. Whether it is perforated or not, I cannot with certainty decide as the physa was rather contracted. In sections through a part of the physa I have not found any apertures. The column is cylindrical, elongated and provided with 20 distinct longitudinal furrows, corresponding to the insertions of the mesenteries. The distal part of the column has 20 longitudinal rows of ampullaceous papillae, each row placed exactly between two insertions of the mesenteries. The rows are not all of the same length. On the parts of the column, adjacent to the 4 lateral endocoels of the first order and the ventral directive endocoel they are longer than the rows, issuing from the dorsal directive compartment, the endocoels of the second order and the 2 exocoels being next to the dorsal directive endocoel. The remaining exocoel-rows are the shorter and composed of the lesser number of papillae. This arrangement is not always distinct, at any rate the rows belonging to the exocoel-parts of the column seem to be shorter than the other rows. The papillae are larger in the distal part than in the more proximal part; in other words, the papillae originate at the distal part, continuing towards the proximal part.

The tentacles are 20, short, cylindrical, in the apex hemispherical, in certain states of contraction the distal end is knob-shaped. The 10 inner tentacles are a little shorter than the outer ones, and proceed from the endocoels (compare Carlgren, 1904, p. 542). The oral disc is of comparatively small diameter. The entrance to the siphonoglyphe is very distinct, though by far not so deep as in *Peachia;* its aboral prolongation is rather long. The actinopharynx is short with numerous longitudinal folds and furrows.

Anatomical description: Mc. Murrich (1892) has described some anatomical details of this species, but an anatomical examination of all organs has not yet been undertaken.

The three layers of the column are all of about the same thickness and of ordinary height. The ectoderm contains numerous typical nematocysts, $17-22 \times 2-2{,}5\ \mu$ in size, and numerous mucus- and albumen-cells. In the ampullaceous papillae, which are only evaginations from the body-wall, the ectoderm is a little differentiated from the other parts of the column (textfig. 136, longitudinal section through a piece of the column with a papilla). The mucus-cells namely decrease in number towards the apex of the papillae, while the nematocysts increase a little.

The main-part of the ectoderm in the apex of the papillae consists of supporting cells. The somewhat more numerous nematocysts in the apex indicate that we have to do with weak batteries of nematocysts. The mesogloea of the column is of a fibrillary structure and contains numerous cell-nuclei. The cavity of the papillae is rather large and in connection with the coelenteron through a narrower canal. In the papillae and in the communicating canal the circular muscles are very weak and form no folds, in the other parts of the column the circular muscles have high folds, which are, however, but slightly ramificated. No differentiated sphincter present.

The acrospheres in the apex of the tentacles (fig. 137 uppermost part) differ considerably in structure from the other part of the tentacles, the stalk or peduncle, in as much as the ectoderm is of quite another character, the muscle-layers almost all waning, and the mesogloea and the endoderm attenuated. The ectoderm of the acrospheres is very high, in comparison with the thin mesogloea and the endoderm. It contains large nematocysts, most densely packed, arranged like palisades, of equal width and of variable size, from 48 to 106 × 2 μ, occupying almost the whole height of the ectoderm. Besides these, there are a little broader nematocysts with visible basal part to the spiral thread, 72—98 × 3,5—4 μ in size. The ectodermal and the endodermal muscles are absent or represented by very few muscle-fibrillae. The stalk of the tentacles is of another structure (fig. 137 lower part). The ectoderm is thinner than in the acrospheres and of about the same thickness as the mesogloea, the folds of the mesogloea included. It contains gland-cells and numerous, but small nematocysts, 13—17 × 2 μ in size. The ectodermal longitudinal muscle-layer is very strong with densely packed, high folds (textfig. 137 *lm*; textfig. 138, transverse-section through a piece of the basis of a tentacle), which are sometimes not ramificated, sometimes near the basis bifid or trifid. The main lamella of the mesogloea is thin, fibrillary with rather few cells. The endoderm is of about the same thickness as the ectoderm, the endodermal circular muscles somewhat strong, through the folds are rather large.

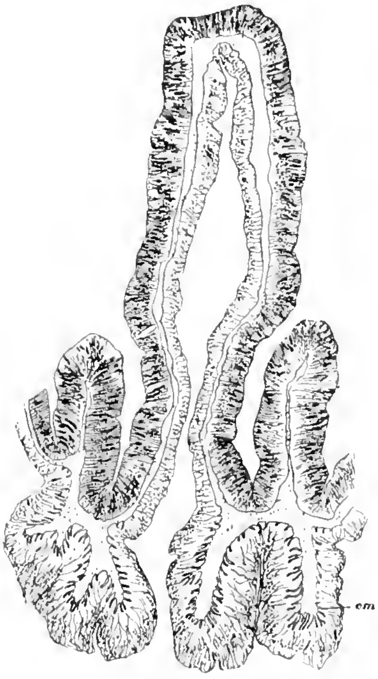


Fig. 136

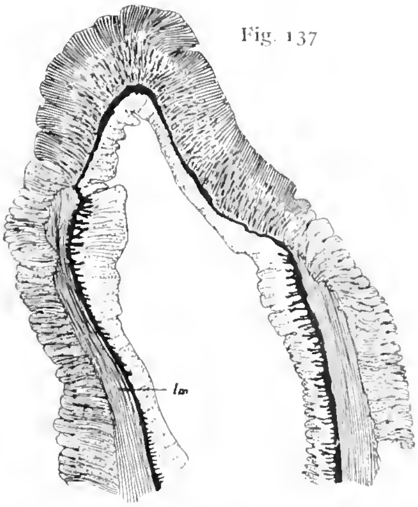


Fig. 137

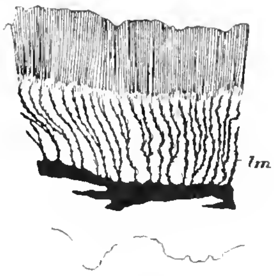


Fig. 138

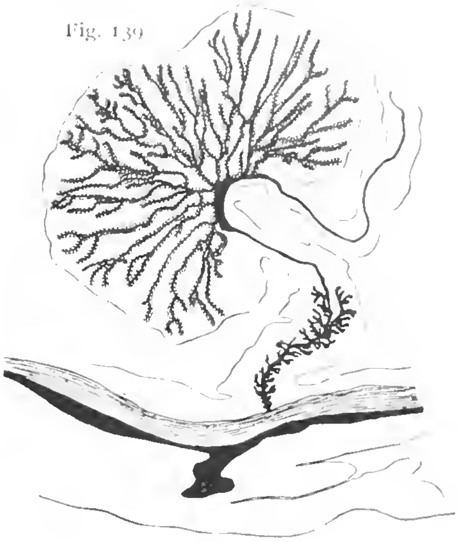


Fig. 139

Textfigs. 136—139.
Haloclava producta.
Fig. 136: Longitudinal section through part of the column with papilla. Fig. 137: Longitudinal section of the distal part of tentacles with acrosphere. Fig. 138: Transverse section through part of a tentacle. Fig. 139: Transverse section of a mesentery in the reproductive region. *lm:* longitudinal muscles; *cm:* circular muscles.

The ectoderm of the oral disc and of the tentacles is devoid of spirocysts, the nematocysts are somewhat sparse and of the same size as in the stalk of the tentacles. In maceration-preparations I also found nematocysts resembling those of the actinopharynx. As the specimens were very much contracted in the region of the oral disc, it is, however, possible that these nematocysts in reality belong to the actinopharynx. The radial muscles were considerably weaker than the longitudinal muscles of the tentacles. The ectoderm of the actinopharynx is much higher than the endoderm, and several times thicker than the mesogloea. It contains numerous mucus- and gland-cells, and nematocysts, 34—46 × 3,6 μ in size. The longitudinal muscles are very weak and here and there absent? The ectoderm and especially the endoderm of the siphonoglyphe are thickened, the gland-cells and the nematocysts of the ectoderm very sparse, the longitudinal muscles very weak. The nerve-layer of the actinopharynx is rather distinct.

The mesenteries are 20[1] in number, namely 6 pairs of the first order and 4 pairs of the second, the latter placed in the lateral and ventrolateral primary exocoels as in *Peachia* and *Eloactis*. The four couples of the first order arising after the "*Edwardsia*-stage", viz. the fifth and sixth couples, are weaker than the outer couples of the first cycle. All mesenteries are perfect, those of the first cycle coalesced with the actinopharynx in its whole length, the mesenteries of the second cycle are inserted upon one half of the actinopharynx. The ventral directive mesenteries are the stronger, the mesenteries of the second order the weaker. The longitudinal muscle-pennons are kidney-shaped in transverse-sections through the reproductive region and well limited from the parietal muscle, in contradistinction to what occurs in *Peachia*. The folds of the muscles are high but few, about 10, richly ramificated even from the basis (textfig. 139 transverse-section through a mesentery in the reproductive region) and all of about equal height. The figures of the mesenteries reproduced by Mc. Murrich (1892, figs. 2, 3) are of a young specimen. The lamellar part of the mesenteries issues near the outside of the pennons. The parietal muscles are well developed with low, but numerous and ramificated folds spread over a comparatively large area of the mesenteries, whereby the folds become narrow and high. The parietal muscles are not expanded upon the body-wall. The mesenterial filaments are of the usual appearance; the ciliated streaks are narrow, the intermediate streaks provided with extraordinarily numerous gland-cells. The mesogloea of the filaments contains sparse cells. Oral stomata are probably absent, but marginal stomata present. They are large and irregular, and arranged with one in each mesentery in about the middle line of the mesenteries, a little below the tentacles. The animal is dioecious. The more closely examined specimen was provided with ovaria on all mesenteries. The egg-cells show a fine-grained ectoplasma and a coarse-grained endoplasma. As in *Peachia* and certain other Actiniaria the eggs are provided with a spinous covering. A "nutrition"-apparatus is developed by distinct invaginations of the endoderm extending towards the egg-cells.

Genus **Eloactis** Andr.

Diagnosis: Halcampoididae with a well developed, rounded aboral body-end, physa, perforated by numerous apertures in 20 longitudinal rows. Column cylindrical; with numerous low, not ampullaceous but solid papillae, scattered over the whole surface; not distinctly divided into regions; without spirocysts and sphincter. Cinclides in the uppermost part of the column. Tentacles as in *Haloclava*. Actinopharynx as in *Haloclava* with longer or shorter aboral prolongation. No conchula. Pairs of mesenteries as well as their muscles as in *Haloclava*. Tentacles and oral disc without spirocysts.

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[1] Hargitt (1914) points out that the mesenteries are hexamerous in young specimens, decamerous in older ones, and from this he concludes that the arrangement of the mesenteries "can hardly be of great significance as a toxonomic feature". As the animal during its development passes through a hexamerous stage with 6 pairs of mesenteries of the first cycle, it is evident that this "variation" in the arrangement of the mesenteries is of no importance to the diagnosis. The adult specimens are namely decamerous.

Eloactis mazelii (Jourd.) Andr.

Pl. 1. Fig. 1.

Ilyanthus mazelii, n. sp. Jourdan, 1880, p. 41, Pl. 2, fig. 5.
Anemonactis magnifica, n. sp., Andres, 1880, p. 329.
Eloactis mazelii Jourd., Andres, 1883, p. 465, Pl. 8, figs. 4—7, fig. 39. Faurot, 1893, p. 110, Pl. 1, fig. 4, Pl. 5, figs. 1, 2. Garstang, 1892, p. 380. Walton and Rees, 1913, p. 68. Rees, 1913, p. 70, textfigs. 1—4.

Diagnosis: Nematocysts in the ectoderm of the column 26—29 × 2,5 μ, in the acrospheres 120—202 × about 4 μ, in the peduncle of the tentacles 20—24 × 2,5 μ, in the actinopharynx 53—65 × 5 μ. Longitudinal muscles of the peduncle of the tentacles strong. Pennons of the mesenteries in the reproductive region very strong with numerous (about 30) folds, high, rather much ramificated and almost all of about equal length. Outer lamellar part of the mesenteries attached to the pennon near the outside. Parietal muscles strong, provided in the outer parts with low, in the inner parts with comparatively high and a little branched folds; not expanded upon the column.

Colour: reddish-orange, physa paler, tentacles white with brown tips, oral disc orange with darker radial streaks (Jourdan) (var. *rubra* compare Andres, 1883, p. 465). Flesh-coloured tint, tentacles marked with brown near the apex, oral disc orange-pink with somewhat paler rays (Walton and Rees). Body-wall orange, tentacles blotched with brown at the apex, several tentacles had purplish, double stripes on the inside, others appear to have only one coloured stripe (Orton). Column white, shading off into yellow. Tentacles white, shading off into flesh-colour or yellow, provided with numerous, irregular, reddish-brown spots increasing in number in the uppermost part of the peduncle, and with small opaque white spots. Oral disc of the same colour as the tentacles with 20 opaque, white tongues turning towards the mouth (specimens from Naples, Carlgren). Column shading off into brown, tentacles uncoloured (Appellöf).

Dimensions: Height of the body unto 8 cm, breadth 5 cm, length of the inner tentacles 3,5 cm, length of the outer ones 6 cm (Andres).

Occurrence: Norway. Hjälte fiord 40—50 fms (Appellöf) 1 small specimen.

Further distribution: The Mediterranean. Gulf of Marseilles 60—80 m (Jourdan). Naples (Andres).
England. Devonshire coast (Garstang). South Devon Coast, Eddystone (Walton and Rees).

Exterior aspect: The proximal body-end is rounded, forming a physa which is, however, not distinctly limited from the other part of the column. The physa is perforated by numerous, radially arranged apertures as in *Peachia*. The rows correspond in number to the mesenteries. In a large specimen from Naples I have observed more than 10 apertures in each row. The shape of the body is cylindrical or more ovoid, according to the state of contraction, and provided with 20 distinct longitudinal furrows, corresponding to the insertions of the mesenteries. On the surface there are numerous, close, flat elevations in scattered groups and of variable size, very distinct in extended specimens, but difficult to discover in contracted ones, as the column of such specimens is very wrinkled. In the uppermost part of the column there are some few cinclides. I have observed cinclides on sections (compare below) as well as on living specimens in Naples. They are, however, irregularly placed; in some chambers I have found one or several apertures, in other chambers none. By an injection with methylen-blue the colour was squeezed through the cinclides. The tentacles are 20 in number in typical specimens, and in extended state rather long. The inner tentacles, belonging to the endocoels, are shorter than the outer ones, the exocoel-tentacles, (compare Faurot, 1895 and Carlgren, 1904, p. 542). They are cylindrical with hemispherical, smooth apices, while the main part of the tentacles, the peduncle, is provided with flat elevations like those found on the column. The oral disc is not wide, but smooth and provided with distinct radial furrows, corresponding to the insertions of the mesenteries. A well developed ventral siphonoglyphe is present. There is no conchula or tongue-shaped formation at the entrance of the siphonoglyphe. Its aboral prolongation is inconsiderable in comparison with that of *Peachia*. The other part of the actinopharynx is provided with numerous longitudinal furrows and comprises about one third of the length of the body.

Textfigs. 140—143. *Eloactis mazelii*. Fig. 140: Longitudinal section through part of the column with solid papilla. Fig. 141: Transverse section through a cinclid in the most distal part of the column. Fig. 142: Transverse section of a young specimen in the actinopharynx tract. Fig. 143: Transverse section of a mesentery in the reproductive region *cm*: circular muscles.

Fig. 140

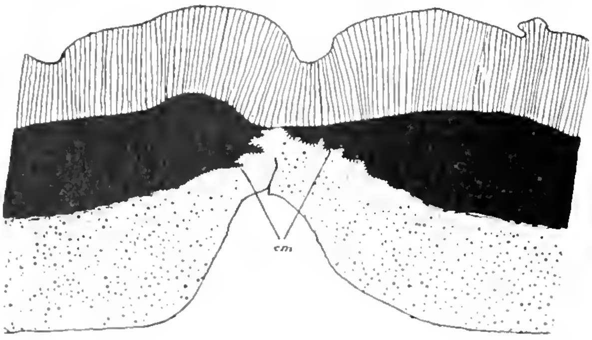

Fig. 141

Fig. 142

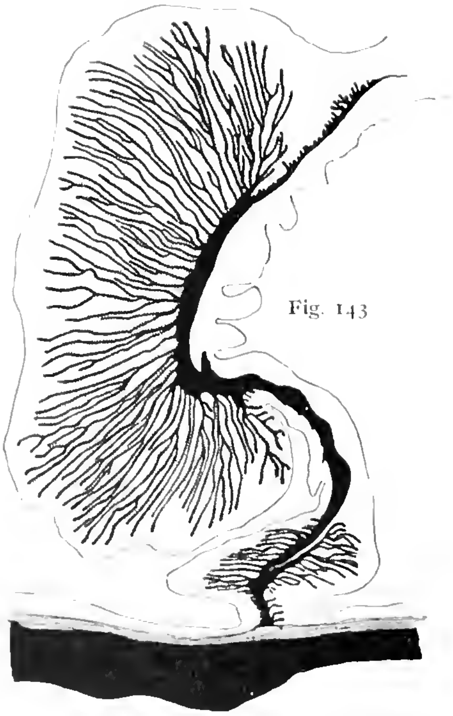

Fig. 143

Anatomical description: Rees (1913) has described the anatomy of this species; but his examination is in several points incomplete. The ectoderm of the column is high and contains numerous mucus- and sparse albumen-cells. In the central part of the elevations the mucus-cells are still sparser, while the main part of the cells is formed by supporting cells and numerous nematocysts which latter are rather sparse in the other part of the column. The nematocysts are 26—29 × 2,5 μ in size. The elevations thus may be regarded as weak batteries of nematocysts as in *Haloclava*, though they are not ampullaceous as in this genus, but compact and supported by an off-shoot of the mesogloea (textfig. 140). The cinclides and the apertures of the physa are of the same structure. The ectoderm as well as the endoderm are invaginated, and the apertures are surrounded by rather strong circular muscles belonging to the endoderm (textfig. 141). The mesogloea of the column is thicker or thinner than the ectoderm, according to the different state of contraction. It is fibrillary and contains rather numerous cells with a scanty amount of protoplasm. The endodermal circular muscles are very strong and form palisade-shaped folds, not concentrated so as to form a sphincter. Strong parts of these muscles, as usual, break through the mesenteries. The uppermost part of the tentacles, the acrospheres, are, as in *Haloclava*, of another structure than the other part of the tentacles, the peduncle. The ectoderm is very high and provided with very numerous nematocysts with slightly visible basal part to the spiral thread. They reach a size of 120—202 × about 4 μ, and are rib-like. The tentacles, as well as all other parts of the animal, are devoid of spirocysts. The nerve-layer is distinct, the ectodermal muscles very weak. The mesogloea contains rather numerous cells, poor in protoplasm, and it is about half or one third as thick as the ectoderm. In the mesogloea I have observed fibres, now straight, now folded, now running along the tentacles, now in transverse direction and terminating partly in the endoderm, partly in the ectoderm, apart from the nerve-layer. I cannot with certainty decide the nature of these fibres, but it is not very probable that they are nerve-fibrils, as they are much thicker than such fibrils; I am more inclined to think that they are nematocyst-threads having been thrown into the tissues of the animal by the ejection of the nematocysts, on account of an abnormal position of certain nematocysts. The endoderm is of about the same thickness as that of the mesogloea. The main part of the tentacles, the peduncle, is provided with a rather high ectoderm, containing numerous mucus-cells and sparse albumen-cells. The nematocysts display an indistinct basal part to the spiral thread and reach a size of 20—24 × 2,5 μ. The nerve-layer is well developed, so are also the longitudinal muscles, the folds of which in transverse-sections are dichotomously branched and of about the thickness of the ectoderm. The mesogloea is of the same structure as in the apex and attenuated towards the base. The ectoderm of the oral disc is of ordinary height and contains sparse nematocysts with indistinct basal part to the spiral thread, 17—19 × 2 μ in size. Their ectodermal muscles recall those of the peduncle of the tentacles. The mesogloea and the endoderm are thin. The ectoderm of the actinopharynx is very high and provided with numerous, rib-like nematocysts, 53—65 × 5 μ in size, and long, close albumen-cells. Their mucus-cells are sparse. The ectoderm is much higher in the ridges than in the furrows. The ectoderm of the siphonoglyphe is also very high, provided with smaller albumen-cells, but devoid of nematocysts. There is no such strongly ciliated boundary streak to be found here as in *Peachia* (compare p. 102). The nerve-layer is rather distinct in the actinopharynx. There are also very weak ectodermal longitudinal muscles. The mesogloea and the endoderm are thin in the actinopharynx, in the siphonoglyphe however thick.

There are 10 pairs of mesenteries, two of which are directives; the ventral pair is connected with the siphonoglyphe; all mesenteries are perfect and fertile. The longitudinal pennons (fig. 143) are very strong and in the reproductive region provided with about 30 high, dichotomously branched folds, most of which are of about equal height; the inner and the outer parts of the pennons are almost equally developed. The parietal muscles (fig. 143) are well differentiated, in their inner part either transversally expanded or in the lower part of the reproductive region more thin but longer. The outer part of the parietal muscles is weak and not expanded upon the body-wall. The part of the parietal muscles corresponding to the parieto-basilar muscles is sharply indicated, and a deep fold separates it from the mesogloeal main lamella of the mesenteries. Sometimes the mesogloea of both sides of this fold is coalesced, so as to form meshes in transverse-sections, a structure recalling that of the parieto-basilar muscles of for instance *Stomphia*. The ciliated streaks are also found on the ventral directives what is not the case in *Peachia*. The median streak of the filaments are provided with numerous, small, rib-like nematocysts, about 14—17 × 2 μ in size; large nematocysts are very sparse. In the cnido-glandular tract, on the other hand, large nematocysts are more common; they are partly 58—67 × 6 μ, partly 68—79 × 4 μ in size. Besides these, there are small nematocysts as in the median streak. The intermediate streak is well differentiated and provided with numerous gland-cells. The mesogloea of the filaments contains sparse cells. There is a very large marginal stoma in each mesentery. The oral stoma is rather large. The specimen is dioecious.

Description of a young specimen: The specimen, dredged in Hjälte fiord, was not sexually ripe and differs in some points from the adult specimens. Its length was 1,5 cm, the largest breadth 0,25 cm, and the length of the tentacles about 0,2 cm. The exterior of this specimen is shown on the figure 1, Pl. 1. The physa was ampullaceous, the elevations of the column distinct, especially in the distal part. The visible tentacles were 11; as there are 12 mesenteries it is probable that one more tentacle is present, though involved; I cannot, however, decide it as I have not sectioned the distal part. The aboral prolongation of the siphonoglyphe was rather well developed.

In order to make an anatomical examination of this specimen I have cut out a piece about 0,6 cm long, encluding the lower part of the region of the actinopharynx and a part below this region. The text-figure 142 shows a transverse-section through the lower part of the region of the actinopharynx. The siphonoglyphe is, seemingly, well developed, the albumen-cells are rather numerous, the endoderm of the siphonoglyphe is high, and, in contradistinction to the other endoderm of the actinopharynx, it is of a bladdery structure. The elevations of the column were not as distinctly differentiated as in the sexually mature specimens. The perfect mesenteries were 12 in number, namely 6 pairs. In a lateral exocoel one pair of weak imperfect mesenteries rose slightly over the surface of the column ectoderm. The lateral mesenteries of the second order thus arise earlier than the ventro-lateral mesenteries, in other words, the development of the mesenteries of the second order proceeds in a dorso-ventral direction, though the dorso-lateral mesenteries are suppressed. The fifth and the sixth couples of mesenteries arise as in *Halcampa*, the ventro-lateral couple thus being the weaker. None of these couples reach the undermost part of the actinopharynx. The longitudinal pennons are weaker than in the sexually ripe specimens. The folds are only slightly branched, in the lower part of the actinopharynx they are about 10 in number, below the actinopharynx a little more numerous, unto 15. The pennons vary in appearance, but their inner and outer parts look almost alike. The parietal muscles are weaker than in the adult specimens and more elongated. The ciliated streaks are not developed on the directives, but they are present on the 4 other pairs of the first order.

Genus **Siphonactinopsis** n. gen.

Diagnosis: Halcampoididae with the basal end rounded. Column cylindrical, of considerable length, smooth, without "*Halcampa*-papillae", not divisible into regions, without spirocysts and sphincter. Tentacles short, conical, 40 in number, not bulbously swollen in the apex, the inner tentacles longer than the outer ones. Only one, a ventral, siphonoglyphe, not elongated below the actinopharynx. Conchula absent. Pairs of mesenteries 20 (10 + 10) all perfect and fertile. 2 pairs of directive mesenteries. Parietal muscles a little differentiated.

Siphonactinopsis laevis n. sp.

Pl. 2. Fig. 9.

Diagnosis: Ectoderm of the column with nematocysts, about 17—20 μ long, densely packed just below the tentacles. Ectoderm of the tentacles with numerous spirocysts about 36—38 × 5 μ in size and with numerous nematocysts (22—29 × 2 μ). Longitudinal muscles of the tentacles well developed, with palisade-shaped folds. Nematocysts of the actinopharynx partly typical, 28 × 3—4 μ in size, partly broader in the basal end and with distinct basal part to the spiral thread (length 24, breadth 5 μ). Pennons of the mesenteries strong, in transverse-sections of considerable length with rather high, branched folds; as these folds are of equal height they make the pennons look like combs. Outer part of the mesenteries issues from the pennon in its most external parts. Parietal muscles not strong, consisting of low, though closely packed, a little branched folds, not expanded upon the column. Marginal stomata large. Well developed ciliated streaks.

Colour?

Dimensions: in contracted state, length 5,5 cm, breadth unto 2,5 cm, inner tentacles 1 cm long, outer tentacles about 0,5 cm.

Occurrence: Greenland? without distinct locality. (Habitat questionable!) 1 sp.

Exterior aspect: The state of preservation was rather good, wherefore I can give a fairly sufficient description of the organisation. The greater part of the ectoderm of the column was, however, lost.

The proximal part of the animal is rounded and involved. The elongated column shows no sign of being divided in regions and is devoid of papillae and other off-shoots. In consequence of the strong contraction the column is deeply transversely furrowed, while the insertions of the mesenteries on the outside are indistinctly marked. The distal end of the column is in certain places crenelated. Whether these crenelations are a normal feature or only due to the contraction I cannot decide, as this part of the animal was not well preserved. No distinct fossa is present. The tentacles are 40 in number, probably arranged in three cycles. As some of the tentacles are invaginated, it is, however, difficult with certainty to ascertain this arrangement. They are short and conical, the inner tentacles almost twice as long as the outer ones. The oral disc is rather small. There is no distinctly marked entrance to the siphonoglyphe. The actinopharynx is well developed, almost as long as half the length of the column or, at any rate, more than one third of it, and provided with numerous high folds. Only one siphonoglyphe is present at the ventral directives, it is distinguished from the other furrows in the actinopharynx by its larger breadth and shows no aboral prolongation.

Anatomical description: The proximal part of the column is — as far as I can see — of usual structure. In the very few fragments left of the ectoderm of the column I have found very sparse nematocysts, about 14—17 μ in length. Just below the tentacles and above the crenelations on the column fragments of the ectoderm were left. In these fragments I observed closely packed nematocysts and very sparse spirocysts, the latter possibly belonging to the ectoderm of the tentacles. These nematocysts were a little larger (17—20 μ long) than those of the other part of the column. Possibly we here have to do with pseudoacrorhagi, the occurrence of which cannot, however, be added to the diagnosis, until it has been stated on better preserved material than mine. The circular muscles of the column are weak and form no sphincter. The ectoderm of the tentacles contains numerous spirocysts, 36—38 × 5 μ, and nematocysts, 22—29 × 2 μ in size. The longitudinal ectodermal muscles are well developed, with palisade-shaped folds. The oral disc is of the same structure as the tentacles, the nematocysts are, however, sparser. The ectoderm of the actinopharynx is of ordinary thickness and much thinner than the mesogloea. The granular gland-cells are very numerous, the typical nematocysts less so and about 28 × 3—4 μ in size. Besides these, there are here nematocysts with discernible basal part to the spiral thread. They are about 24 μ long and 5 μ broad in their broadest end. I have here and there found a spirocyst of the same size as that of the tentacles. The nematocysts and the gland-cells are much sparser in the siphonoglyphe than in the actinopharynx. The mesogloea of the column and of the other parts of the body is rather thick.

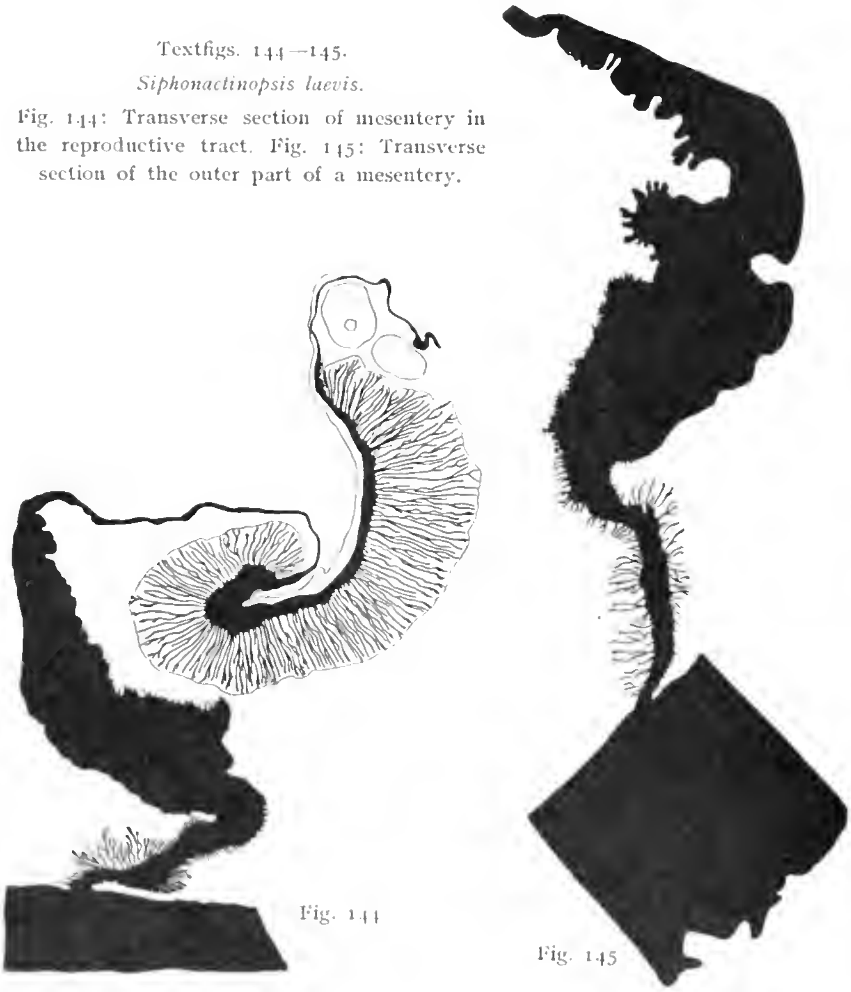
Fig. 144

Fig. 145

Textfigs. 144—145.
Siphonactinopsis laevis.
Fig. 144: Transverse section of mesentery in the reproductive tract. Fig. 145: Transverse section of the outer part of a mesentery.

The mesenteries are arranged in 20 pairs (10 + 10), of which 2 are directive mesenteries. All mesenteries are perfect, fertile and coalesced with the actinopharynx in its whole length. It is difficult to decide whether a pair of mesenteries belongs to an older or a younger cycle, because all pairs of mesenteries and often also both mesenteries of one pair are differently developed, as regards the muscle-pennons. The longitudinal muscles of the pennons are strong, in transverse-sections elongated with numerous (about 100) close folds, almost all of about equal height, whereby the pennons in transverse-sections get a comb-like appearance. The main lamella of the mesogloea is thickened in the outer part of the pennons, in the inner part thin. The outer, more lamellar part of the mesenteries is attached to the outside of the pennons. The inner part of the pennons is on the directive mesenteries curving towards the endocoels, on the other mesenteries towards the exocoels (textfigure 144. Transverse-section through a mesentery in the reproductive region). The parietal muscles are comparatively weak, with rather low folds, smooth or a little ramificated, especially on the side of the pennons. On the opposite side they are, however, more high and a little more richly branched (Fig. 145. Transverse-section of the outer part of a mesentery). They are not expanded on the column. No basilar muscles present. As far as I can see the oral stomata are also lacking. A large stoma, probably a marginal stoma, is visible on the mesenteries, aside from the pennons, rather near the upper end. The mesenterial filaments are very long and extended almost to the proximal end of the animal. The ciliated streaks are well developed. The mesogloea of the filaments is thick and contains few cells, poor in protoplasm. Inside the parietal muscles the mesogloea is very much thickened.

Family *Halcampidae*.

Diagnosis: Athenaria with commonly elongated, cylindrical body, with a simple or double mesogloeal sphincter, without acontia. Column divided or not divided in regions. Perfect mesenteries 8 to 12 (or more?). Ciliated streaks present, sometimes discontinuous.

Concerning the arrangement of this family, its designation and the genera, which, according to me, belong to it, compare p. 19, 21, 22.

The type of the genus *Halcampa*, after which the family is named, has, as I suggested (1893, p. 37), and as I have shown (1900 b, p. 1171), a mesogloeal sphincter, which Stephenson (1918, p. 9) has at length confirmed.

Genus **Halcampa** Gosse.

Diagnosis: Halcampidae with the column divisible into three regions, physa, scapus and capitulum. Physa ampullaceous with pores in one or two cycles. Scapus with papillae ("*Halcampa*-papillae") to which grains of sand often adhere. Ectoderm of the capitulum with numerous spirocysts, with a well developed layer of nerve-cells and nerve-fibrillae, in the uppermost part with longitudinal muscles forming a prolongation of the muscles of the tentacles and of the oral disc, and probably belonging to these muscles. Sphincter comparatively weak, often close to the ectoderm and expanding a little into the base of the tentacles. Tentacles 8 to 12, short, of equal width, with rounded apices. 2 rather slight siphonoglyphes and 2 pairs of directive mesenteries. 8—12 perfect and 6—12 fertile mesenteries forming strong pennons, besides a more or less perfect second cycle of very weak, sterile mesenteries, never producing pennons, but expanded over almost the whole length of the column.

The structure of the papillae, named by me "*Halcampa*-papillae" has never been subject to a closer anatomical examination. In English and American literature they are simply called suckers, a name also used for several heterogeneous differentiations of the column. On closer examination the papillae of *Halcampa duodecimcirrata* are found to be completely differing in structure from the verrucae of *Urticina* and other Cribrinidae. To the scapus of *Halcampa, Paraedwardsia* and other forms provided with "*Halcampa*-papillae", greater or smaller numbers of grains of sand most often adhere. After having loosened the grains of sand we find on closer inspection that the ectoderm of the papillae is differentiated from the other parts of the scapus ectoderm. The figure 8, Pl. 4 shows a transverse-section through a piece of the outer part of the scapus of *Halcampa duodecimcirrata* with a papilla (only the ectoderm (*ec*) and part of the mesogloea (*me*) are reproduced, the section is stained with iron-hematoxyline). The ectoderm is rather high between the papillae, but considerably attenuated towards the papillae. The outer parts of the ectoderm cells contain numerous grains. In the papillae the ectoderm is wholly transformed. Between the mesogloea and the thick cuticle we see on the section bundles of fibres (*ch*), rather strongly stained, radially arranged and separated from each other by, as it seems, fairly large intervals. The fibres connect the mesogloea, forming off-shoots with the outer, darker part, the cuticle (*c*); they are not always distinctly limited from the mesogloea. The intervals are probably only seemingly cavities, I have sometimes found several intervals to be more or less filled up by granular cells (*gl.*). I have also observed that these cells easily get loose and are torn off from their original position by sectionizing. As to the cuticle it is of a rather loose consistency, on account of its being stratified. The main part of the cuticle is strongly stained on the reproduced section, in the outer, more faintly stained part, we, however, observe that the cuticle forms several irregular lamellae, which stand out more distinctly when the cuticle is unstained. These layers are incrusted with foreign bodies (*in*).

For the sake of comparison I here reproduce two sections through the scapus of *Paraedwardsia sarsii* and *Scytophorus antarcticus*. In both species the scapus is provided with a distinct cuticle which is thicker in the papillae than in the other parts. The figure 7, Pl. 4 shows a papilla of *P. sarsii* with adjoining parts of the skin. The section much recalls that of *Halcampa*. The cavities of the ectoderm are, however, smaller, the bundles of fibres thicker. The cuticle is incrusted with foreign bodies forming a very thick layer in the papillae. The figure 6, Pl. 4 representing a transverse-section of one part of *Scytophorus antarticus* looks a little different. The cavities are large and contain cells, among others large mucus-cells (*gl.*), the bundles of fibres are shorter, and the mesogloea reaches further on towards the cuticle than in the other forms. In spite of this, there is no doubt that also here we have to do with "*Halcampa*-papillae".

How are we to explain these papillae? As far as I can see, these organs are secretory papillae, for which suggestion the circumstance also speaks that the grains of sand are not strongly attached to these papillae, while they are only with difficulty loosened from the verrucae (sucking warts) of for inst. *Urticina*. The secretion by which the grains are attached is, everything considered, formed by the granular cells enclosed in the intervals, while the fibrous bundles may be chitinized supporting cells, partly fused with the mesogloea.

Among the specimens of *Halcampa arctica* I found a specimen without incrustations. I at first suggested that this specimen did not belong to this species, but a closer examination of some sections proves that there are traces of papillae. Fig. 5, Pl. 4 represents a section through a part of the scapus, stained with carmin of borax. The ectoderm is high in the papillae and unaltered, or possibly only a little transformed. From the mesogloea off-shoots project, staining more intensely than the mesogloea itself (in the figure dark). On some folds of the ectoderm these off-shoots are transversely sectioned, in which case they show a circular arrangement. Though these papillae differ in structure from the typical papillae, I think that we also here have to do with "*Halcampa*-papillae". Unfortunately I have only a few sections which are even more than 20 years old, and it has been impossible to make new preparations as only very little of the ectoderm of the scapus remains. For these reasons I cannot with certainty judge of the structure. It is possible that the section has hit the edge of the papillae obliquely, so that the ectoderm above the papillae does not belong to these latter; this is, however, not likely. Perhaps the structure of the papillae may be interpreted thus, that the primitive papillae have been lost, so that of the chitinized ectoderm-cells, only the off-shoots, which are dark in the figure, have been left and the ectoderm has then regenerated to its full height.

Halcampa duodecimcirrata M. Sars.

Pl. 4. Fig. 8.

Edwardsia duodecimcirrata n. sp. Sars, 1851, p. 142.
— — Sars, Danielssen and Koren, 1856, p. 87. Danielssen, 1861, p. 45, Lütken, 1861, p. 196. Meyer and Möbius, 1863, p. 70, Pl. 3, figs. A-D. Andres 1880 p. 137.
Edwardsia Chrysanthellum Peach., Möbius, 1873, p. 100 (pro parte).
Halcampa — — Schulze, 1875, p. 121, 140. Haddon, 1886, p. 5, 1887, p. 478, 1889, p. 335 (pro parte).
Edwardsia lütkeni n. n. Andres, 1883, p. 308.
Halcampa farinacea Verr., Andres, 1883, p. 314 (pro parte).
— *duodecimcirrata* Sars, Carlgren, 1893, p. 38, Pl. 5, figs. 1—5, Pl. 6, figs. 1—2, textfigs. 6, 7.

Diagnosis: Physa ampullaceous, capable of almost complete involution, with small elevations, perforated by 9 (—13?) apertures, one central and the others arranged in a circle around the central one. Nematocysts of the scapus 10—12 × almost 1 μ, those of the capitulum 11—17 × 1—1,5 μ, those of the tentacles about 12 × 1 μ. Spirocysts of the capitulum 14—19 × 1,5—2 μ, those of the tentacles 14—19 × almost 1—1 μ. Tentacles 8—12. Nematocysts of the actinopharynx 27—34 × 3,5—4 μ, often narrower in the distal end and with discernible basal part to the spiral thread. Perfect mesenteries 8—12. A more or less perfect cycle of the second order present. Longitudinal pennons of the mesenteries with comparatively few folds, 8—16 or a little more, only slightly branched. Parietal muscles and the muscles of the imperfect mesenteries weak, of about the same appearance. Expansion of the parietal mucsles on the column considerable. 8 to 10 (12?) perfect mesenteries fertile.

Colour: Physa uncoloured, with small white spots. Scapus and capitulum pale flesh-coloured, the latter often pale brownish-red, especially in the distal part, and often provided with 8—12 white longitudinal stripes, terminating in a white spot below the tentacles, or with rows of spots instead of stripes. Tentacles more or less transparent, white or yellowish with 3 to 5 (6) transversal reddish-brown bands, the first band next to the oral disc M-shaped, the second V-shaped. Directive tentacles sometimes opaque white. Oral disc commonly yellowish with radial brownish-red stripes at the insertions of the mesenteries, around the mouth a brownish-red annulus, between the stripes 1—3 triangular spots. Sometimes the oral disc is opaque white without spots (Carlgren, 1893).

Dimensions: In contracted state unto 4 cm long.

Occurrence: The Baltic Sea. 6′ S. to W. off Karlskrona (Kolmodin, 1882), E. off Simbrishamn 45 fms. (Gunhild-Exp., 1878), 25′ E.N.E. off Hammeren (Hammerodde) 40 fms. clay (Kolmodin, 1882), N.N.E. off Gudhjem 38—40 fms. (Kolmodin, 1882), 7′ E. to S. off Svaneke 38 fms. (Kolmodin, 1882), off Svaneke 47 fms. (Mortensen, 1895), 7′ W.N.W. off Rönne 25 fms. (Kolmodin, 1882), 55°9′ N. 13°49′ E. 25 fms., 55°7′ N. 13°31′ E. 25 fms., 54°57′ N. 13°42′ E. 25 fms. (Öberg, 1871), Kiel 7—10, 5 fms. (Meyer, Möbius, Schulze, Michaelsen). Hoh-wachterbucht 8,5 fms., W. off Ærö (Winther). The Sound (Möller, Lütken, Hering, "Sven Nilsson" St. 27, 29, 30, 38, 41, 42, 46) Kullen (Lovén), Hellebæk (Lütken, Mortensen).

The Great Belt (Winther) W. off Refsnæs 48 m (Mortensen, 1912), Königshaff Alsen (Ahlborn), The Little Belt 7—24 fms. (Schiödte).

Samsö Belt (Winther).

Cattegat (Petersen and others), Hirtsholm (Mortensen, 1897), S. off Morup reef (Gunhild-Exp., 1878), Marstrand fiord 15 fms. (1864), Gullmar fiord, Strömmarne, Skatholmen (Carlgren, 1895), between Gräsholmen and Gullholmen, N. Gåsö fiord (Wirén, Carlgren), Bohuslän (Lovén), Väderöarne (Arwidsson, 1895).

Skagerrak, $4^1/_2$ leagues S.W. $^1/_4$ W. off Skagen lightship 60 fms. (Danish biological station 1904).

Norway. Bergen (teste Sars), Drontheim fiord, Rödberg 5—10 fms. Lofoten Ure 20 fms. (teste Sars), Vadsö 20—30 fms. (teste Danielssen).

As I have before (1893) described the exterior appearance and the anatomy of this species I have not much to add now. The structure of the "*Halcampa*-papillae" has been discussed above. Concerning the relation of this species to *Halcampa arctica* compare the remarks to the latter species.

Halcampa arctica Carlgr.

Pl. 1. Figs. 3, 4. — Pl. 2. Figs. 14, 15. — Pl. 4. Fig. 5.

Halcampa arctica n. sp., Carlgren, 1893, p. 45, Pl. 1, figs. 1,2. Pl. 5, figs. 6—12.

Diagnosis: Physa ampullaceous, retractile, provided with a central aperture surrounded by two cycles of apertures. Nematocysts of the scapus 12—14 × 1,5 μ, those of the capitulum 12—16 × 1—1,5 μ; those of the tentacles 12—17 × 1,5 μ. Spirocysts of the capitulum 19—32 × 2—2,5 μ, those of the tentacles [illegible], 19—31—36 (41) × 2,5—3 μ. Tentacles 12. Nematocysts of the actinopharynx 24—41 × 3,5—5 μ of the same appearance as in *H. duodecimcirrata*. Perfect mesenteries 12, imperfect 12. Longitudinal pennons of the perfect mesenteries very strong, with about 20—30 larger folds in the upper part of the reproductive region. The large folds have numerous secondary folds. Parietal muscles and the imperfect mesenteries of about equal appearance, mostly comparatively strong, in transverse-sections elongated with low, but rather numerous folds. Expansion of the parietal muscles on the column considerable. All perfect mesenteries fertile.

Colour?

Dimensions: Length unto 6 cm in contracted state, breadth unto 1,2 cm. Length of the tentacles unto 0,5 cm.

Occurrence: West-Greenland, Godhavn (Andersen). Holstensborg 20 fms. (Holm 1884). Nordre Strömfiord (Nordmann). Jacobshavn 120 fms. (1870). Greenland without distinct locality.

E. of Iceland, 64°25′ N. 12°9′ W. 211 fms. Temp. at the bottom 0,8 (Ingolf-Exp., St. 58).

West Spitzbergen, Treurenberg bay 3—66 fms., Wijde bay 40 fms. (Sw. Spitzbergen-Exp. 1861), Mosel bay 3 fms. (Sw. Spitzbergen-Exp. 1862), Bel Sound 5 fms. (Sw. Spitzbergen-Exp. 1861, Malmgren, 1864), Ice fiord, Safe Harbour 30 fms. (Malmgren 1864), between Coles bay and Green bay 4 m (Sw. Spitzbergen-Exp. 1908), Kobbe bay 3 fms. (1861).

East Spitzbergen, Great Island 80°15′ N. 30° E. 95 m. King Charles Land. Eastside of Jena Isl. 75 m (Römer and Schaudinn 1898, St. 37, St. 30).

Norway. Finmark (Lovén). Outer part of the Kvaenang fiord 20—30 fms. (C. Aurivillius 1881).

72°10′ N. 20°37′ E. (1868), Besimennaja bay 4—5 fms. (New Zembla-Exp. 1875), New Zembla S. of Cape Goose 3—6 fms., Cape Grebeni 8—10 fms. (New Zembla-Exp. 1875).

Kara Sea. Jugor Sound. Chabarova 5—8 fms (Vega-Exp. 1878).

It is not necessary to describe this species in detail as I have before (1893) given a summary of its anatomy. To this description I will, however, add some observations of the nematocysts, the spirocysts, and the filaments. The size of the nematocysts and spirocysts in the different parts of the body is shown on the following table. *n* nematocysts, *sp* spirocysts.

Concerning the structure of the filaments the appearance of the intermediate streaks, and probably also that of the ciliated streaks, somewhat recalls the Zoanthids. The ciliated streaks are, as we know transversely sulcated in the Actiniaria, as well as in the Zoanthids. The ridges between the furrows are not supported by mesogloeal off-shoots, but by thickenings of the epithelium. In the Zoanthids the furrows and the ridges of the ciliated tract pass into similar furrows and ridges on the intermediate streaks, so that also these latter become transversely sulcated. The ridges of the intermediate streaks are supported by mesogloeal off-shoots, and a narrow band of the ciliated streaks covers the bottom of the furrows of the intermediate

Habitat	physa	scapus	Capitulum		tentacles		actinopharynx
	n	*n*	*n*	*sp*	*n*	*sp*	
Godhavn	—	—	—	—	about 14 × 1 μ	19 × 1—36 × 2 μ	26—36 × 3,5—4 μ
Holstensborg ...		—	—	—	14—17 × 1,5	19—34 × 2	26—34 × 4—5
Greenland (juv.) .	—	—	—	—	—	—34 × 2,5	29—35 × 4
	—	—	—	—	14 × 1,5	13 × 1—30 × 2 (2,5)	(26) 31 × 4
Bel Sound	13 × 1,5 μ	13 × 1,5 μ	12—14 × 1 μ	19—29 × 2—2,5 μ	12—17 × 1,5	17 × 1—36 × 2,5	26—34 × 4
E. off Iceland ...	—	—	—	—	about 14	17 × 1—36 × 2—2,5	29—41 × 5
Nordre Strömfiord	—	—	—	—	—14	22—41 × 2,5	24—34 × 4—5
Treurenberg Bay .	12—14	12—14	12—16 × 1	28—32	12—16	—about 28	36—40
Besimennaja Bay.	—	—	—	—	14 × 1,5	13 × 1—30 × 2—2,5	26—31 × 4

streaks. In the Actiniaria such a structure has not been observed before. Though a more extensive examination of the filaments of *Halcampa arctica* is desirable, I am, however, able to state that the filaments of this species at least indicate a structure like that of the filaments of the Zoanthids. The furrows and the ridges of the ciliated streaks also here pass into similar furrows and ridges on the intermediate streaks which are also here supported by mesogloeal off-shoots. The nuclei in the lower part of the intermediate streaks look a little different from those of the ridges. I therefore think that also here bands of the ciliated streaks are prolonged into the furrows of the intermediate streaks. Still a control examination of this feature on better material is desirable. The furrowed part of the intermediate streaks is, however, not as broad in *H. arctica* as in the Zoanthids. It almost only includes the curved part of the intermediate streaks, while at least half the intermediate streaks, adjoining the median streak, are unfolded. The figure 14, Pl. 2 shows a longitudinal section of the intermediate streaks (*is*, *is*$_1$) and of the ciliated streak (*cs*). The section has hit the filament a little obliquely. On one side (downwards in the figure) the unfolded intermediate streak (*is*) has been sectioned, on the other side the sulcated part of the intermediate streak (*is*$_1$) is seen. The figure 15, Pl. 2 also shows a similar section, a little more magnified, almost cutting through the apex of the wings of the filaments.

Remarks: The *Halcampa*-species, until now described, especially *H. duodecimcirrata, arctica, chrysanthellum, arenaria* and *farinacea*, are so very nearly related to each other that it is difficult to find any good species-characters. Probably there are small differences between them, but in order to judge of the constancy of these differences a closer examination is required. The nematocysts and spirocysts are of about the same size as those of the mentioned species. If Haddon's statement that only 6 mesenteries are fertile in *H. chrysanthellum*, is correct, a renewed examination of this point is desirable — this species is well characterized. As my material of *H. arenaria* and *farinacea* is too poor — both species certainly belong to the genus *Halcampa* as the sphincter is mesogloeal — I will not now discuss these species any further. Concerning *H. arctica* and *duodecimcirrata* it is possible that we have to do with only one species having its habitation proper in the Arctic Sea, where it reaches its largest size, but also distributed at the shores of Norway and Sweden and the Eastern sides of Denmark right into the Baltic Sea, simultaneously becoming smaller and smaller in size — the numerous specimens from the vicinity of Bornholm and Scania all were very small. For the present it may be the best to retain these forms as different species. To which species Sars's short description alludes, is difficult to decide with certainty. It is possible that his *duodecimcirrata* is identical with my *arctica* as a specimen from Ure dredged by Sars and examined by myself had rather richly branched pennons. If this specimen is the type, not those from Bergen, I am almost inclined to regard *arctica* and Sars's *duodecimcirrata* as one and the same species (a closer examination of some other specimens from Lofoten is, however, to be undertaken before deciding it with certainty) If this should be found to be the case, the *Halcampa*-species from South Norway, from Sweden and from the Baltic Sea may be named *H. variabilis*. Sars has besides, at another time, evidently confounded an *Edwardsia* proper with a *H. duodecimcirrata*. In the museum of Christiania there are several now exsiccated specimens, labelled Ogsfiord, Finmark Sars, and determined probably by himself as *Edwardsia duodecimcirrata;* in reality these specimens are *Edwardsia* proper, probably *E. andresi*, like *H. duodecimcirrata* mostly provided with 12 tentacles.

Halcampa ? vegae n. sp.

Pl. 1. Fig. 2.

Diagnosis: Apertures of the retractile physa? Scapus with a thin, easily deciduous periderm. Nematocysts of the scapus, capitulum and tentacles about 13 × 1,5 μ. Spirocysts of the capitulum and the tentacles unto about 11 μ long. Tentacles probably 12. Perfect mesenteries 12, imperfect 12. Longitudinal pennons of the mesenteries very strong, their ramification almost like that of the pennons of *H. arctica*. Parietal muscles strong, in transverse-sections not elongated, divided into very fine and numerous branches. Imperfect mesenteries very finely folded, elongated.

Occurrence: Behring Sea 64°52′ N. 172°3′ W. 18 fms (Vega-Exp. N. 1056) 1 sp.

Exterior aspect: The exterior of the very contracted and partly not well preserved animal (Pl. 1, fig. 2) recalls that of other *Halcampa*-species. On account of the strong contraction and involution of the physa I have not been able to examine it more closely. The scapus is provided with a thin, easily deciduous periderm. Round the papillae foreign bodies are fastened. The tentacles were not well preserved, but are probably 12 in numbers.

Anatomical description: The anatomy of this species much recalls that of *H. artica*. I have indeed not been able to find the sphincter, because of the very bad preservation of the uppermost part of the capitulum and of the tentacles. I do,

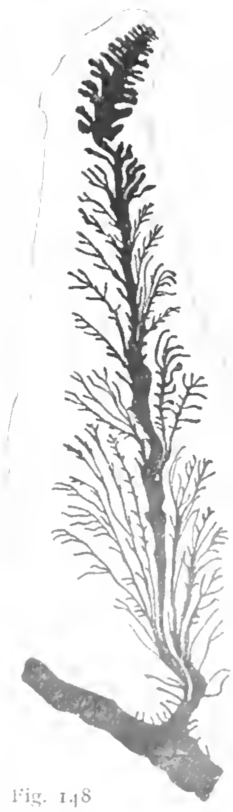

Fig. 148

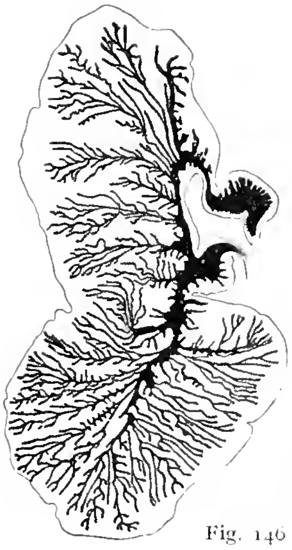

Fig. 146

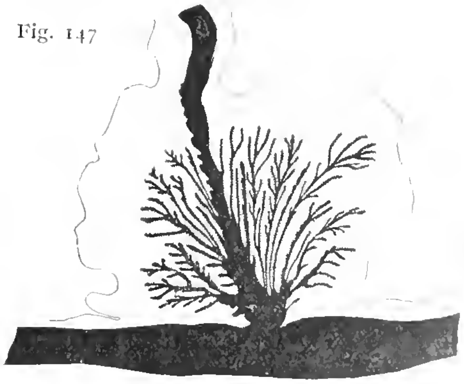

Fig. 147

Textfigs. 146—148. *Halcampa ? vegae*
Transverse section through parts of perfect mesenteries in the reproductive region. — Fig. 146: through the pennon. — Fig. 147: through the parietal muscle. — Fig. 148: Transverse section of a mesentery of the second order.

however, think that the species is a *Halcampa* as it agrees well with other characters of this genus. The pennons of the perfect mesenteries are very much branched, as the textfigure 146 shows. The parietal muscles (textfig. 147) are more ramificated than in *H. arctica*, so are also the muscles of the imperfect mesenteries (textfig. 148). The parietal muscles are not elongated as in *H. arctica*, but more transversely spread, possibly on account of a different contraction of the muscles.

Whether this form is in reality a species different from *H. arctica* I cannot at present decide

Genus **Cactosoma** Dan.

Diagnosis: Halcampidae with the column divisible into three regions, physa, scapus and capitulum. Physa small, often flattened, not ampullaceous, probably without pores. Scapus with a cuticle and "*Halcampa*-papillae". Capitulum with comparatively sparse spirocysts. Sphincter simple, weak, expanding a little into the base of the tentacles. Tentacles short, more than 12. Actinopharynx short, without distinctly differentiated siphonoglyphes. Mesenteries arranged in two or several cycles. Only the mesenteries of the first cycle perfect, fertile and furnished with longitudinal muscle-pennons. Mesenteries of the second (and other) cycles sterile, without pennons and filaments, extended over the whole length of the column.

This genus is synonymous with *Phelliomorpha*, proposed by myself 1902 (compare below under *Cactosoma abyssorum*). As the above diagnosis clearly shows, this genus is nearly allied with *Halcampa*, and consequently it is not a transition form to the Zoanthidae, as declared by Danielssen (1900, p. 85). In addition to the type, *Cactosoma abyssorum* Dan. (= *Phellia crassa* Dan.), I refer to this genus a hitherto undescribed species from the coast of California (*Cactosoma arenaria*) and *Halianthus chilensis* Mc. Murr. Mc. Murrich (1904, p. 224) namely says about this species "The sphincter seems to have been imbedded in the mesogloea, for just below the line of insertion of the outer tentacles there was in the column-wall a narrow band of what seemed to be muscle tissue, enclosed within the mesogloea and separated by narrow bands of it from both the ectoderm and the endoderm".

Cactosoma abyssorum Dan.

Cactosoma abyssorum, n. sp. Danielssen 1890, p. 82, Pl. 6, fig. 5, Pl. 23, figs. 5—8.

Phellia crassa n. sp. Danielssen 1890, p. 60, Pl. 4, fig. 9, Pl. 13, figs. 5, 6, Pl. 14, figs. 1—5.

Isophellia crassa (Dan.) Carlgren 1900, p. 52.

Phelliomorpha crassa (Dan.) Carlgren 1902, p. 44, textfigs. 7—11.

Diagnosis: Body elongated. Typical nematocysts in the ectoderm of the scapus 10—16 × 2 (2,5) μ, in the capitulum 20—26 × 2,5 μ, in the tentacles 14—22 × 2—2,5 (3,5) μ and in the actinopharynx about 14—29 μ in length. In the ectoderm of the latter, nematocysts with discernible basal part to the spiral thread 22—33 × 4,5—5 μ in size. Spirocysts in the ectoderm of the capitulum sparse, in the tentacles very common 24 × almost 2—36 × 2,5 (1 spirocyst 43 × 4 μ). Tentacles 24 (6 + 6 + 12), the inner about one third longer than the outer. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal, strong, with palisade-shaped folds. Actinopharynx longitudinally plicated. Two cycles of mesenteries. Longitudinal pennons on the perfect mesenteries strong, in the reproductive region with about 20—30 high, rather richly ramificated folds. The outer parts of the mesenteries issue not far from the outer side of the pennons. Parietal muscles elongated with close, though not high folds, they are not expanded on the body-wall, or only slightly so. Mesogloea in the region of the parietal muscles thick. Muscles in the mesenteries of the second cycle of about the same appearance as the parietal muscles of the first cycle. Well developed ciliated streaks.

Colour: Scapus brown, with dark, almost black spots. Longitudinal lines of the capitulum pale red. The rest of the capitulum pale rose-coloured. Tentacles bright salmon-red. Oral disc almost white, round the mouth a red annulus, from which 12 fine rose-coloured stripes run towards the margin of the disc (*Cactosoma abyssorum*, Danielssen). Scapus greyish-brown, capitulum almost white, outer tentacles purple, more intensely coloured at the base, inner tentacles rose-coloured. Oral disc purple, with radial violet stripes. The folded oral labiae more intensely purple (*Phellia crassa*, Danielssen). Tentacles light brown (Appellöf). The whole animal is in alcohol light brown (1 sp. from the Michael Sars-Exp.).

Dimensions: in extended state: Length of the column 4 cm, breadth 1 cm in the distal part, 0,5 cm in the proximal part; length of the tentacles 0,2 cm (Danielssen, *Cactosoma abyssorum*) — length of the column 4—5 cm, breadth in the proximal end 1—2 cm or more (Danielssen, *Phellia crassa*). In preserved state length of the column 1,3 cm, breadth 0,9 cm, inner tentacles 0,2 cm long; outer tentacles 0,1 cm (*Phellia crassa*) — length of the column 2,2 cm, breadth 0,8 cm (preserved specimen from Greenland). Length 1,8 cm. Largest breadth 1 cm. Length of the tentacles about 0,5 cm (Spec. from Michael Sars-Exp.).

Occurrence: Greenland without distinct locality (Ryder) 1 sp.

Between Spitzbergen and Finmark 74°55′ N. 16°19′ E. 400 m (Olga-Exp. St. 53, 1 sp.), 72°27′ N. 20°51′ E. 349 m. Temperature at the bottom 3,5° Sand and clay (Norw. N.-Atl.-Exp. St. 290 — *Phellia crassa*.) Off Lofoten 68°21′ N. 10°40′ E. 836 Temp. at the bottom — 0,7° (Norw. N. Atl.-Exp. St. 164, *Cactosoma abyssorum*). 62°29′ N. 4°12′ E. 518 m. Temp. at the bottom 1° (Michael Sars-Exp. 1902, St. 66), 1 sp.

Exterior aspect: The column is divided in three regions, physa, scapus and capitulum. The most proximal part, the physa, is flattened in the specimens from the Olga- and the North-Atlantic-Expeditions, in the specimens from Greenland rounded and more physa-like. There is, however, no regular pedal disc as the basilar muscles are absent, but as in many other Actiniaria the most proximal part of the body can be flattened and attached like a regular pedal disc, wherefore I supposed in my description of *Phelliomorpha crassa* (1902) that in fact a pedal disc and also basilar muscles were present. The physa is devoid of a cuticle; in the type-specimen of *Phellia crassa* it looks, however, as if it had a cuticle in some parts. The middle part of the column, the scapus, occupies the largest part of this region and is provided with a cuticle and "*Halcampa*-papillae", to which grains of sand are attached. The capitulum is short, without a cuticle and with distinct or indistinct longitudinal furrows corresponding to the insertions of the mesenteries. The tentacles are 24, in three cycles, short, the inner tentacles about one third longer than the outer ones and, according to the state of contraction, cylindrical or conical with a porus in the apex. The oral disc is flattened and small. It is true that Danielssen declares that the oral disc of *Cactosoma abyssorum* is well developed, but it seems to me that Danielssen has come to this conclusion by regarding an evaginated part of the actinopharynx as part of the oral disc. The actinopharynx is short and longitudinally sulcated. The two narrow siphonoglyphes are only little differentiated, symmetrically placed and devoid of aboral prolongations.

Anatomical description: For the anatomical examination I have used the type-specimen of *Phellia crassa* and a piece of the distal part of *Cactosoma abyssorum* (Danielssen has sectioned the lower part), I have, besides, more closely examined certain parts of the specimens from the other stations. The ectoderm of the physa is rather high and contains nematocysts of the same size as those of the scapus. The ectoderm of the scapus is a little lower and provided with a cuticle and conspicuous "*Halcampa*-papillae". It contains typical nematocysts 10—16 × 2—2,5 μ in size. The ectoderm of the capitulum is devoid of a cuticle and is higher than the ectoderm of the scapus. Its nematocysts are very numerous and much larger (20—26 × 2,5 μ) than those of the scapus. They are sometimes a little curved and tapering in the distal end. Between the nematocysts there are scattered spirocysts of the same size as those of the tentacles, they are, however, much sparser than in the capitulum-ectoderm of *Halcampa*. The mesogloea of the scapus is much thicker than that of the capitulum and of the physa, but also in these latter regions the mesogloea may be thickened, according to the state of contraction of these parts. The sphincter is mesogloeal, but weak and of about the same appearance as the sphincter of *Halcampa*. In position it likewise agrees with the sphincter of this genus. Also here the sphincter is drawn into the basal region of the tentacles, and the ectodermal muscles of the tentacles and of the oral disc expand over the upper part of the sphincter (compare *Halcampa!*). I have in another work (1902, p. 45) given two figures of the sphincter of a specimen of *Phellia crassa* from the Olga-Expedition, here I reproduce a transverse section (textfig. 149) of the sphincter of the type-specimen of *Cactosoma abyssorum*. These figures seemingly correspond well with each other. The strong thickening of the mesogloea on figure 8 (1902) is due to a strong contraction of the capitulum, and is of no im-

Fig. 149

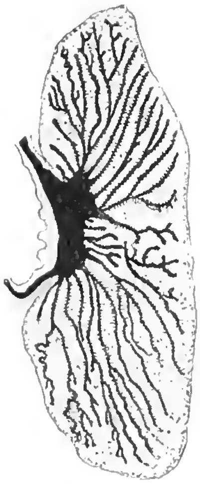

Fig. 150

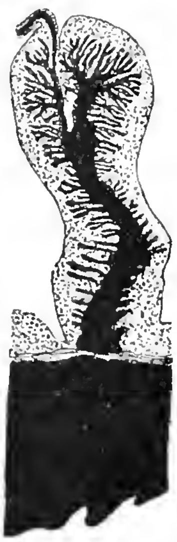

Fig. 151

Fig. 152

Textfigs. 149—152. *Cactosoma abyssorum*. Transverse section through the sphincter (fig. 149), through a pennon (fig. 150) through a parietal muscle (fig. 151) and through an imperfect mesentery (fig. 152). The sections of the mesenteries are taken from about the middle of the column. *lm:* longitudinal muscles, *ec:* ectoderm, *en:* endoderm.

portance. Danielssen states that the circular muscles of the column of *Cactosoma* are mesogloeal, this is, however, wrong; these muscles are, as usual, ectodermal, only the sphincter is mesogloeal, and this part has not been examined by Danielssen — the distal part of the type-specimen not having been sectionized by him. The ectoderm of the tentacles is very high and contains very numerous spirocysts of variable size, from about 24 × almost 2 to 36 × 2,5 μ and sparser nematocysts 14—22 × 2—2,5 (3,5) μ in size. The ectodermal longitudinal muscles of the tentacles are well developed, forming high folds, palisade-shaped and a little ramificated. The mesogloea and the endoderm of the tentacles are thinner than the ectoderm. The radial muscles of the oral disc are rather strong, and appear in transverse-sections as closely packed lamellae. The ectoderm of the actinopharynx is rather high and provided with numerous granular gland-cells and rather common, typical nematocysts (about 14—20 μ long); besides these, there are also nematocysts here with visible basal part to the spiral thread (22—33 × 4,5—5 μ in size). I have not examined the siphonoglyphe more closely, but it looks as if it is weakly developed. I have examined the stinging capsules in *Phellia crassa* as well as in *Cactosoma* and in the specimen from the Michael Sars-Expedition. They agree well in size; in *Phellia crassa* I have not observed any nematocysts with visible basal part to the spiral thread.

The mesenteries are arranged in two cycles and are also 24 in number, 6 pairs of perfect and fertile and 6 pairs of imperfect and sterile mesenteries. The former have pennons, the latter not. The folds of the muscle-pennons are very strong and high, especially in the tract of the actinopharynx (fig. 9, 1902); in the reproductive region they are from 20 to 30 in number, commonly of equal height and somewhat richly ramificated, particularly in the outer and the inner parts. The outer lamellar part of the mesenteries is attached to the pennon close by its outer edge (fig. 150). The parietal muscles are strong, in transverse-sections elongated, that is, much expanded radially (textfig. 151 from the type-specimen of *Cactosoma*). The mesogloea is rather strongly thickened in the tract of the parietal muscles; from the main lamella issue numerous, but not high folds which are more or less ramificated. The folds are of rather equal height, the highest folds still being situated in the innermost part of the parietal muscles. More strongly contracted parietal muscles appear more flattened. They are only a little or not at all prolonged on the column, so are also the muscles of the imperfect mesenteries, the appearance of which very much recalls the parietal muscles of the perfect mesenteries (textfig. 152 from the type specimen of *Cactosoma*).

In my report (1902, p. 45) I have supposed that *Phelliomorpha crassa* has weak basilar muscles. A closer examination proves that these muscles are nothing but the exterior part of the parietal muscles which, where the physa-region begins, are more strongly curved than the inner parts of these muscles and therefore, in transverse sections through the mesenteries in the region of the physa have been hit transversely or obliquely, while the inner part of the parietal muscles are hit more longitudinally. If transverse-sections of the Actiniaria seem to have very weak, not well marked basilar muscles, a control-examination of these muscles ought to be made on surface preparations of the mesenteries, the ectoderm having been pencilled off. On such preparations the arrangement of the muscles is namely more distinct than on single sections. The perfect mesenteries have mesenterial filaments, the imperfect mesenteries none. The ciliated streaks are of typical appearance, their mesogloea contains few cells. Danielssen declares that there are acontia in *Phellia crassa*, I have not observed any such. Only the perfect mesenteries are fertile. The species is dioecious.

Remarks: After having examined Danielssen's *Cactosoma abyssorum* I think that this species is identical with his *Phellia crassa*. In the above-named publication (1902) I placed *Phelliomorpha* (*Phellia*) *crassa* among the Paractiidae as I suggested that a regular pedal disc and basilar muscles were developed here. After having stated the incorrectness of this suggestion (compare above) the position of the genus must be among the Halcampidae. Its structure, especially that of the capitular region and of the sphincter, also agrees well with that of *Halcampa*. It might, however, not be correct to place both genera together in a single genus. The genus *Halcampa*, although furnished with 2 cycles of mesenteries, has never more than 12 tentacles, while in the genus *Cactosoma* the development of the tentacles and that of the mesenteries correspond in this way that if two cycles of mesenteries appear, the number of tentacles is also more than 12.

Fam. *Halcampactiidæ*.

Diagnosis: Athenaria without a sphincter or with a diffuse endodermal one. Acontia present.

To this family I refer the below described *Haliactis* and the genus *Halcampactis*, summarily charterized by Farquhar (1898), with its two species *mirabilis* Farq. and *dubia* Stuck. Farquhar namely states that the aboral end of *Halcampactis* is rounded and forms a physa and that there are "no sharply defined circular muscles". Stuckey (1908, p. 387), not having had an occasion to see the type, is inclined to take the genus to be a Sagartiid If Farquhar's informations are correct, the family keeps its present name Halcampactiidae; if, on the other hand, the sphincter afterwards should turn out to be mesogloeal, the genus must be placed among the Andwakiidae, provided that the basilar muscles are absent, which is likely, as Farquhar declares that the type-species has a rounded physa. If *Halcampactis* has to be removed from the family, it will be necessary to give it a new name, *Haliactiidae*. It is besides questionable if the genera *Ilyactis* and *Octophellia* proposed by Andres, do not belong to this family. If their sphincters are endodermal or no sphincter is present they probably do belong to it, if their sphincters are mesogloeal they are most likely Andwakiids.

Halcampactis is no doubt a species provided with brood-rooms. Farquhar namely says about this species "I have found full-grown individuals with numerous young ones grouped around them, evidently as they had attached themselves round the parent, when born".

Genus Haliactis nov. gen.

Diagnosis: Halcampactiidae with rounded proximal body-end. Column not divisible into regions, smooth, without papillae and spirocysts. No sphincter. Tentacles rather numerous, short, not swollen in the apex, the inner longer than the outer. Two weak siphonoglyphes and two pairs of directive mesenteries. Only 6 pairs of mesenteries perfect, imperfect mesenteries in several cycles. More than 6 perfect pairs fertile. Distribution of the acontia on the mesenteries?

Haliactis arctica[*] n. sp.

Pl. 1. Fig. 31.

Diagnosis: Column elongated. Nematocysts in the column partly 13—17 × 1,5 μ, partly 17—31 × 3,5—5 μ, in the tentacles 20—31 × 2 μ, in the actinopharynx partly 14—17 × 1,5 μ, partly 26—36 ×

2,5—3 μ, partly 19—38×3,5—5 μ. Spirocysts in the tentacles very numerous 13 × 1,5 μ to 29 × 3 μ. Longitudinal muscles of the tentacles and radial muscles of the oral disc rather well developed. Pairs of mesenteries 6 + 6 + 12; in addition to these pairs a fourth cycle in large specimens. Only the 6 first pairs with pennons, which are strong, furnished with high folds and rather richly ramificated, especially in the inner and outer parts. Parietal muscles weak, with somewhat low and sparse folds, expanded over all the outer lamellar part of the mesenteries, not sharply outlined from the other longitudinal muscles, not expanded upon the column. Muscles of the mesenteries of the second and third cycles recalling the parietal muscles of the first cycle, but with more numerous folds. Marginal stomata present. Filaments only on the mesenteries of the first order and on the distal part of the mesenteries of the second one. Ciliated streaks of usual type. Rather numerous acontia with large nematocysts. Reproductive organs on the first pairs and on the distal part of the second pairs.

Colour?

Dimensions: Largest specimen from Greenland in contracted state: Length 1,6 cm, breadth about 0,9 cm. Another specimen was 1,1 cm long and 1 cm broad, the inner tentacles 0,3, the outer 0,2 cm. Specimen from Siberia: Length 2 cm, breadth 1 cm.

Occurrence: Greenland without distinct locality, 3 sp., West-Greenland Nordre Stromfiord 375—380 m. (Nordmann, St. 2).
Bear Island (1886), 1 sp.
Spitzbergen. King Charles land 78°50′ N. 29°39′ E. 60—70 m. Clay (Sw. Spitzbergen-Exp. 1898), 1 sp.
Arctic Ocean of Siberia. 2 miles north of the winter station of the Vega (Vega-Exped.), 1 sp.

Exterior aspect: The column is much more high than it is broad and, according to the state of contraction, now more broad in the distal part, now in the middle. The proximal end is now flattened, now physa-shaped, expanded or involved. In consequence of the strong longitudinal contraction of the body the column shows numerous circular furrows. The column is smooth, without cuticle, papillae and acrorhagi, but with a broad fossa. The distal margin is distinct. The insertions of the mesenteries are clearly visible where the ectoderm is lost; probably there are longitudinal furrows, corresponding to the insertions of the mesenteries. The tentacles are most likely hexamerously arranged, in four or five cycles. The maximal number is about 96, in the reproduced large specimen (Pl. 1, fig. 31) I namely counted between 80 und 90 tentacles. Probably some tentacles may have been torn off as the preservation of the tentacles was very bad. The tentacles are conical, short, not longitudinally sulcated, and not swollen in the apex, the inner tentacles are about one third longer than the outer ones. The oral disc is probably not wide, it was not well preserved. The actinopharynx is of ordinary length and folded. The two siphonoglyphes are not very distinct and their aboral prolongations short.

Anatomical description: The ectoderm of the column, of the tentacles and of the actinopharynx is high and much thicker than the mesogloea. No cuticle is found. In the different regions of four specimens the nematocysts and the spirocysts show the following size.

Habitat	column		tentacles		actinopharynx		
	na	*nb*	*n*	*sp*	*na*	*nb*	*nc*
1. Bear Isl.	19-25 × 3,5-5 μ	15-17 × 1,5 μ	22-26 × almost 2 μ	17 × 1,5-29 × 3 μ	29-36 × 5 μ	29-36 × 3 μ	14-17 × 1,5 μ
2. Largest spec. from Greenland	19-25 × 3,5-5	?	20-24 × —	14 × 1,5-29 × 2,5-3	29-34 × 5	26-34 × 2,5	?
3. Winter-station of the Vega ..	17-23 × 3,5-5	13-14 × 1,5	22-26 × —	13 × 1,5-26 × 3	19-26 × 4-5	26-34 × 2,5	17 × 1,5
4. Greenland (Nordmann)	24-31 × 5?	14-17 × 1,5	24-31 × —	17 × 1,5-20 × 2,5-3	22 × 3,5-38 × 5	29-34 × 2,5	?

The a-nematocysts of the column were generally more thin in the distal end, in the specimens 1 and 3 sometimes a little curved and with indistinctly visible basal part to the spiral thread. In the specimen 2, the maceration preparations of which are a little unreliable in consequence of the bad state of preservation, the basal part of the spiral thread was visible, most of the capsules were destroyed here and only the rib-like basal part left. The b-capsules of the column were of equal breadth. In the a-capsules of the actinopharynx the basal part of the spiral thread was more or less visible, the a-capsules were broader in the basal end, the b- and c-capsules were in all places equally broad. The main part of the capsules in the column and the actinopharynx consists of a-capsules, the b- and c-capsules were very sparse. The nematocysts of the tentacles were rather sparse, the spirocysts numerous. The a-capsules of the actinopharynx vary a little in size, I must, however, mention that the size of the capsules in the actinopharynx is unreliable, according to the strong compression of this part; it is possible that one part of the capsules belongs to the filaments. The size of the nematocysts and the spirocysts besides agrees well in the four specimens.

Fig. 153

Fig. 154

Textfigs. 153–154. *Haliactis arctica*

Fig. 153. Transverse section of a perfect mesentery in the reproductive tract (spec. from Greenland, »*Hyanthus*«). Fig. 154. Transverse section of mesenteries of the second and third order and of an acontium (*ac*) (spec. from Bear Isl.)

The mesogloea of the column is not thick but very fibrillated, the endoderm is thin. The endodermal circular muscles are not strong, in the region of the fossa a little stronger, but form no differentiated sphincter (four specimens examined in this respect). The longitudinal muscles of the tentacles and the radial muscles of the oral disc are well developed.

The pairs of mesenteries are arranged in three cycles 6 + 6 + 12 = 24. In addition to these pairs a fourth cycle is probably present in the largest specimen reproduced in fig. 31, Pl. 1. This specimen was namely provided with a greater number of tentacles than the other specimens (compare above). Only the mesenteries of the first cycle are perfect and strongly developed, the other mesenteries (fig. 154) have no pennons and their muscles recall the parietal muscles of the first cycle. The longitudinal muscle-pennons of the first 6 pairs are in the reproductive region provided with numerous high folds, ramificated in the outer and inner parts (textfig. 153). The lamellar outer part of the mesenteries is attached to the outer edge of the pennon. The parietal muscles are in transverse-sections very elongated, with rather low folds, sparse and only a little branched or not at all so, on the longitudinal muscle-side passing into the pennon, but not expanded upon the column. The parietal muscles of the specimen from Bear Island and still more of that from the Vega-Expedition are of a more robust appearance than the reproduced section of the specimen from Greenland (in the Vega-specimen the main lamella of the mesogloea is considerably more thick), probably at least partly because of a different state of contraction. They moreover greatly recall the parietal muscles of *Acthelmis intestinalis*. The mesenterial filaments are only present on the mesenteries of the first order and on the distal part of the second one. The ciliated streaks are of usual appearance. The acontia observed in sectioned specimens from all habitats are rather numerous, in transverse-sections broad and provided with very numerous nematocysts (textfig. 154 *ac*). In the specimen from Bear Island there are, as far as I can see, in the perfect mesenteries large marginal stomata near the oral disc. Concerning the reproductive organs I observed ovaria in two more closely examined specimens. They appeared only on the mesenteries of the first order and in the distal part of the second one.

Remarks: The specimens dredged off Greenland (without distinct locality) and belonging to the museum of Copenhagen were labelled *Ilyanthus*(?) *arcticus*. Lütk. They are evidently one of the two *Ilyanthus*-species which Lütken (1875) mentions from Greenland, though never describing them. They were rather badly preserved while the other specimens were in better condition. For the anatomical description I have used specimens from all habitats.

Fam. *Andwakiidae*.

Diagnosis: Athenaria with elongated, cylindrical or low, conical column. Proximal body-end forming either an ampullaceous physa or a wide flattened base, recalling a pedal disc. Sometimes with cinclides? Sphincter mesogloeal, well developed. Acontia present.

The preliminary diagnosis of this sub-family, proposed by myself 1893 (p. 38) — I then regarded it as a sub-family — differed considerably from the first diagnosis of the family, given by Danielssen (1890). In fact Danielssen's diagnosis was so extensive that it would include almost all the then described Actininae being devoid of a pedal disc. Danielssen in his diagnosis neither mentions the presence of acontia nor the occurrence of a mesogloeal sphincter, two characters of great importance to the limitation of the family. Perhaps Danielssen comes nearer to the mark when speaking of the systematic placing of the family. According to the Norwegian author the family namely forms a transition stage between the Edwardsids and the Sagartids (the Phellidae). Among the Athenaria the family is, according to me, most nearly related to the family Halcampidae with which it has several characters in common, such as the exterior habitus of the body, the occurrence of "*Halcampa*-papillae" and few perfect mesenteries, the absence of basilar muscles and the presence of a mesogloeal sphincter. With the Phellidae, on the other hand, it agrees for instance in this that acontia occur. Probably we may regard such forms as the Andwakiidae as transition stages to at least certain species described as *Phellia*, very likely not a homogeneal genus. Besides it does not seem improbable that the Sagartids including at present all Actiniaria with basilar muscles and sphincter are of polyphyletic origin, a suggestion which, however, requires closer examination in order to be confirmed[1].

To this family I think that also the genus *Octineon* Mosel. belongs. In fact this Actinia is not as remarkable as Fowler supposes and as I can confirm from my own examination of type-specimens. The basal disc and the column, both incrusted with grains of sand, have no doubt an ectoderm, though the strong incrustation makes it difficult to ascertain its true nature. It is besides difficult to get a good figure of the ectoderm because the cuticle of the scapus, viz. the incrusted part of the column, is very strongly folded. On the sections it seems as if the scapus is provided with "*Halcampa*-papillae". On the other hand, Fowler supposes that a secretion of mesogloea by wandering cells from the endoderm takes place for the adhesion of the sand — he declares, however, that he has not observed any such cells. The capitulum is short, without a cuticle and probably without spirocysts. The sphincter is very elongated, mesogloeal, with, especially in certain places, scattered meshes. The tentacles are 12, of which 6 are primary-endocoel and 6 exocoel tentacles. They are capable of invaginating like the tentacles of *Halcampoides*. Their ectodermal muscles are very weak. Like Fowler I have not observed any distinct siphonoglyphes. The number of mesenteries is in the proximal part very great, this is closely correlated with the large diameter of the basal disc. In one specimen I counted 157 mesenteries in this part, thus a much greater number than stated by Fowler. Two cycles of mesenteries in the examined specimen reach the capitular region. Of the mesenteries of the first cycle only the 8 "*Edwardsia*-mesenteries" are perfect, as far as I can see. Fowler declares that some of the weaker mesenteries are attached to the actinopharynx, and also the four couples which, together with the 8 "*Edwardsia*-mesenteries", form the 6 pairs of mesenteries of the first order. Still on Fowler's reproduction (fig. 12, Pl. 30, 1888), only the six first pairs are connected with the actinopharynx. According to Fowler the section hits the actinopharynx. It is, however, questionable whether it really is so, I am more inclined to think that the section is more distal — a mistake which may easily have occurred to Fowler as he declares that "in the histological conditions no differences are apparent between the stomadaeum and the oral disc", and the strong contraction of this part has rendered it more difficult to examine the insertions of the mesenteries. In fact the actinopharynx is easily distinguished from the oral disc, because the former is devoid of ectodermal muscles, while the latter has such. In the best preserved specimen, sectioned by myself, only the 8 "*Edwardsia*-mesenteries" certainly were perfect, and besides, no mesenteries but these reach the inner part of the oral disc. As to two other sectionized specimens I cannot determine the number of the perfect mesenteries, on account of the bad preservation and the animals being torn asunder in the region of the actinopharynx. Nevertheless it is not impossible that, in certain cases, some more mesenteries may be attached to the actinopharynx, it is namely to be observed that no reproductive organs were developed in the above-named specimen. As, however, this was one of the largest specimens and furnished with very numerous mesenteries I think that there is little reason to suppose that possibility. The 8 *Edwardsia*-mesenteries have very strong, in transverse-section perfectly circumscript, muscle-pennons, filaments and reproductive organs, the ventral mesenteries of the dorso-lateral pairs (the 5th couple), according to Fowler, has only

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[1] compare p. 10.

weak pennons and is devoid of filaments and reproductive organs. The 6th couple, the ventral mesenteries of the ventro-lateral pair, is only a little stronger than the subsequent mesenteries, which are all sterile and devoid of pennons and filaments. No distinct parietal muscles are present. The parieto-basilar muscles one half of the parietal muscles — hardly show any folds, not even on the perfect mesenteries. Basilar muscles are absent. There are ciliated streaks. I cannot, however, describe their appearance as they have been hit longitudinally. Typical acontia with close, large nematocysts are present, but I cannot decide which mesenteries have acontia. They have not been observed by Fowler. I think that the genus *Octineon* may be characterized as follows:

Andwakiidae with very wide basal disc and low conical body, much smaller in the distal part than in the proximal one. Column divisible into two regions, a proximal part, scapus, the lower part of which forms the flattened basal disc, and a short distal part, capitulum. The ectoderm of the scapus with a cuticle and "*Halcampa*-papillae" (to which grains of sand are attached). Capitulum without a cuticle and spirocysts. Sphincter mesogloeal, very elongated. Tentacles 12. No distinct siphonoglyphes. The 8 "*Edwardsia*-mesenteries" (or some more mesenteries?) perfect, fertile, with filaments and strong, perfectly circumscript, pinnate muscle-pennons. The 5th couple with weak pennons, but without filaments and reproductive organs. The 6th couple and the subsequent mesenteries like the 5th couple, but weaker and without pennons. Numerous mesenteries in the proximal part of the body. Parietal muscles not distinctly differentiated, weak parieto-basilar muscles. Ciliated streaks and acontia present.

Octineon is particularly interesting because of the transformation of its proximal body-end. Instead of forming a physa this part is flattened like a regular pedal disc (compare *Milne-edwardsia carnea* (p. 16, 63) which, under certain circumstances, can flatten its proximal part) and, in comparison with the distal part, considerably increased in size and provided with "*Halcampa*-papillae", to which grains of sand are attached. Thus the proximal body-end serves as a good anchor to the animal which is incapable of attaching in the usual way.

Genus **Andwakia** Dan.

Diagnosis: Elongated Andwakiidae with the column divisible into physa, scapus and capitulum, the first of which being only a little differentiated from the second. Scapus with "*Halcampa*-papillae". Capitulum without spirocysts. Sphincter elongated, strongly mesogloeal in the distal part reaching the basal region of the tentacles as in *Halcampa*. Tentacles more than 12. Two rather feebly developed siphonoglyphes. 6 pairs of perfect and fertile mesenteries with strong muscle-pennons. One or several cycles of sterile(?) imperfect mesenteries with weak muscles without pennons. Acontia present, but few in number. Column with cinclides (?).

The above diagnosis of the genus only slightly agrees with that given by Danielssen 1890. Also my description of the species differs considerably from that of this author. As it would be too elaborate to point out all the differences between my conception of the organisation of *Andwakia mirabilis* and that of Danielssen, I here give a mainly new description of the species which nowise deserves the name of *mirabilis*. On the contrary its organisation scarcely deviates from that of a typical Actinia, as far as I can see.

Andwakia mirabilis Dan.

Andwakia mirabilis n. sp. Danielssen, 1890, p. 86, Pl. 4, figs. 10—11, Pl. 11. Appellöf 1893, p. 12.

Diagnosis: Physa ampullaceous, probably without papillae, as for the rest like the scapus. Scapus with a cuticle and very distinct "*Halcampa*-papillae". Capitulum in contracted state with high ridges between the insertions of the mesenteries. Sphincter elongated, about twice as long as the capitulum, not stratified, not forming an offset. Tentacles about 24 in three cycles. Nematocysts in the scapus 13—17 × 2 μ, in the capitulum 17—18 × 2,5 μ, in the tentacles 19—24 μ and in the actinopharynx 19—22 × 2 μ. Spirocysts of the tentacles 17 × 2—29 × 3,5 μ. 12 pairs of mesenteries. Muscle-pennons in transverse-sections through the upper part of the reproductive region with about 20 high folds which are richly ramificated and slightly recalling a circumscribed sphincter. Parietal muscles comparatively weak with few folds, not expanded upon the column. Muscles of the mesenteries of the second order recalling the parietal muscles of the mesenteries of the first cycle.

Colour according to Danielssen: The scapus brownish-black, dotted with partly white, partly green and reddish points. The capitulum faintly salmon-red, occasionally purely white with a fine rose-coloured tinge. The oral disc cinnabar-red with fine, darker lines. The tentacles of the same colour but somewhat darker at the base, lighter at the apex.

Dimensions in extended state: Length of the body 6—7 cm, breadth in the distal end 1,5 cm, in the proximal end 0,4—0,5 cm. Length of the capitulum 0,8 cm, breadth of the oral disc 1,2—1,4 cm (Danielssen). — In preserved state to about 2,5 cm long.

Occurrence: Norway. Sognefiord. Husön 100—150 fms. Sand (Norw. North-Atl.-Exp., Grieg, 1889), Hjelte fiord (Appellöf).

Exterior aspect: The proximal part of the body, the physa, is ampullaceous or flattened and, as it seems, but little differentiated from the scapus. As on the scapus the ectoderm is here furnished with a cuticle? (compare below) to which detritus-particles are fastened; it seems, however, that this cuticle is more easily thrown off than that of the scapus. Probably there are no "*Halcampa*-papillae" here. The scapus is elongated, narrow in the proximal part, more broad in the distal part, and set with numerous "*Halcampa*-papillae" to which grains of sand are attached. The capitulum is short, without a cuticle and in contracted state provided with high ridges and deep furrows, the latter corresponding to the insertions of the mesenteries. The body is in extended state cornucopia-shaped (Danielssen), in contracted state cylindrical.

The tentacles are 24, arranged in three cycles, short, conical or cylindrical, according to the state of contraction. The inner tentacles are a little thicker than the outer ones. The oral disc is not broad, the actinopharynx rather short, in preserved state with irregular longitudinal and transversal folds. Two, not very distinct siphonoglyphes are present.

Anatomical description: The ectoderm of the physa is rather high and contains somewhat numerous nematocysts of the same appearance and size as in the ectoderm of the capitulum. At the outside it is surrounded by a thin covering, imbued with detritus-particles, this is possibly a cuticle but more probably a mucus-membrane secerned by the mucus-cells. The mesogloea of the physa is much thinner than its ectoderm. The ectoderm of the scapus is thinner than that of the physa and contains nematocysts, 13—

17 μ long. The periderm is thicker than the covering of the physa and imbued with detritus, especially on the numerous papillae which seem to be of the same nature as the "*Halcampa*-papillae", though they are here supported by strong prominences of the mesogloea. The smooth ectoderm of the capitulum is high and provided with rather numerous nematocysts, 17—18 × 2,5 μ in size, sometimes a little curved, but without spirocysts. Its mesogloea is thick, especially at the ridges. The endoderm of the column is somewhat thick, in the physa thinner than the ectoderm. The endodermal circular muscles are rather well developed and form short, palisade-shaped folds. The sphincter (textfig. 155) is mesogloeal and strong, elongated, about twice as long as the capitulum, not forming an offset, not stratified. The most distal part of the sphincter much recalls the sphincter of *Halcampa*. It is namely here divided in somewhat fine meshes and is so much elongated that the longitudinal muscles of the tentacles cover the uppermost part of the sphincter. It is besides, as in *Halcampa*, rather close to the ectoderm. In the other, larger part of the sphincter, where the

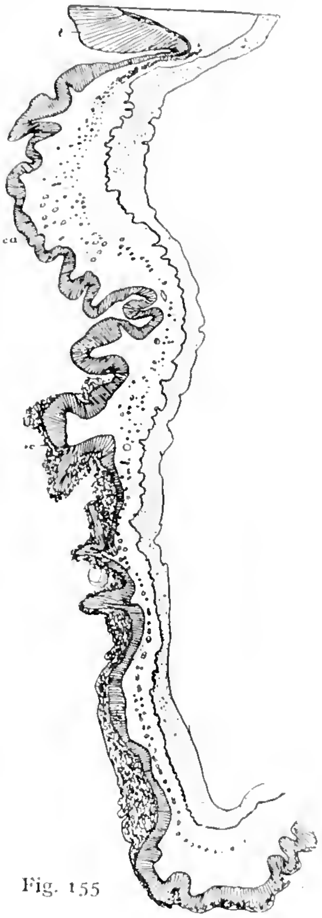
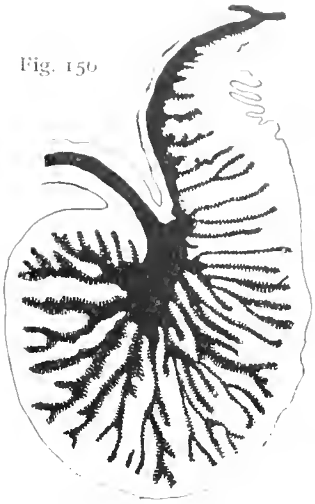


Fig. 155

Fig. 156



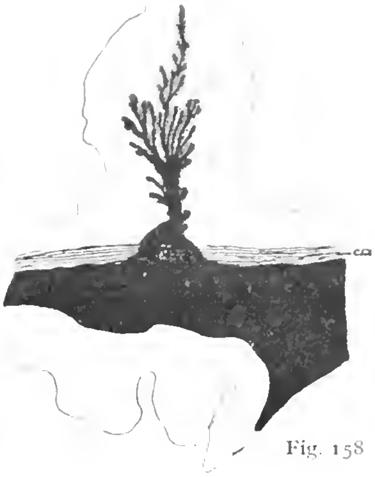


Fig. 158

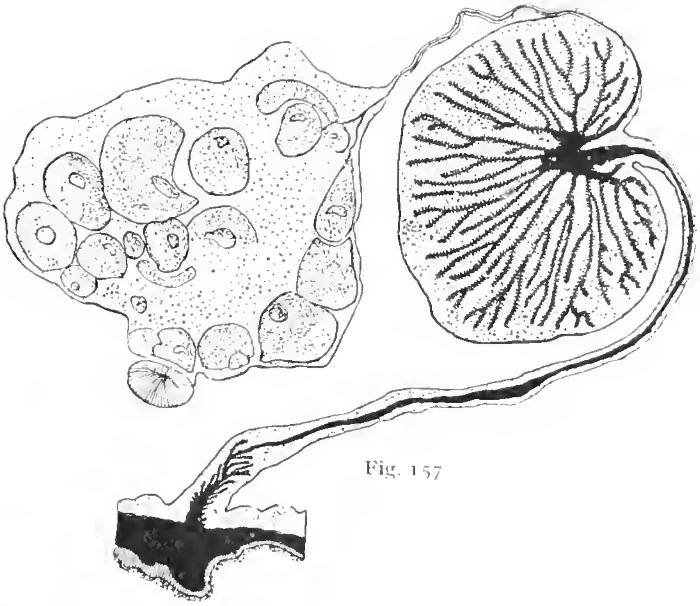


Fig. 157

Textfigs. 155—158. *Andwakia mirabilis.*
Fig. 155: Longitudinal section of the upper part of the column and of the basis of a tentacle showing the mesogloeal sphincter *t*: tentacle, *ca*: capitulum, *c*: cuticle. Fig. 156: Transverse section of a pennon in the lower part of the actinopharynx. Fig. 157: Transverse section of a perfect mesentery in the reproductive tract. Fig. 158: Transverse section of a mesentery of the second order.

mesogloea commonly is more thick, the meshes are more scattered, and larger and smaller meshes are intermingled.

The ectoderm of the tentacles is high and contains rather numerous nematocysts, 19—24 μ long, and very numerous spirocysts of variable size, from 17 × 2 μ to 29 × 3,5 μ. The longitudinal muscles are ectodermal and well developed in the proximal part, here forming palisade-shaped folds, in the distal part, however, weaker. At the base the longitudinal muscles are a little stronger on the inner side than on the outer one. The endoderm is high and extended in numerous off-shoots.

The ectoderm of the oral disc contains nematocysts similar to those of the tentacles, their number is, however, considerably smaller. The radial muscles are strong and almost exclusively ectodermal, still there are sparse meshes enclosed in the mesogloea. The folds are numerous and higher than the unfolded part of the mesogloea. The ectoderm and the mesogloea are much thinner at the insertions of the mesenteries than in the intermediate parts.

The actinopharynx is folded. The ectoderm contains very numerous typical nematocysts, 19—22 × 2 μ in size, besides these also sparse nematocysts with visible basal part to the spiral thread. The latter are broader in the basal than in the distal end and 22—26 × 3,5 μ in size. The gland-cells are numerous; longitudinal muscles absent. The mesogloea is thicker than the ectoderm at the ridges, weaker in the furrows. The siphonoglyphes are narrow, their ectoderm contains less numerous nematocysts and gland-cells than the other part of the actinopharynx.

The pairs of mesenteries are 12 of which two pairs of directives. 6 pairs are perfect and 6 imperfect. The pairs of the first cycle are provided with large, longitudinal muscle-pennons which are, however, rather short and mostly developed in the distal part. The larger part of these mesenteries is devoid of pennons and the proximal part of the mesenteries therefore looks like thin lamellae. On the top of the lower part of the actinopharynx the pennon is the most developed on the outside, the folds are high and rather richly ramificated here (textfig. 156). In the reproductive region the pennon is, however, almost as much developed on the inside as on the outside. As the outer lamellar part of the mesenteries issues from the middle part of the pennon, which is thickened in the region of the actinopharynx as well as in the reproductive tract, the pennon looks rather circumscribed in transverse-sections through the reproductive region (textfig. 157). The folds amount to about 20 in number. The parietal muscles are not strong, the folds are few, low and not transversely expanded, but radially elongated (textfig. 157). They are not expanded upon the column. The muscles of the mesenteries of the second order (textfig. 158) have no pennons and are in transverse-sections of about the same appearance as the parietal muscles of the first cycle. The filaments are well developed on the mesenteries of the first cycle. Whether such filaments appear also on the mesenteries of the second cycle I cannot with certainty decide as my material was not in every respect well preserved, it seems, however, in certain cases as if also these mesenteries might be provided with very weak filaments. The ciliated streaks are of typical appearance, their mesogloea contains few cells. Acontia are present, but I cannot decide where they are attached. I have observed them in transverse-sections, they are typical and provided with large nematocysts. The reproductive organs are developed in the proximal part of the pennons of the mesenteries of the first cycle. In two examined specimens they were ovaria. I have not found any reproductive organs on the mesenteries of the second cycle, and look upon the occurrence of such organs on the mesenteries as very improbable. There are small oral stomata. Whether the large marginal stomata, observed by myself in certain mesenteries, are normal formations or not, I cannot with certainty decide. It is possible that they are artificial and due to ruptures as the specimens were strongly contracted.

Remarks: The specimens examined by myself were dredged by Grieg in their primary habitat and no doubt identical with the species of Danielssen.

Thenaria s. Basilaria.

Fam. *Actiniidae.*

Diagnosis: Basilaria with pedal disc commonly well-developed. Column smooth or provided with verrucae (sucking warts) but never with ampullaceous offshoots. Pseudoacrorhagi and acrorhagi (bourses marginales) present or absent. Sphincter absent or weak, endodermal-diffuse or diffuse-circumscribed, rarely aggregated. Tentacles cylindrical or conical, without a sphincter at their base. Mesenteries arranged in several cycles, of which generally more than one is perfect. Longitudinal muscles very rarely strongly circumscribed, mostly diffuse. Acontia absent.

Genus Actinia Brown.

Diagnosis: Body rather low. Column smooth without verrucae, its upper part capable of involution. Fossa distinct, deep. Acrorhagi, well-developed offshoots from the inner part of the fossa-wall in variable number (rarely absent.). Sphincter broad, diffuse endodermal (or meso-endodermal in *A. bermudensis* teste Mc. Murrich). Tentacles short conical. Siphonoglyphes well-developed. Mesenteries numerous, mostly perfect. Reproductive organs in the mesenteries of the first and the following orders, except as a rule in the directive and the youngest mesenteries.

Whether *A. bermudensis* really is provided with a meso-endodermal sphincter needs confirmation. Possibly the section has hit the sphincter in the vicinity of the mesenteries, where all sphincters show a tendency to be more or less mesogloeal.

Actinia equina L.

Priapus equinus n. sp. Linné, 1758 p. 656.

Actinia equina L. Linné 1766—68, p. 1088. Müller 1776, p. 230. Andres 1883, p. 393. Jourdan 1880, p. 65, Pl. 4, figs. 19—27, Pl. 5, figs. 28—40. Brunchorst 1890, p. 30. Simon 1892, p. 42. Appellöf 1900, p. 4, 1905, p. 59. Grieg, 1887, p. 12, 1898, p. 6. Pax, 1907, p. 53 (p. p.), 1908, p. 467, 1920, textfig. 1, 2.

Actinia mesembryanthemum n. sp. Ellis & Solander 1786, p. 4.

— — Ell. & Sol. Rapp 1829, p. 52, Pl. 2, fig. 1. Sars 1851, p. 144, 1853, p. 12, 1857, p. 32. Danielssen & Koren 1856, p. 87. Danielssen 1861, p. 45, Möbius 1873, p. 149. Schulze 1875, p. 139.

Priapus ruber n. sp. Forskål 1775, p. 101, p. 27, fig. a.

Actinia rubra, Forsk., Sars 1835, p. 3, 1853, p. 12.
?*Actinia cari* delle Chiaje, Arndt 1912, p. 123.

A more complete list of synonyms and literature is given by Andres 1883 and Pax 1908, p. 467. I think however that *A. rufa* of Müller is not this species but rather a young *Metridium dianthus*. *A. cari* is probably a distinct species.

Diagnosis: Nematocysts of the column 14—19 × 1,5 μ, those of the acrorhagi 41—58 (65) × 2,5—4 μ, those of the tentacles 19—24 × 1,5 μ and those of the actinopharynx 18—29 × 1,5 (2) μ. Spirocysts of the tentacles 14 × 1—29 × 2 μ. Acrorhagi spherical with an aperture, in variable number (commonly 24 teste Andres). Sphincter with low folds especially in its proximal and distal parts, the folds however rather much ramificated. Outer parts of the oral disc with tentacles in number to about 192. Inner tentacles a little longer than the outer ones. Pairs of mesenteries to about 96. Longitudinal muscles in the outer parts of the mesenteries very weak, in the inner forming rather weak diffuse pennons. Parieto-basilar muscles distinctly definite, broad, expanding over almost the whole length of the column. Basilar muscles strong. Development of the embryos in the coelenteric cavity.

Colour very variable. Pax (1907, 1920) distinguished two main forms 1) forma *rubra:* Red or scarlet-red. Acrorhagi blue. Sometimes blue annulus at the base of the column (the Bergen-specimens lack this annulus teste Appellöf), 2) forma *viridis:* Column olive grey to grass-green, acrorhagi bluish-green, annulus blue. Sars states that liver-coloured specimens (forma *hepatica* Gosse?) are common in Ögsfiord and at Hammerfest. Gosse and Andres described several varieties of colour in this species.

Dimensions: in expanded state: breadth to about 7 cm, height to 5 cm, length of the tentacles to 1,5 cm (Andres).

Occurrence. Norway: The West coast at least from Stavanger (teste Brinkman) to Hammerfest. Bergen (teste Sars, Appellöf), Solsvig (teste Schulze and Sars), Vaagsfiord, Ulvesund, outer Nordfiord (teste Grieg), Molde (teste Arndt, *A. cari*?). Nordland—Finmark to Vadsö (teste Danielssen), Ögsfiord, Hammerfest (teste Sars).

Kola peninsula. Pala Guba (teste Pax).

Shetland Isl. Balta sound (Hammarsten, 1 sp.) (teste Norman).

?Denmark. Great Belt, Romsø (teste Möbius, probably not this species).

Further Distribution: North Sea, coast of Germany (Helgoland and other localities), Great Britain and Ireland. W. coast of Europe, W. coast of Africa to Cape Verd Isl., Madeira, Canary Isl., Mediterranean, Black Sea, Sea of Asov. on exposed rocks from half-tide to low-water mark (Gosse).

The exterior aspect of this species has been described by several authors, likewise the anatomy especially by Jordan (1880), Simon (1892) and Pax (1920). I will here only add some notes. I have examined two species, one from the Shetland Islands (height 0,7 cm, breadth 1,5 cm) another from Naples (height 2 cm, breadth 5 cm), as regards the stinging capsules. Though the specimens were very different in size the stinging capsules were of about the same size in them both. The nematocysts of the column were very sparse, 14—19 × 1,5 μ resp. 14—16 × 1,5 μ, those of the tentacles not numerous 19—22 × 1,5 μ resp. 19—24 ×

1,5 μ, those of the actinopharynx were numerous 18—24 × 1,5 μ resp. 22—29 × 1,5 (2) μ. The nematocysts of the acrorhagi were of about equal length in both specimens 41—55 (1 nematocyst 65) μ resp. 43—58 μ, in breadth however different 2,5 μ resp. 3—4 μ. There were moreover in the first specimen broader nematocysts, to about 4 μ, but they were more irregular and probably nematocysts in development. Also sparse spirocysts are present in the ectoderm of the acrorhagi.

The acrorhagi are perforated by an aperture as already shown by Dalyell. In sectionized arorhagum of a specimen from the North Sea the aperture was aborally situated. At the aperture in the mesogloea there was an annular wall, probably formed by the endoderm. The wall, which probably forms a movable stopping, is turned outwards. Whether other apertures, cinclides, are present in the upper part of the column I cannot decide (compare Andres 1883, Simon 1892 and Pax 1908). A priori it may very well be so as the cinclides are not correlated with the acontia. Several Actiniaria namely have acontia but no cinclides, and others, as Eloactis and Harenactis, have cinclides but no acontia.

Fam. *Boloceridae*.

Diagnosis: Basilaria with a well-developed basal disc. Column without sucking warts, acrorhagi and pseudoacrorhagi. Sphincter from rather well-developed to strong, endodermal diffuse or circumscribed. Tentacles at the base constricted and furnished with an endodermal sphincter, by the contraction of which the tentacles are thrown off.

This family is proposed by Mc. Murrich (1893) for the genus *Bolocera*. At the same time he suggested that the *Liponema* of R. Hertwig was synonymous with this genus. Haddon (1898, p. 429) was of the same opinion and this was further confirmed by myself (1899, p. 40), as I found some tentacles in the type-specimen. Haddon moreover thinks that *Polystomidium* is very closely allied to *Bolocera*, and I myself gave as my opinion 1899 that both genera are identical and that the presence of acrorhagi and the occurrence of openings in the actinopharynx are the only characters through which *Polystomidium* is distinguished from *Bolocera*. The presence of acrorhagi was doubted by Haddon (1898), and their absence was stated by myself 1899, when I had examined the type-specimen. To my mind the openings are of little importance, because they probably are artificial products. As for me, I think that *Bolocera* and *Polystomidium* are synonymous.

Later (1899) I proposed for *Bolocera mc. murrichi* Kwietn. a new genus *Boloceroides* which was removed to the family Gonactiniidae, though I pointed out (1900) that the genus does not at all agree with the typical Gonactiniidae. With the placing of *Boloceroides* among the Gonactiniidae Pax (1914, p. 608 and Poche (1914, p. 97) agree, and *Stephenson* (1918a, p. 20) declares that it may be doubted, if the genus belongs to the Boloceridae, though he thinks that its "position needs reconsideration." In a paper which I am going to publish I will show that the family Aliciidae is heterogeneous — an opinion which I expressed already 1898 and 1900 — I put *Boloceroides* together with *Bunodeopsis*, *Alicia* and *Thaumactis* in the family Aliciidae, while *Phymactis*, *Rivetia* (= ?*Phymactis*), *Cystiactis*, *Phlyctenactis* (= *Cystiactis*) and *Eucladactis* (probably = *Phymactis*) are removed to a new family Cystiactiidae and *Phyllodiscus* to the Lebruniidae (Dendromelidae).

A new Bolocerid genus, *Bolocerópsis*, was established 1904 by Mc. Murrich. Concerning this genus

I have before given utterance to my doubt of its place among the Boloceridae. True enough, the tentacles are constricted at the base and the mesogloea of the tentacles thicker than that of the oral disc, whereby a narrowing is formed at the base of the tentacles, but there is no tentacular sphincter. On account of this it is very improbable that the tentacles are able to loosen themselves. For the present I hold it suitable to place the genus among the Actiniidae. Pax (1914, p. 610) and Poche (1914) share my opinion, while Stephenson (1918, a, b) comes to the same conclusion as Mc. Murrich.

Stephenson (1918a, p. 20) supposes, that also *Polyopis* is a Bolocerid. In consequence of the reasons I have before given (p. 81, 82) I must place this genus to the Athenaria.

At last Stephenson (1918 b, p. 112) proposes a new genus, *Leipsiceras*, for such *Bolocera* forms which have "an extremely long and peculiar circumscribed sphincter." In this I fully agree with him. I have found a new species of this genus from Gote Islands having a still stronger sphincter than that of the type, *L. pollens*. To this family thus only *Bolocera* and *Leipsiceras* to my mind belong.

From the species, enumerated by Stephenson (1918 b, p. 112), the following must be removed.

1) *Bolocera brevicornis* Mc. Murr. which, according to Mc. Murrich (1904, p. 255), is a *Boloceroides*.
2) *Bolocera africana* Pax which is a Sagartiid (Carlgren, 1911, p. 21).
3) *Bolocera norwegica* Pax. Nothing in the imperfect description indicates that the species is a *Bolocera* (Carlgren 1911, p. 21).

Genus Bolocera.

Diagnosis: Column smooth, sometimes (always?) with scattered irregular gland-spots, not or only a little capable of involution, with a distinct fossa. Sphincter endodermal diffuse. Tentacles in contracted state longitudinally sulcated, generally very numerous, short or of considerable length, hexamerously arranged. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Two well-developed siphonoglyphes with distinct gonidial tubercles and aboral prolongations. Muscle pennons of the mesenteries rather well-developed, parieto-basilar muscles rather weak, basilar muscles distinct. More than 6 pairs of perfect mesenteries. Distribution of the reproductive organs on the mesenteries variable.

Bolocera tuediae (Johnst.) Gosse.

Actinia tuediae n. sp., Johnston 1832, p. 163, fig. 52.

Anthea — (Johnst.), Johnston 1847, p. 242, fig. 53. Sars 1846, p. 29. Düben & Koren 1847, p. 267. Danielssen & Koren 1856, p. 87.

Anemonia — (—), *Milne-Edwards* 1857—60, p. 235.

Bolocera — (—), Gosse 1860, p. 186, Pl. 5, fig. 1. Verrill 1873, p. 5, 1883, p. 59. Schulze 1875, p. 140. Andres 1883, p. 421. Levinsen 1893, p. 396. Appellöf 1894—95, p. 11, 1905, p. 67, 71. Grieg 1897, p. 6, 7, 9, 11, 13, 1913, p. 144. Parker 1900, p. 753. Carlgren in Nordgaard 1905, p. 159. Walton 1908, p. 215. Pax 1909, p. 342, 343. Stephenson, 1918 b, Pl. 14, fig. 2, Pl. 20, figs. 1, 3—6.

Bolocera longicornis n. sp., Carlgren 1891, p. 241, 1893, p. 50, Pl. 1, fig. 18, Pl. 6, figs. 3—6, Pl. 7. Walton 1908, p. 216. Stephenson 1918 b, Pl. 20, fig. 7.

Diagnosis: Body cylindrical, in expanded state considerably longer than it is broad. Sphincter diffuse, of about the same appearance as in *Bolocera multicornis*. Circular muscles in the endoderm of the column rather strong. Tentacles conical, in expanded state very long (in regenerating specimens short?), but strongly contractile, with deep longitudinal furrows, covering about half the oral disc, numerous, arranged in 5 or 6 cycles, the outer tentacles about half as long as the inner ones. Longitudinal muscles of the tentacles and radial muscles of the oral disc well-developed with close, rather high folds. Aboral prolongations of the siphonoglyphes long. All or almost all mesenteries perfect in 4 or 5 cycles. Oral and marginal stomata present. Longitudinal and basilar muscles about as in *B. multicornis*, parieto-basilar muscles half as long as the column, weak but distinct. Reproductive organs on most mesenteries except the directives and some others of the first (second) cycle? Nematocysts in the ectoderm of the column variable, partly 14—19 × 1,5 μ, partly 26—48 × about 2.5—3,5 μ, those in the apex of the tentacles in smaller specimens 60—82 × 2,5—3 μ, in larger 70—127 × 3—3,5 μ, those in the proximal part of the tentacles in smaller specimens 36—60 × 2,5—3 μ, in larger 53—72 (86) × 2,5—3 μ, those of the actinopharynx (38) 43—62 × 3—4 μ. Spirocysts in the ectoderm of the tentacles 22 × 1—2 μ to about 77 × 4—5 μ.

Colour: Column varying from pale flesh-coloured and pink to dark red. Tentacles and oral disc generally correspond in colour with the column but are of a deeper tint, on the inside often reddish brown, in which case also the oral disc is of the same colour but of a fainter shade. Gonidial tubercles and mesenteries sometimes carmine.

Dimensions: Length in expanded state unto 20 cm, in preserved state about half as long. In contracted state the diameter of the disc is almost like the length of the column. Inner tentacles about the length of the column in expanded state.

Occurrence: The Sound, Öretvisten about 40 m ("Sven Nilsson") 1 sp.

Sweden. Gullmarfiord 40—80 fms. (Carlgren and others), Väderöarne (Goës).

Skagerrak, 370 fms, 320—380 fms (Gunhild-Exp., St. 10, 5, 6), 120 fms (Petersen 1887), 244—338 m (Thor-Exp. 1904, St. 312), (Thor-Exp. 1906, St. 11), (Thor-Exp. 1911, St. 6), $15^1/_2$ miles $N^1/_2$W. of Skagen's lightship 140 m (Thor-Exp. 1904), $16^1/_2$ miles SW. to W. of Skagen's lightship 106 fms (Petersen), NW. to W. of Hanstholm (Pommerania-Exp., teste Schulze).

Norway, Christianiafiord Konglungen about 10 m (Christiania mus.), Dröbak (Carlgren, Christiania mus.), Hardangerfiord, Jonanes, Saetveitnes, Thorsnes, Ljonestangen, Straumastein 100—400 m (teste Grieg), Herlöfiord 150 fms (teste Appellöf), Korsnes 337 fms (teste Schulze), Vaagsfiord 120 fms (teste Grieg), Sulenfiord 430 m. Temp. at 400 m 7°22 (M. Sars exp. 1902, St. 32), Drontheimfiord (Biol. stat.), Malangen fiord 380 m, Bottom temp. 4°1, Stönesbottn 40—80 m (Nordgaard). Lyngö (Kier).

North Atlantic: 60 57′ N. 3°42′ E. 350 m. Bottom temp. 6°16 (M. Sars-Exp. 1902 St. 47), 61°3′ N. 2°13′ E., 130 m. Temp. at 125 m 6°78 (M. Sars-Exp. 1902, St. 49), 61°4′ N. 3°11′ E. 400 m Bottom temp. 6°34 (M. Sars-Exp. 1902, St. 51), 59°35′ N. 7°8′ W. 585 fms (Ingegerd & Gladan-Exp.), $5^{1}/_{2}$ miles S.S.E. of Bispen, Faroe Isl., 50 fms (Mortensen). S. of Iceland 49°38′ N. 11°35′ W. 923 m (M. Sars-Exp. 1910, St. 4).

West Greenland: Bredefiord 490 m (Rink-Exp. 1912, St. 49).
Davis Strait 64°54′ N. 55°10′ W. 393 fms Bottom temp. 3°8 (Ingolf-Exp. St. 27).
Davis Strait 65°14′ N. 55°42′ W. 420 fms Bottom temp. 3°5 (Ingolf-Exp., St. 28).

Further distribution: North Sea. Coast of Great Britain and Ireland (teste Gosse, Stephenson and others), Shetland Isl. (teste Norman), Atlantic coast of North-America, Nova Scotia 50—100 fms, Gulf of Maine 50—150 fms, Casco bay 40—90 fms, Massachusetts bay 40—52 fms, Cape Cod 37—90 fms, George's bank 306 fms, Martha's Vineyard 160—640 fms, Southern New England, Cape Fear 464 fms (teste Verrill).

In my paper (1893) I have left the question open, if *Bolocera tuediae* and *B. longicornis* are identical or not. It seems to me from the above list of synonyms that we have to do with a single species, though the figures reproduced by Johnston and Gosse of *B. tuediae*, apparently the species with very strongly contracted tentacles, do not agree with the common appearance of *B. longicornis* in contracted state (compare Carlgren 1893). The tentacles of *B. longicornis* namely are capable of varying extraordinarily in length, owing to their strong longitudinal muscles. In recently dredged, sound specimens the extended tentacles are very long — the tentacles of the specimens living in the aqvarium of the biological station of Drontheim are of the same appearance — while half dead specimens have very short tentacles but often strongly swollen at the base (about as the figure reproduced by Gosse). Thus I think that the difference in length of the tentacles in *B. tuediae* and *longicornis* is due to a different state of contraction.

Another difference in the exterior of both species consists in the presence of columnar warts in *B. tuediae*, which are not observed in *B. longicornis*. Gosse not having seen the species alive namely says (1860, p. 186) that *B. tuediae* "is studded, somewhat sparsely, with minute rounded warts, which are scarcely apparent, when the animal is extended, but, on contraction, "resemble the heads of small pins in a pincushion "(W. P. Cocks)." The figure Pl. 5 in the work of Gosse representing *B. tuediae*, also shows scattered warts on the column. That they are not real sucking warts is evident (compare also Stephenson, 1918b, p. 113), it still remains to be explained of which kind the warts drawn by Cocks are. For that reason I have examined the extended column of the specimen of *B. longicornis* from Ireland on stained surface preparations, as well as on sections. It then became clear that the ectoderm of the column is not homogeneous. Over the surface there are namely scattered irregular spots containing numerous gland-cells and nematocysts, which are very sparse in the intermediate parts of the ectoderm. Probably it is these spots (possibly the intermediate parts) which Cocks has observed and which ought to appear more distinct when the column has such a colour as on Cocks' figure, but which disappear when the column is pale flesh-coloured. I therefore think that there is no difference in the structure of the column of *B. tuediae* and *longicornis*. As also the nematocysts of the two species show a good conformity it seems to me that we have every reason to conjoin the two species.

Another view is expressed by Walton (compare Stephenson 1918 b, p. 113), who has seen both species alive and who declares that they are quite "distinct." Also Stephenson (1918 b) believed himself to have found some little difference between the two forms — perhaps partly owing to his having compared "*Bolocera longicornis*" from the Falkland Islands with *B. tuediae*. He thus pointed out that *B. tuediae* has a tendency to produce "humps of mesogloea at different points in its course." I have also observed such in a specimen of *longicornis* from Bohuslän. I cannot find any real differences between the two species, though I have examined the structure of the tentacles and the sphincter and the size of the stinging capsules in specimens from very different localities, also from North-America.

The following table shows the size of the nematocysts and spirocysts in different parts of the body. The nematocysts in the apex of the tentacles are considerably longer than in the proximal part of the tentacles, the smaller specimens have shorter tentacular nematocysts than the larger specimens.

Habitat	column		tentacles: apex.		tentacles proximal part		actinopharynx	Dimensions of the column in cm
	n	*n*	*n*	*sp.*	*n*	*sp*	*n*	
Ingolf St. 27	14—17 × 1,5 μ	29—36 × 2,5—3 μ	(60)65—77 × 3 μ	22 × 1,5—58 × 3,5 μ	43—60 × 3 μ	26 × 1,5—53 × 5 μ	46—60 × 3,5 μ	l 1,5 b 2,5
— · 28	…	…	60—79 × 2,5—3	24 × 1,5—58 × 3—3,5	36—50 × 2,5—3	24 × 1,5—50 × 5		only small tentacles
Lyngö (Kier)	…	…	60—73 × 2,5—3	…	…	…	38—50 × 3—3,5	l 2,2 b 1,5
Skagerrak	…	…	60—74 × 2—5,3	…	43—55 × 2,5—3	…		l 2 b 1,5
Bredefiord (»Rink«)	…	…	72—82 × 2,5	…	…	…	46—58 × 3—3,5	l 2 b 2,5
»M. Sars« 1902 St. 51	…	…	60—77 × 3—3,5	…	…	…	48—58 × 3,5	l 2 b 3
Bergen	…	…	(72)82—113 × 2,5—3	24 × 1—62 × 3,5	58—73 × 2,5	24 × 1—62 × 4,5	46—58 × 3,5	l 2 b 3,2
Skagerrak	14—18 × 1,5	26—31 × 2,5	72—96 × 3	22 × 1,5—67 × 2,5	53—62 × 2,5	24 × 1,5—67 × 4,5	43—84 [illegible]	l 3,3 b 3,3
Maine U. S. A.	17—19 × 1,5	37—41 × 3—3,5	87—112 × 3—3,5	29 × 2—77 × 3-(3,5)	65—72 × 3—3,5	29 × 2—77 × 5	50—62 × 2,5—3	l 3,5 b 5
Off Bispen (Mortensen)	15—17 × 1,5	28—37 × 2,5—3	70—109 × 2,5-3,5	…	53—74(96) × 3—3,5	…	43—58 × 3,5—4	l 4 b 6,5
Bergen (Grieg)	17—19 × 1,5	29—46 × 2,5—3	77—106 × 3,5	24 × 1,5—74 × 3	62—77 × 3—3,5	29 × 2—77 × 5	46—60 × 3,5—4	l 4 b 7
Off Martha's Vineyard	…	…	79—103 × 2,5-3,5	…	58—72(82) × 2,5—3	…		
— (U. St. F. com.)	…	…	84—106 × 2,5—3,5	…	58—72 × 2,5—3	…		
North-America Verr.	…	…	96—127 × 3,5	…	70—86 × 3—3,5	…	…	
Bohuslan	18—24 × 1,5	34—41 × 2,5	72—127 × 3,5	26 × 2—65 × 2,5	(53)60—72 × 3	29 × 2—77 × 4—5	53—62 × 3—3,5	l 8 b 9,5
—	…	…	98—118 × 3,5	…	…	…	…	large spec.
S. o. Iceland »M. Sars« St. 24	15 × 1,5	38—48 × 3	96—106 × 3,5	…	…	…	53—60 × 3,5—4	l 10 b 8,5

The anatomy of this species was described by myself (1891, 1893) as to *B. longicornis*, and by Stephenson 1918 b as to *B. tuediae*. I have not placed *B. longicornis* from the Falkland Islands (Stephenson 1918 a, p. 20) in the list of literature, as I am not fully convinced that this species is identical with *B. tuediae* (*longicornis*), though it may possibly be so.

Bolocera multicornis Verr.

Bolocera multicornis n. sp. Verrill 1879, p. 198. Andres 1883, p. 453.
— — Verr., Mc Murrich 1893, p. 155. Haddon 1898, p. 430. Parker 1900, p. 351. Carlgren 1902, Pl. 3, figs. 1, 2, textfig. 1, 2.
Sagartia (*Phellia*) *abyssicola*, Koren and Dan. (p. p.). Danielssen 1890, p. 30, Pl. 10, fig. 4.

Diagnosis: Column low with distal part considerably broader than proximal part. Sphincter diffuse without tendency to become somewhat circumscript, with close, high folds. Circular endodermal muscles of the column comparatively strong. Tentacles extraordinarily numerous, closely packed together, covering the greater part of the oral disc, short, longitudinally sulcated, conical to cylindrical and in the latter case rounded in the apex, all of about equal length. Well-developed aboral prolongations of the siphonoglyphes. Mesenteries of large specimens extraordinarily numerous. Perfect mesenteries, in comparison to the number of mesenteries, probably few. Oral stomata present; marginal stomata? Pennons of the mesenteries broad with palisade-shaped folds. Basilar muscles well-developed, fan-like expanded. Nematocysts in the ectoderm of the column, tentacles, and actinopharynx very numerous, those of the column 19—24 (28) × 1,5—2 μ, those of the tentacles 30—60 × (2) 2,5 μ in the apex and (19) 22—36 × 2—3 μ in the proximal part, and those of the actinopharynx 31—47 (52) × 2,5—3,5 μ. Spirocysts in the extoderm of the tentacles numerous, from 22 × 1,5 μ to 55 (60) × about 5 μ.

Colour of the column and tentacles nearly uniform, bright redlead-coloured or orange-scarlet, mouthfolds a deeper shade of the same colour (Verrill). The tentacles of the Ingolf-specimens are dark reddish-brown in the distal parts.

Dimensions in preserved state: Oral disc unto 16 cm, length of the column unto 6 cm, breadth of the basal disc unto 9 cm, length of the tentacles to about 4,5 cm.

Occurrence: Davis Strait: 65°34′ N. 54°31′ W. 68 fms. Bottom temp. 0,2 (Ingolf-Exp., St. 29), 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9° (Ingolf-Exp., St. 32), 68°20′ N. 54°03′ W. 228—280 fms. (Tjalfe-Exp. 1908).

In the neighbourhood of Bear Island 74°25′ N. 17°36′ E. 180 m (Olga-Exp., St. 49). Between Bear Island and Spitzbergen 75°40′ N. 17°10′ E. 190—200 m (Olga-Exp., St. 55), 75°31′ N. 17°50′ E. 225 m. Bottom temp. 1°6 (Norw. North.-Atl.-Exp., St. 326). 61°15′ N. 9°35′ W. 872 m (Thor-Exp., 1904, St. 99).

Behring Island, 75 fms. (Vega-Exp.).

Further distribution: North-America. Cape Cod 45 fms. (U.S. Fish Com.) 47°40′ N. 47°35′30″ W. 206 fms. (U. S. Fish Com.) (teste Verrill).

A description of this species was given by myself 1902. The following table shows the size in μ of the nematocysts and the spirocysts in some specimens.

Habitat	column	tentacles, apex		tentacles: proximal		actinopharynx
	n	*n*	*sp.*	*n*	*sp.*	
Behring Isl.	19—24 × 1,5—2	38—60 × 2,5	20 × 1,5—55 × 4(5)	24—31(30) × 2,5(3)	20 × 2—43 × 5(6)	37—47 × 3—3,5
Davis Str (Ingolf)	19—24 × 1,5	34—50 × 2,5	22 × 1,5—45 × 2,5	19—36 × 2-2,5	24 × 1,5—43 × 5	31—41 × 2,5—3,5
(Tjalfe)	—	30—53 × 2—2,5	—	24—31 × 2-2,5	—	—
Olga Exp	21—28	52—60	—	—	—	40—52

The size of the stinging capsules in the specimen from the Olga-Expedition is only approximate.

In addition to these species tentacles of a *Bolocera* species were taken during the Ingolf-Expedition at the stations 37 and 38 (60°17′ N. 54°05′ W. 1715 fms. Bottom temp. 1°4, 59°12′ N. 51°05′ W. 1870 fms. Bottom temp. 1°4). The nematocysts were considerably longer here than in very large specimens of *B. tuediae*.

In the apex of the tentacles the nematocysts show a size of 96—192 × 3,5—4,5 μ, in the proximal part 68—120 × 3,5—4 μ. Probably we have to do with a new species which provisionally may be named *B. maxima*.

Fam. *Cribrinidae s. Bunodactiidae.*

Diagnosis. Basilaria with well developed pedal disc. Column sometimes smooth, sometimes with sucking warts or ampullaceous papillae. Acrorhagi (bourses marginales) or pseudo-acrorhagi sometimes present. Sphincter strong, endodermal circumscribed. Tentacles short or of ordinary length, rarely with transversal swellings on their oral surface (*Ixalactis*). Mesenteries arranged after the number of 6, 8 or 10. Perfect mesenteries usually numerous. Acontia always absent.

The genera belonging to this family must undergo a renewed revision. It is true that Mc. Murrich (1901) has made an attempt to give a more distinct definition of the genera of this family, but his attempt seems too provisional to me. Besides, the genera cannot be definitely limited until the family has been examined more particularly as to its anatomy. In his publication (1901) Mc. Murrich comprises 12 genera, 3 of which with an interrogation mark. Of these latter *Tealiopsis* must be completely excluded as, according to my examination, it is synonymous with *Stomphia* and therefore not belonging to this family. On the systematic place of *Thelactis*[1] and *Physactis* we cannot as yet set forth any opinion, as they have not been anatomically examined. The genus *Gyractis*[2] is not identical with *Cribrina*, as Mc. Murrich thinks possible, but very likely with *Anthopleura*, and the genus *Leiotealia* must perhaps be dropped, based as it is on the presence of a smooth column, a character which it has in common with the older *Epiactis* of Verrill, as well as with *Isotealia* and partly with *Urticina*. It is, however, possible that it can be retained, but in that case the diagnosis of the genus must be altered and perhaps partly be founded on the appearance of the longitudinal muscles of the mesenteries which seem to differ from those in *Epiactis*. So far the genus must be regarded as dubious. The genus *Isotealia* is certainly a distinct genus and not synonymous with *Leiotealia*, as Hertwig does not mention the presence of any perforated pseudo-acrorhagi in the latter genus (among others). *Pseudophellia* is not identical with *Tealiopsis* which latter does not belong to this family (compare above!), but, as far as I understand, with *Epiactis*. True enough, the column of *Pseudophellia arctica*, "the type of the genus, is covered by an adherent cuticle" (Verrill), as, however, the column of the type of *Epiactis*, *E. prolifera*, which I have had the occasion to examine, is limited towards the outside by a cuticle, though a very thin one, and as it seems easily deciduous, there exists between the cuticle of *Pseudo-*

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[1] *Thelactis* is probably a *Bunodeopsis* and not belonging to the family.

[2] Unfortunately a control examination of the specimens, determined by Boveri as *Gyractis*, does not seem to be possible. I have not been able to distinguish with certainty in the Munich Museum the specimens examined by Boveri. In the collection of Dr. Ondaatje there are, however, a number of specimens externally exactly resembling Boveri's *Gyractis* — part of these specimens had been sectioned, probably by Boveri. These latter as well as the whole collection were badly preserved and the ectoderm almost in all places lost. On several specimens I could, however, find a great number of closely packed, large nematocysts in glycerine preparations of the region of the acrorhagi. This indicates that there are true acrorhagi. As besides the sphincter was circumscribed the specimens must belong to the genus *Anthopleura*. As also Boveri mentions acrorhagi ("Randbläschen") in *Gyractis*, there is no doubt that *Gyractis* is synonymous with *Anthopleura*. The absence of directive mesenteries and siphonoglyphes in *Gyractis* possibly might serve to justify the establishment of a special genus; I do, however, think that it is unnecessary, above all because I am not fully convinced that Boveri's observations concerning the mesenteries are correct. Some of the above named *Gyractis*-shaped specimens, examined by myself, were furnished with 2 pairs of directive mesenteries. As Boveri's examination of the mesenteries seems to be somewhat superficial, it will be advisable to accept with caution his statement of the absence of directive mesenteries and siphonoglyphes in the genus *Gyractis*.

phellia and that of *Epiactis* only a difference in degree, in as much as the cuticle is stronger in the former species, weaker in the latter. As *Epiactis* and *Pseudophellia* agree in other characters too, *Pseudophellia*, which is synonymous with the older *Epiactis*, may be dropped, and the type of *Pseudophellia* be called *Epiactis arctica*. *Cribrina*, *Urticina* and *Ixalactis* are, to my mind, rather well defined genera. Whether *Epigonactis* is synonymous with *Urticina* or not is, however, very dubious and cannot be decided until the genus has been subject to a careful anatomical examination — I have before (1901 p. 483) placed this genus together with *Epiactis*, and Stephenson (1918 a p. 27) was of my opinion. Finally I do not think that *Anthopleura* and *Bunodosoma*, which Mc. Murrich has placed together to a single genus, are identical. As far as I can see from Mc. Murrich's description of the verrucae of *Anthopleura xantogramma* and *A*. (*Aulactinia*) *stelloides* they are in structure like those of *Cribrina* and *Urticina* and are real suckers to which foreign bodies are attached, while the ampullaceous off-shoots in *Bunodosoma* are constructed in a different way, and, according to my examination, more in accordance with the prominence of the column of *Phymactis* and *Cystiactis*. Thus the ampullaceous off-shoots of the column of *Bunodosoma* are not suckers, but rather to be considered as weak batteries of nematocysts to which no foreign bodies are attached. Mc. Murrich (1889 p. 24) himself has emphasized this difference, but later on (1901) not made use of it for systematic purposes, in which he was mistaken, as far as I can understand.

The characters which distinguish the genera of this family from each other are first of all based on the presence of acrorhagi, further, on the occurrence or non-occurrence of real suckers and ampullaceous batteries of nematocysts on the column, on the exterior of the tentacles and the arrangement of their longitudinal muscles and of the radial muscles of the oral disc, on the distribution of the reproductive organs in the mesenteries and on the arrangement of the latter. The importance of these characters to the classification however wants further discussion.

The absence or presence of acrorhagi is no doubt a good character, as no variation occurs within the genera in this respect, but these characters are either present or absent in the respective genera. On the other hand, the systematic importance of other differentiations of the column is partly totally different. It is true that the ampullaceous papillae are characteristic of *Bunodosoma* and always present here (as in *Anthopleura* this genus is characterised through the presence of acrorhagi), but the appearance of suckers is evidently subject to variation, in as much as the same genus and the same species now have suckers, now are devoid of such. This is the case with *Urticina*. It is also possible that the below described, new genus *Cribrinopsis*, which is typically furnished with suckers, sometimes is devoid of them. The absence of discernible suckers in strongly contracted and badly preserved specimens should not, however, absolutely be interpreted as if suckers were in reality lacking, the suckers of such specimens not being easily discernible to the naked eye, not even under high magnifying powers. Thus it is only with great caution that we may use the presence or absence of sucking warts as a systematic character, as mentioned before by Mc. Murrich. In the other genera, *Cribrina* and *Anthopleura*, the occurrence of verrucae seems to be constant, while the genus *Epiactis* is always devoid of verrucae.

The longitudinal muscles of the tentacles and the radial muscles of the oral disc are now mesogloeal, now ectodermal and commonly constant in the respective genera, though also here a certain variation sometimes takes place. Concerning the former they seem to be almost exclusively mesogloeal in *Cribrinopsis*; in *Urticina* they variate, as I will show below, from ectodermal to meso-ectodermal or ecto-mesogloeal, and this even in the same species. In the other genera these muscles are ectodermal or meso-ectodermal as in *Cribrina elegantissima* and *spetsbergensis*. It is exactly the same with the radial muscles, though they are never as much enclosed in the mesogloea as the longitudinal muscles of the tentacles. Commonly they are ectodermal, in the genera *Cribrina* and *Urticina* ectodermal or meso-ectodermal, in the latter case they agree with those of *Cribrinopsis*. In *Urticina* they variate from ectodermal to meso-ectodermal in the same species.

Concerning the distribution of the reproductive organs in the older mesenteries, the genera *Isotealia* and *Urticina* differ from the other genera. In *Urticina*, according to its age, only the 6 first pairs of mesenteries, or the 10 or 20 oldest mesenteries are sterile (compare below), while in *Isotealia* the reproductive organs first appear on the mesenteries of the third cycle. The other genera have reproductive organs, as far as we know, even in the mesenteries of the first order which remain fertile.

The arrangement of the mesenteries as a genus character is of more secondary significance, as it varies considerably especially in certain genera, even in species such as *Cribrina* and *Cribrinopsis*. On the other hand the mesenteries are in the other genera more typically, hexamerously arranged, while the genus *Urticina* shows decamerism. Especially concerning the latter genus the question has been raised, whether the decamerism may be used as a genus-character. Mc. Murrich (1901 p. 21) namely declares: "to establish a genus on its decamerism seems to me .... to place it on an exceedingly insecure foundation." He founds his statement, for one, on an information by Verrill that "many *Urticina crassicornis* are hexamerous, many others decamerous, some octamerous and a few irregularly or unequally developed on opposite sides." If that really is so, the decamerism is here certainly worthless as a genus-character. At present I, however, much doubt that Verrill's identifications of the genus have always been correct. As we will see from the following it is very difficult, without the most careful investigation, to distinguish the genus *Urticina* from another genus, *Cribrinopsis*, and young specimens of *Urticina* likewise from *Cribrina*. I for my part have almost always found *Urticina* decamerous (only a single time octamerous), though irregularities occur, so that not all mesenteries of the same cycle may be developed. There is, besides, nothing astonishing in this that the arrangement of the mesenteries in an early period of its life displays a variation, as *Urticina* during its development passes through a hexamerous stage. To my mind the decamerism may be used as a genus-character to *Urticina*, though with a certain restriction. Decamerism, octomerism and hexamerism principally may be used as genus-characters. Certain genera (and species) namely have a more constant mesenterial arrangement than other genera, wherefore the arrangement is usable here as a systematic character, while other genera show so great a variation in the grouping of their mesenteries that the mesenterial arrangement is useless for systematic purposes. Of course we must leave out of consideration accidental defects of the mesenteries causing any kind of disorder to the typical arrangement. There can, for instance, be no doubt that the arrangement of the 8 "*Edwardsia*-mesenteries" is of great systematic importance, though in the Milne-Edwardsinae only 7 mesenteries exceptionally occur (p. 64 compare a similar suppression of mesenteries in a young *Peachia* p. 105). Finally it must be proved in each special case if the decamerism, the octomerism etc. is due to regeneration, in which case it is of no systematic importance, as I have before pointed out (1914 p. 63).

The identification of the Arctic and North-American Cribrinidae has till now been rather difficult. True enough, it is easy to distinguish *Cribrina stella* from other forms, though alcoholic specimens of this species have possibly been confounded in the literature with the below described *C. spetsbergensis*, but some of the other forms, especially specimens without reproductive organs, agree so well with each other that in certain cases it is almost impossible to distinguish them, if we do not make use of the dissimilarity of the nematocysts as a means of identification. Through a systematic examination of the size of the nematocysts in a great number of specimens I have, however, been able to distinguish several Cribrinids which have certainly been more or less confounded with each other by several authors, myself not excepted. After having laid a sure foundation through a study of the size of the nematocysts I have, little by little, found other characters usable as distinctive marks to the different genera and species. The importance of a closer study of the nematocysts in order to classify the Actinians — which I have several times emphasized — stands out here in the most striking manner.

Whether any of the species, mentioned below by myself, have been described before can hardly be decided as the North-American Cribrinids are more or less imperfectly known, especially as regards their nematocysts. No satisfactory answer can be given to this question, until the nematocysts of the North-American forms have been subject to closer examination.

Genus **Cribrina** Ehr. s. **Bunodactis** Verr.

Diagnosis: Cribrinidae with a well developed pedal disc. Column with suckers (verrucae), arranged in more or less distinct lines, without true acrorhagi, sometimes with pseudo-acrorhagi. Sphincter strong. Tentacles from short to of ordinary length, simple, like the mesenteries hexamerously arranged, in certain species after another number or irregularly arranged. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal, sometimes with a tendency to be a little mesogloeal. Most often 2 distinct siphonoglyphes. Numerous perfect mesenteries. Reproductive organs on the first cycle (sometimes not developed on the directive mesenteries) and on the other stronger mesenteries.

In my paper 1899 I have put forms furnished with real acrorhagi together with *Cribrina*. That is however not right, but such species as *Bunodes hermafroditica* might be referred to *Anthopleura*. Whether such species, having pseudo-acrorhagi, belong to *Cribrina* or to *Anthopleura*, is difficult to decide. Mc. Murrich refers them to *Cribrina*, and for the present I do the same, though it would perhaps be more correct to arrange them with *Anthopleura*, as the pseudo-acrorhagi may be regarded as beginning acrorhagi.

Cribrina stella (Verr.) Mc. Murr.

?*Actinia coriacea* Stimpson 1853 p. 7.

Bunodes stella n. sp. Verrill 1864 p. 16. Pl. 1 figs. 1—8. 1868 p. 258. Andres 1883 p. 447. Parker 1900 p. 752.

Bunodactis stella (Verr.) Verrill 1899 p. 43.

Cribrina stella (Verr.) Mc. Murrich 1910 p. 76 Pl. 3 figs. 6—7.

Bunodactis spectabilis Verrill 1879 a p. 15, 1879 b p. 152.

Diagnosis: Body generally cylindrical or columnar, its height often double its diameter Column with well-developed verrucae in the upper part. Tentacles 40—48. Sphincter of the palmate or mixed type. 2 siphonoglyphes. Mesenteries hexamerously arranged in 4 or 5 cycles, more numerous than the tentacles, the first two cycles perfect. Longitudinal muscles of the mesenteries well-developed, forming distinct, diffuse pennons. Parietobasilar and basilar muscles rather well developed. Nematocysts of the tentacles (17) 22—31 × 1.5 — 2.5 μ, those of the actinopharynx 24—38 × 3—4.5 μ. In the latter also nematocysts with distinct basal part to the spiral thread 24—31 × 3.5—5 μ in size. Nematocysts of the column 17—19 × 1.5 μ. Spirocysts of the tentacles from 13 × 1 μ to 31 × 2 μ.

Colour olive-green or brown, sometimes flesh-coloured. Tentacles translucent greyish or brownish with an opaque white spot at the base and a faint whitish chevron mark about half-way between the tips and the base. The disc brownish, in young individuals opaque white bands radiating towards the bases of the primary tentacles. Actinopharynx white, inside of the mouth light orange (Verrill, Mc. Murrich). Colour green (Dons).

Dimensions unto 5 cm in length in extended state (Verrill).

Occurrence: North America: New Foundland's bank 46°5′ N. 51°44′ W. 56 fms., sand, shells (Ingegerd-Gladan-Exp. 1871 J. Lindahl).

North Greenland: 25 fms. (Torell).

West Greenland: Upernivik 34 fms. (Ingegerd & Gladan-Exp. 1871), Disco fiord (The Danish Arctic station 1898), Disco bay 3—25 fms. (Holm 1886), Godhavn (Ammondsen 1872), Claushavn (Öberg 1870), Godthaab littoral (Ryder 1883), Frederikshaab (Lundbeck 1889), Nordre Stromfiord littoral (Nordmann 1911), Holstensborg (Traustedt 1892), Store Hellefiskebanke 18 fms. (Holm 1886).

East Greenland: 72°20′ N. 21°20′ W. 70 m. (Sw. Greenland-Exp. 1899), Tunok Angmagsalik 65°53′ N. (Kruuse 1902), Tasiusak 25—30 fms. (East Greenland-Exp. 1899).

Iceland: Berufiord 3 fms. littoral, Skerja fiord, littoral (A. C. Johansen 1900), Stykkisholm littoral (A. C. Johansen. 1900), Djupivogur littoral (A. C. Joh. 1900). Iceland without distinct locality.

West Spitzbergen: Smeerenberg bay 4—10 fms. (1868), Treurenberg bay 6—30 fms. (1881), Icefiord, Klas Billen bay 32—40 m (Sw. Spitzbergen-Exp. 1908), Axel Isle, Bel sound (1910).

East Spitzbergen: Lomme bay 10 fms. (Sw. Spitzbergen-Exp. 1861), Great fiord, Cap Blanck 65 m. (Römer & Schaudinn 1898 St. 5), Whales point 20—30 fms., clay (Malmgren 1864).

Norway. Finmark: Vadsö littoral (Sandeberg 1877), Porsanger fiord, littoral (Michael Sars-Exp. 1900), Nordkap (Verkrüsen 1875), Kjösen in Ulfsfiord, littoral (1861), Grötsund littoral (1861), Tromsö littoral (Kier 1902, Dons 1910, 3 m, Dons 1912), Gibostad 3 m (Dons 1912), Sorvaer (Ohlin 1890).

Kola peninsula: The Russian biological Station, Kolafiord (Derjugin 1906), Ladigano, Chewanna 30 fms. (Sandeberg 1877), Vaideguba littoral (Sandeberg 1877), Semiostrowa 50—55 fms. (Sandeberg 1877), Litsa (Sandeberg 1876), Scharetskaja (Lilljeborg 1848).

Kara Sea: Jugor Shorr off Chabarova 5—8 fms. (Vega-Exp.).

Arctic Sea of Sibiria: 20′ off Cape Jakan 12 fms. (Vega-Exp.), 2 miles north of the winter harbour of the Vega 67°4′49″ N. 173°23′2″ W. (Vega-Exp.), Behring sound 67°4′ N. 173°24′6″ W. 7—9 fms. (Vega-Exp.).

Further distribution. North America. Arctic ocean to Cape Cod (teste Parker). Cape Elisabeth Me., Eastport Me., Grand Menan N. B. in crevices of rocks near low-water mark, Cumberland Bay (teste Verrill), Passamaqvoddy Bay St. Andrews on rocks (teste Mc. Murrich). From Maine to Greenland (teste Verrill).

The anatomy of this species has been described before by Mc. Murrich (1910), wherefore I find a recapitulation unnecessary, but will add some supplementary remarks to his description.

The longitudinal muscles of the tentacles are ectodermal and resemble those of *C. spetsbergensis*, described below, the muscle folds however show no tendency here to be mesogloeal. The radial muscles of the oral disc are a little weaker and ectodermal (verified on several specimens). In 8 specimens collected from different localities, among others from Eastport, I have more closely examined the sphincter. In all specimens it was of a palmate type. In no case the secondary lamellae issue from any distinct main lamella — in a specimen from Frederikshaab there is, however, an indication of a main lamella. Now the sphincter was more broad with distinct palmate extension of the lamellae, now it was more narrow and composed of several very thin main lamellae. Mc. Murrich's figure (1910 Pl. 3 fig. 7) of the sphincter probably is not typical as it shows a pinnate appearance with a thick main lamella. In the textfigure 159 I have reproduced the sphincter of a specimen from Wales point.


Textfig. 159.
Cribrina stella.
Transverse section of sphincter.

The verrucae were commonly distinct, in some specimens (from Discofiord, Porsangerfiord and North Cape) indistinct, owing to a bad state of preservation or to a strong contraction of the column.

The number of mesenteries variates from 24 to 48 pairs, that of the tentacles in the specimens examined by myself from 40—48. The mesenteries thus are more numerous than the tentacles. The mesenteries of the last cycle are developed in the proximal part of the body and grow from here in oral direction, but do not reach the distal end of the column.

In order to show the constancy of the size of the nematocysts, I give here the following table.

Habitat	nematocysts of the tentacles	spirocysts of the tentacles	actinopharynx typical nem.	actinopharynx nem. with visible thread	number of tentacles	number of mesenterial pairs 73
Eastport	24—29 × 2 μ	18 × 1—31 × 2 μ	31—36 × 3—3,5 μ			
— (small spec.).	20—26 × 2	—31 × 2	(24 × 2)26—34 × 2,5—3,5	—	46	23 + 21
Discofiord	20—26 × 2	—	26—36 × 2—3,5		40	12 + 12
—	20—26 × 2	—	26—36 × 3—3,5		48	
Frederikshaab........	17—24 × 2	13 × 1—19? × 2	24—30 × 3—3,5			
Nordre Stromfiord ...	22—29 × 2—2,5	15 × 1—29 × 2—2,5	29—36 × 4	—	48	
Angmasalik..........	24—31 × 2—2,5	17 × 1—31 × 2	30—36 × 3,5—4,5			
Berufiord............	22—29 × 2	—	26—36 × 3	—	—	
Bell Sound	24—31 × 2(2,5)	17 × 1—31 × 2	30—38 × 3—3,5	—		—
Porsangerfiord	22—25 × 2	17 × 1—24 × 2	29—36(38) × 3,5	24—31 × 3,5—5		
Nordkap	22—26 × 2(2,5)	—24 × 2	26—31 × 3—3,5	—	—	
—	22—26 × (1,5)—2	—26 × 2	—	—	—	
Tromso	22—29 × 2	—	29—37 × 3	—	—	
—	22—29 × (1,5)2	—29 × 2	29—36 × 3	—	—	
Gibostad	(19)22—26 × (1,5)2	17 × 1—26 × 2	26—34(36) × 3(3,5)	22—24 × 3,5—5	—	—
Coast of Murman	22—26 × 2	—	31—36 × 3	—	—	—
Kola. Chewanna	24—29 × 2—2,5	—	29—35 × 3—3,5	—	—	—
Winter harbour of Vega	23—29 × 2—2,5	—	30—37 × 3—3,5	—	46	24 + 24
— — —	22—26 × 2	—	29—37 × 3—3,5	—	—	—
— — —	22—29 × 2—2,5	—	31—36 × 3	—	—	the half 22

As we see, the size of the nematocysts and the spirocysts agrees well in the different specimens. The nematocysts of the column are shorter than those of the tentacles, in five more closely examined specimens 12—14 × 1,5 μ, 12—14 × 1 μ; 18—23 × 1,5—2 μ; 17—19 × 1,5 μ, 20—23 × 2 μ.

Mc. Murrich has found embryos in the coelenteric cavity in May, I myself in June, July, August and October.

Cribrina spetsbergensis (n. sp.).

Pl. 2. Fig. 2.

Rhodactinia crassicornis (O. F. M.) var. *spetsbergensis* Carlgren 1902 p. 39, textfig. 3.
?Leiotealia spetsbergensis n. sp. Kwietniewski 1898 p. 134 (pro parte).

Diagnosis: Column with commonly rather small verrucae, at least in the upper part. Sphincter palmate or pinnate. Tentacles in variable number unto 96, thick, cylindrical, in contraction smooth or more seldom longitudinally sulcated, at most as numerous as the mesenteries, all of about equal length. Longitudinal muscles of the tentacles well-developed with in general high folds, principally ectodermal, but at the base of the folds and sometimes at their apex in small parts enclosed in the mesogloea. Radial muscles of the oral disc like the longitudinal muscles of the tentacles but more enclosed in the mesogloea. Mesenteries of variable number unto 49 pairs, commonly hexamerously but often irregularly arranged, so that not all mesenteries of the last cycle are developed. Muscles of the mesenteries strong, especially the longitudinal and the parietobasilar muscles. Reproductive organs on all the stronger mesenteries, sometimes also on the directives. Nematocysts of the tentacles (24) 26—42 × 2—3 μ, those of the actinopharynx (34) 36—53 × 3,5—5 μ, spirocysts of the tentacles (18) 22 × 1—1,5 to 53 × 2,5 μ.

Colour?

Dimensions: Specimen from Behring Sound (Pl. 2 fig. 2) in contracted state: Height 3 cm, largest breadth about 6 cm. Length of the tentacles 0,8 cm. — Specimen from New Foundland: largest breadth 7 cm, height about 3,5 cm.

Occurrence: New Foundland (Verkrüzen 1876).
Greenland without distinct locality.
Between Iceland and Faroe islands 64°07′ N. 11°12′ W. 237 fms. Temp. at the bottom 2°,5 (Ingolf-Exp. St. 4).
76°23′ N. 15°7′ E. 145 m (Olga-Exp. St. 41). 74°55′ N. 17°30′ E. 180—135 m (Olga-Exp. St. 52).
64°53′ N. 10°0′ E. 630 m. Temp. at the bottom — 0,69° (Michael Sars-Exp. 1900 St. 10).
62°35′ N. 4°4′ W. 620—640 m. Temp. at 620 m. —0°,03 (Michael Sars-Exp. 1902 St. 67).
Norway. Finmark (Kolthoff).
Behring Sound 67° N. 173° W. 9—15 fms. (Vega-Exp.).

Exterior aspect. The exterior of the body much recalls that of *Urticina.* The pedal disc is wide and the length of the column in contracted state shorter than the diameter. On the column there are longitudinal lines of verrucae, which are probably always present in the upper part. Whether the verrucae are developed also in the most proximal part of the column I cannot decide, as the specimens were strongly contracted in this region and partly not well preserved. On most specimens the verrucae were distinct. In some specimens (from the Michael Sars-Expedition and in one specimen from New Foundland the verrucae were very indistinct or inconspicuous, and it is questionable if the species sometimes is devoid of verrucae, a question, which is very difficult to answer, as it regards strongly contracted and badly preserved material. The verrucae are commonly not as large as those of *Urticina felina coriacea.* A distinct fossa is present. The tentacles are short, cylindrical, all of about the same length, smooth or sometimes with shallow to rather deep longitudinal furrows, and a little flattened in the apex. The arrangement of the tentacles probably varies considerably in the outer cycles, as the number of the tentacles (like that of the mesenteries) is very indistinct, in the inner cycles the number of 6 may be prevalent. The smallest number of tentacles was 34, possibly 36, the greatest 96. The number of tentacles corresponds to that of the mesenteries or is a little smaller. The oral disc is wide. The two siphonoglyphes are broad and furnished with well-developed aboral prolongations. The actinopharynx is long and has longitudinal folds in great numbers.

Anatomical description: The ectoderm of the column is high and contains numerous mucus-cells. The nematocysts of the column are smaller than those of the tentacles, in the specimen from Finmark the size was 17—22 × 1,5—2 μ, in the other examined specimens from four localities the size varied from 22 to 31 × 2—2,5 μ. The verrucae are of the same appearance and structure as in *Urticina felina coriacea* (compare below!). The mesogloea is thick and fibrillary with numerous, scattered, protoplasma-poor cells. The endodermal circular muscles are well developed. The structure of the sphincter is rather variable. In the most closely examined specimens it was of a palmate type, in two specimens of a pinnate one. In the textfig. 164 I have reproduced the palmate sphincter of the specimen from the Olga-Expedition St. 41. A similar sphincter is developed in the specimen from Finmark. In the specimens from the station 4 (Ingolf-Exp.), and from Greenland, in one specimen from the station 67 (Michael Sars-Exp.) and in one individuum of *Leiotealia spetsbergensis* the sphincters are of decidedly palmate type without a distinct main lamella. A pinnate sphincter with a thin main lamella is present in the reproduced specimen from Behring's Sound textfig. 163) and in a specimen from the station 25 (Michael Sars-Exp.). As transition stages between the pinnate and palmate type we may cousider the sphincters of a specimen from the station 52 (Olga-Exp.) and of an individuum from New Foundland. In the former there is a very thick main lamella, but not so long that we may regard the sphincter as palmate, in the latter the main lamella is thin at the base, but much expanded inwards and forming a thick irregular triangle. In the sphincter, reproduced on the textfig. 163, streaks of muscle meshes are seen in some places. Such mesogloeal streaks in the sphincters indicate that parts of the mesenteries have been sectioned. All endodermal sphincters as well as the endodermal muscles in common become mesogloeal at the moment when they break through the mesenteries.

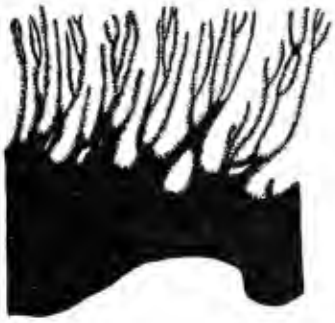


Fig. 160

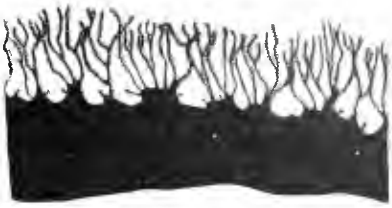


Fig. 161

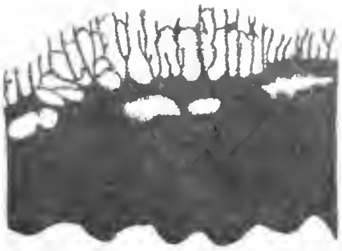


Fig. 162

Textfigs. 160—164.
Cribrina spetsbergensis.
Transverse sections of tentacles (figs. 160, 161), of oral disc (fig. 162) and of sphincters (figs. 163—164). (Fig. 160 spec. from St. 52 Olga-Exp.; figs. 161, 163 spec. from Vega-Exp.; fig. 162 spec. from St. 67 M. Sars-Exp.; fig. 164 spec. from St. 41 Olga-Expedition).

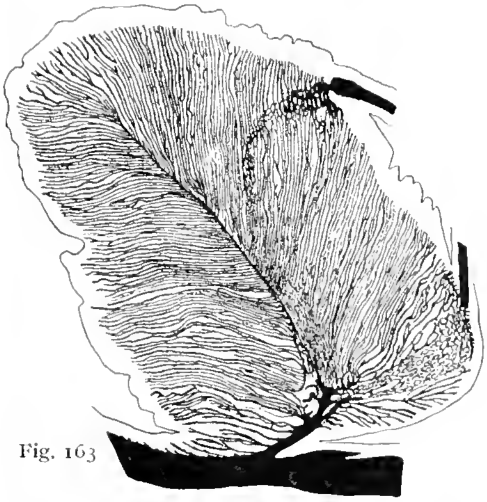


Fig. 163


Fig. 164

The ectoderm of the tentacles is high and contains numerous nematocysts and very numerous spirocysts. The size of the nematocysts in the tentacles and in the actinopharynx and of the spirocysts in the tentacles is seen from the following table, in which also the number of tentacles and pairs of mesenteries and the distribution of the reproductive organs on the directives are stated.

Habitat	Tentacles nematocysts	Tentacles spirocysts	Actinopharynx nematocysts	Number of tentacles	Number of mesenterial pairs	Distribution of the reproductive organs on the directives
New Foundland	31—38 · 2,5 μ	19 · 1,5—48 · 2 μ	36—43 · 4,5—5 μ	82	22 + 23	♂ d+
—	31—36 · 2	—	41—50 · 3,5	77	19 + 21	♂
—	29—34 · 2	24 · 1,5—53 · 2—2,5	41—48 · 3,5	96	24 + 27	♂
—	26—30 · 2	—48 · 2	41—48 · 3,5	—	23 + 24	
—	29—30 · 2	—43 · 2	36—43 · 3,5—4,5	88	22 + 23	
Ingolf-Exp. St. 4	24—31(34) · 2	—	36—46 · 4—5	34 (possibly 36)	9 + 9	♂
Finmark.............	26—36 · 2—2,5	22 · 1,5—43 · 2	38—43 · 4,5—5	36	9 + 9	♂ d+
Greenland (small sp.) .	24—29 · 2	—	34—41 · 3—3,5	—	—	—
"Michael Sars" St. 67 .	34—41 · 2,5—3	24 · 2—53 · 2,5	43—53 · 4—5	80	20 + 20	♂
— — .	31—42 · 2—2,5	24 · 1,5—53 · 2—2,5	41—49 · 4,5—5	—	16 + 16	♀ d+
— St. 10 .	27—35 · 2,5	22 · 1,5—43 × 2—2,5	38—47 · 3,5—4,5	77	19 + 21	—
Behring's strait.......	29—36 · 2,5	22 · 1,5—48 · 2—2,5	42—48 · 3,5—4	the half 40	24 + 24	♀ d+
Olga-Exp. St. 52	—	—	—	—	17 + 17	d o
"*Leiotealia*"	25—31 · 2	18 · 1—36 · 2	30—38 · 3,5—4	—	—	—

d + and *d* o = directives with and without reproductive organs.

The longitudinal muscles of the tentacles are always strong, sometimes they form very high folds. These latter are closely packed and of a palisade-shaped appearance, though they are more or less dichotomously branched. The main part of the muscles is ectodermal, here and there small parts are however enclosed in the mesogloea at the base (textfig. 160), as well as higher up on the folds (textfig. 161). I have examined specimens from all localities and all show a similar appearance of these muscles, with the exception of a specimen of Kwietniewski's *Leiotealia* (compare *Urticina felina* p. 175) which had ectodermal muscles. The muscles of the tentacles are also meso-ectodermal. The radial muscles of the oral disc in their arrangement resemble the longitudinal muscles of the tentacles. Here the folds are, however, commonly more in connection with each other in the middle part between the insertions of the mesenteries, as the textfigure 162 (St. 67) shows. At the insertions of the mesenteries the muscles are much weaker. The ectoderm of the actinopharynx contains very numerous nematocysts (compare the table).

The number of the mesenteries seems to variate considerably, as shown by the table. The smallest number in an adult individuum was 18 pairs, the largest 51 pairs. The pairs of mesenteries were besides sometimes a little more numerous on one side than on the other side. The mesenteries are evidently hexamerously arranged, though it was to be expected that with such a variable number of mesenterial pairs as 18, 32, 40 and 48 etc. (compare the table) also the cardinal number might be liable to variation. The cause of the seemingly great variation in the number of mesenteries is connected with the miscarrying of the mesenteries of the last order in certain exocoels, and sometimes with the occurrence of some other irregularities in the development. The arrangement of the mesenterial pairs in the specimen from Finmark for inst. was 6 + 6 + 6 = 18. Issuing from one pair of directives the mesenterial pairs 2, 4 and 6 of the third cycle were not developed on any side of the directive plane. The arrangement of the mesenteries in the specimen with 32 pairs (from St. 67 "Michael Sars") was 6 + 6 + 12 + 8. Of the compartments between the mesenteries of the first and second order one was typically developed with one pair of the third and 2 pairs of the fourth cycle, 5 compartments were devoid of all mesenteries of the fourth cycle, and 6 compartments contained one pair of the fourth cycle instead of two. In the specimen with 40 pairs the number of mesenterial pairs was in one half of the animal 3 + 3 + 6 + 8 = 20, in four compartments between the mesenteries of the first and second order one pair of mesenteries of the fourth cycle was wanting. The mesenteries were commonly a little more numerous than the tentacles, in individuals with a greater number of mesenteries. In a specimen with 18 pairs of mesenteries all were perfect, in specimens with numerous mesenteries at least one half or more was perfect. The longitudinal pennons are strong and recall those of *Urticina*. Especially strong pennons were developed in the specimen from Finmark. The parieto-basilar muscles are well defined, broad, and reach to the sphincter. The basilar muscles are distinct and appear clearly under magnifying powers. Oral and marginal stomata are present, the latter are small.

The reproductive organs already appear on the mesenteries of the first order. In nearly all (4) by myself examined cases the directive mesenteries were fertile, in one case sterile.

I have not found any embryos in the coelenteric cavity of this species. The material is however too small — only three specimens were female, the other examined ones male (compare the table) — for deciding whether the young develop in the coelenteric cavity or not. On the other hand, there were in a specimen from the station 67 (Michael Sars-Exp.) lots of embryos, embedded in mucus inside a circular fold below the sphincter. I cannot with certainty decide, if we have to do with a species having the embryos attached to the outside of the column as in *Epiactis prolifera*, or if lots of young have been ejected during the strong contraction of the body, when the animal was killed. Nevertheless, the circumstance that there were marks of the embryos upon the column inside the circular folds, indicating that the embryos have been fastened there, speaks for the opinion that we have to do with a species, taking care of its brood. It would besides be peculiar, if by an eventual squeezing out of the embryos during the preservation, all embryos should have been ejected; on the contrary, it was to be expected, that at least a few had been left in the interior, but this is not the case. I therefore believe that I am not erring if I suppose that *C. spetsbergensis* is a species, taking care of its brood.

Systematic remarks. This species is probably nearly related to *Cribrina elegantissima*. It is possible, that *Leiotealia spetsbergensis* may be partly identical with my species. I conclude it hence, that Kwietniewski (1898 p. 122) declares that he has found a brood-room in the most distal part of the column of a specimen. However, Kwietniewski does not mention any verrucae. Besides, *Leiotealia spetsbergensis* is not a homogeneous species (compare p. 175).

Genus **Cribrinopsis** n. gen.

Diagnosis: Cribrinidae with commonly feebly developed verrucae (or no?) on the column. Acrorhagi and pseudo-acrorhagi absent. Sphincter strong, palmate or pinnate. Tentacles simple, thick, cylindrical, short. Longitudinal muscles of the tentacles principally mesogloeal. Radial muscles of the oral disc ecto-mesogloeal. Numerous, perfect mesenteries decamerously, hexamerously, or irregularly arranged. Well developed mesenterial muscles. Reproductive organs on the mesenteries of the first cycle and on the other stronger mesenteries, often not developed on the directives. Nematocysts in the ectoderm of the tentacles and in that of the actinopharynx of about the same length.

This genus and *Urticina* are very easily confounded. They are distinguished from one another by the distribution of the reproductive organs on the mesenteries, and by the different relation of the nematocysts in the tentacles to those of the actinopharynx. If it were to be found out in future that *Urticina* in its first adultness has reproductive organs also in the mesenteries of the first cycle, which I hold improbable (compare *Urticina felina* p. 167, 168, 174), and that these reproductive organs are later on reduced, the only important difference between the two genera lies in the above named different size of the nematocysts. Under such circumstances it is possible that we must drop the above genus and place it together with *Urticina*. So far, we have every reason for preserving it.

Cribrinopsis similis n. sp.

(Pl. 3. Fig. 7).

Rhodactinia crassicornis (O. F. Müll.) pro parte Carlgren 1902 p. 39 textfig. 6.
?*Urticina crassicornis* (O. F. Müll.) and *Rhodactinia Davisii* Agas. pro parte. Auctorum.
Actinostola abyssorum Carlgr. Pax 1915.

Diagnosis: Pedal disc wide. Column at least in the upper part with verrucae (sometimes inconspicuous or not present?) Sphincter pinnate to palmate. Tentacles in larger specimens from 64 to 90, commonly almost as numerous as the mesenteries, the inner longer than the outer; thick, cylindrical or a little conical, more robust than those of *Urticina*, in contracted state irregularly wrinkled or longitudinally sulcated with numerous transversal folds. Longitudinal muscles of the tentacles very strong, mesogloeal meshes fine, radially extended. Radial muscles of the oral disc strong between the radial furrows, in the furrows feeble, mesogloeal muscles fusing into the ectodermal muscles. Mesenteries commonly decamerously, more seldom hexamerously, sometimes a little irregularly arranged. Nematocysts in the ectoderm of the tentacles 34—70 × 2—2,5 (3) μ, in that of the actinopharynx 36—67 (70) × 3,5—5 μ. Spirocysts of the tentacles of variable size from 19 × 1,5 to 67 × 3 μ.

Colour?

Dimensions: The size of some of the largest, strongly contracted specimens was the following: 1) Spec. from Ikamiut: largest breadth 9 cm, height about 3 cm, length of the inner tentacles about 1,7 cm. 2) Spec. from Behring's Sea: largest breadth 8,5 cm, height 7 cm, length of the inner tentacles 3,5 cm, that of the outer 2—2,5 cm. (The tentacles were not strongly contracted).

Occurrence: New Foundland? (The bottle, containing also several *Urticina* was labelled Greenland and New Foundland).

West Greenland. Ritenbenk 15—20 fms. (Öberg 1870) (Traustedt 1892). Godhavn 70 fms. (Torell). Claushavn 10—15 fms.; 20 fms. (Öberg 1870). Christianshaab 15—30 fms. (Öberg 1870), Ikamiut (Lohmann 1905). Egedesminde (Traustedt; Bergendal 1890). Nordre Stromfiord 14—38 m. (Nordmann St. 3 b). Sukkertoppen 15—26 fms. (Öberg 1870, Holm and others), Fiskenaes 63° N. 51°10′ W. 150 fms. (Ammondsen). Bredefiord 170—180 fms. (Rink-

Exp. 1912), Ikertokfiord 5—20 fms. (Holm 1886). St. Hellefiskebanke 18 fms. (Holm 1886). 69°46′ N. 51°22′ W. 250 fms. (Tjalfe-Exp. 1908 $^{27}{}_{7}$ St. 155).

Greenland without distinct locality.

West Spitzbergen: Treurenberg bay 6—30 fms. (Sw. Spitzbergen-Exp. 1861). Bell Sound Duyn Point 30 fms. (Sw. Spitzbergen-Exp. 1872—73), 30—40 fms. (Torell).

East Spitzbergen: Foster Isl. 40 fms. (Sw. Spitzbergen-Exp. 1861). W. Thymen strait 38 m, King Charles land between Jena and Abel islands 40 m, Bismark strait 35 m, Ryk-ys islands 60—80 m (Römer & Schaudinn 1898 St. 47, 32, 45, 49).

North Atlantic: 62°35′ N. 4°4′ W. 620 m. Temp. at the bottom —0°,03 (Michael Sars-Exp. 1902 St. 67). 62°27′ N. 13°27′ W. 150 m. Temp. at the bottom probably 4°5 (Michael Sars-Exp. 1902 St. 91 (only tentacles).

Faroe islands (Müller 1900).

Norway. Finmark. (Kolthoff).

Murman coast: 75—120 fms. ("Alexander Kowalewsky" St. 191, 218 1909, teste Pax = *Actinostola abyssorum*!). Kolafiord, without distinct locality teste Pax = *A. abyssorum*!). Kolafiord (The Russian biological station Derjugin), Chewanna 30 fms. (Sandeberg-Exp. 1877), Orafiord.

Behring Island 75 fms. (Vega-Exp. 1879).

Corea strait 65 fms. ("Store nordiske" 1890).

Exterior aspect: The pedal disc is wide. The body is, according to the state of contraction, cylindrical, conical or flattened, in contracted specimens the height of the column is commonly shorter than the diameter of the base. The column is furnished with lines of verrucae which appear more or less distinctly, according to the state of contraction. In a part of the specimens I have not been able to verify with certainty the presence of verrucae, it may be possible that such ones are sometimes lacking, which is very difficult to determine in contracted and badly preserved material, above all as the verrucae are rather small. I have, however, observed that the verrucae become inconspicuous by a strong contraction of the column. As an instance I can adduce that a specimen with very distinct, though small verrucae on a great part of its circumference shows no trace of verrucae in the remaining, strongly contracted part. If the specimen had been strongly contracted in all places, it would have been considered to be devoid of verrucae. On most specimens there were however distinct verrucae. How far they expand on the column I cannot with certainty decide. On some specimens I have observed them only in the distal part, on others the distribution of them was considerably more extensive, the most proximal part is, however, probably always devoid of such. There is a well marked fossa. Acrorhagi and pseudo-acrorhagi are wanting. The tentacles variate a little in number in the examined specimens. Excepting a small, not adult specimen with only 45 tentacles, the others had from 64 to 90 tentacles (compare the table). To judge from the grouping of the mesenteries the tentacles are commonly decamerously arranged, though a hexamerous arrangement also seems to occur. They are cylindrical or in more extended state a little conical, more robust than in *Urticina*, and in contracted state irregularly folded or longitudinally sulcated with numerous transversal folds and with a distinct opening in the apex (Pl. 3 fig. 7). The outer tentacles are considerably smaller than the inner (about half as long). At the entrance to the siphonoglyphes there are conspicuous gonidial tubercles, the siphonoglyphes are well marked and furnished with well developed aboral prolongations. The actinopharynx is long and has longitudinal folds in great numbers.

Anatomical description: The ectoderm of the column is high and contains nematocysts 17—25 × 2 μ in size, in the specimen from Finmark the nematocysts were a little longer (23—30 × 2,5 μ). The verrucae seem to be of the same structure as those of *Urticina*. The mesogloea is thick and contains rather numerous, protoplasma-poor cells. The endodermal circular muscles is rather well developed. The sphincter is strong, pinnate or palmate. Two examined species were furnished with such a sphincter, as the textfig. 165 (specimen from Finmark) shows, viz. with a strong main lamella, thickening inwards; in a specimen (from the Corea strait) the sphincter was distinctly palmate without a main lamella. A specimen from Kola, Chewanna had a sphincter with a short and thick main lamella (textfig. 166).

The ectoderm of the tentacles is high and contains numerous nematocysts, which in the apex reach a size of 34—70 × 2—2,5 (3) μ. They are of the same length as those of the actinopharynx, but the latter is considerably broader (about double as broad). The size of the nematocysts and spirocysts from part of the material is given in the following table, in which also a survey of the variation of some other organs has been included (p. 160).

The longitudinal muscles of the tentacles are very strong, almost entirely enclosed in the mesogloea, and separated from the ectoderm by a commonly thick mesogloeal lamella. Towards the ectoderm the mesogloea projects into fine, sometimes ramificating off-shoots, between these there are sometimes (always?) solitary muscle-fibrils, never forming any coherent layer. These muscles are considerably thinner than those enclosed in the mesogloea and are probably in a state of reduction. The muscle meshes are in contracted tentacles radially extended, they are sometimes rather large (textfig. 167 specimen from Finmark) but commonly densely packed together (textfig. 168). Still denser meshes may occur. The radial muscles of the oral disc are not so much enclosed in the mesogloea as the longitudinal muscles of the tentacles, but the muscles here may commonly be designated as ecto-mesogloeal. Between the insertions of the mesenteries they have commonly the appearance as the textfigure 169 shows, sometimes the meshes are smaller. At the insertions of the mesenteries the muscles are weaker and commonly not so enclosed in the mesogloea as it is in the middle part between the insertions, and here it is sometimes chiefly ectodermal. The ectoderm of the actinopharynx contains numerous nematocysts of about the same length as those of the tentacles, but in breadth they are considerably larger. The size variates between 36—67 (70) × 3,5—5 μ.

The number as well as the arrangement of the mesenteries variate. The most closely examined specimens had 40 or about 40 pairs of mesenteries decamerously arranged (10 + 10 + 20; 10 + 10 + 20 + 1). In the two largest specimens the mesenteries were hexamerously arranged, in the specimen from Behring's Sea the number of mesenteries was 46 (6 + 6 + 12 + 22), on one side all the mesenteries of the 4th cycle were developed, on the other side two mesenteries of the 4th order were lacking. In the specimen from Ikamiut the number was 55 (6 + 6 + 12 + 24 + 7 — compare the table). The arrangement of the mesenteries thus seems commonly to be decamerous, though it may happen to be hexamerous. All mesenteries were perfect in the larger specimens, in the smaller specimens the last cycle was not connected with the actinopharynx. The number of mesenteries seems sometimes to be a little smaller than that of the tentacles, which indicates that also here the mesenteries grow from the basis upwards, a rule, which perhaps holds good for all Cribrinids. The longitudinal muscles of the mesenteries recall those of *Urticina*, and the pennons appear as bands, a little but deeply folded. The parietobasilar muscles are well developed, though not as strong as in *Urticina*. The uppermost part is rather narrow, and the muscles end before reaching the region of the sphincter. The basilar muscles are well developed and discoverable to the naked eye. Oral stomata are present, sometimes also marginal stomata, the latter, however, occur anything but regularly. All mesenteries are fertile, only on the directive mesenteries they are often lacking (compare the table p. 160). The species is dioecious.

Fig. 165

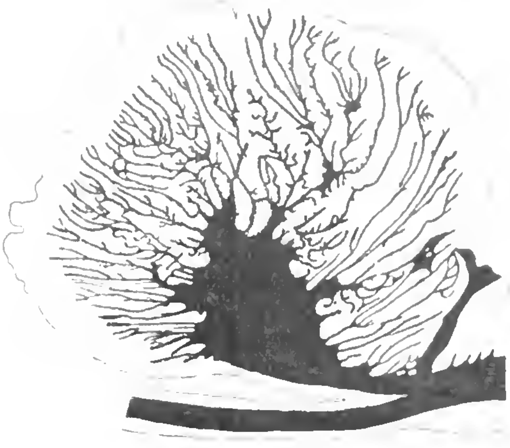


Fig. 166

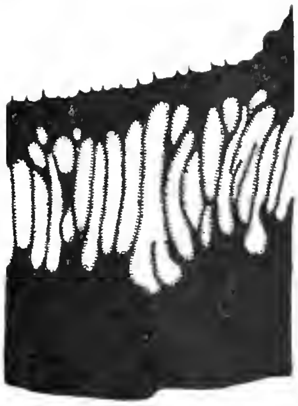


Fig. 167

Fig. 168

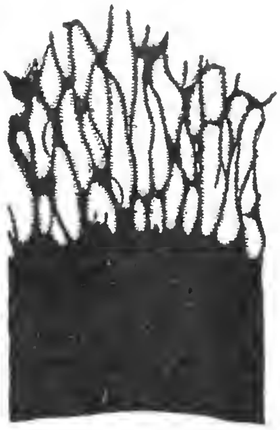


Fig. 169

Textfigs. 165–169. *Cribrinopsis similis.*
Transverse sections of sphincters (figs. 165, 166), of tentacles (figs. 167–168 and oral disc (fig. 169). (Figs. 165, 167, spec. from Finmark; fig. 166 spec. from Kola, Chewanna; fig. 169 spec. from Corea strait).

Remarks. In this specimen I have never found any embryos in the coelenteric cavity. The most closely examined specimens were however male. A specimen was a double animal, each specimen had two pairs of directive mesenteries symmetrically arranged, perpendicularly to the dividing plane.

The small fragments of the oral disc with tentacles, which **Pax** 1915 has determined as *Actinostola abyssorum*, certainly do not belong to this species but to *Cribrinopsis similis*. I have namely examined such tentacles taken in the Kola fiord (The Russian biological station) and labelled *Zoanthus* sp., and they were tentacles of *Cribrinopsis* (Pl. 3 fig. 7). The exterior aspect and the arrangement of the muscles are about the same in both species, but the size and the structure of the nematocysts are very different. I have often found such torn-off tentacles in *Cribrinopsis* from different localities.

Habitat	tentacles nematocysts	tentacles spirocysts	actinopharynx nematocysts	number of mesenterial pairs	number of tentacles	verrucae	distribution of the reproductive organ on the directives
Sukkertoppen	42—60 × 2,5(3) μ		42—53 × 3,5—4,5 μ	20+20	64	?	♀ d:o
Claushavn	43—60 × 2,5	22 × 1—1,5—53 × 2—2,5 μ	55—62 × 3,5	40	80	+	♀ d:o
Foster's islands	41—55 × 2,5	22 × 1,5—50 × 2—2,5	55—66 × 4—4,5	41	82	+	♂ d:o
Corea strait	41—53 × 2,5	19 × 1,5—50 × 2,5	41—50 × 4—4,5	20+20?	about 80	?	♀ d:o
Behring's sea	46—62 × 2,5	24 × 2—67 × 3	46—62 × 3,5—5	22+24	79	?	♂ d:+
Ritenbenk	55—67 × 2—2,5	—	48—60 × 3,5—4,5	20+21	—	+	♀ d:o
Bell Sound	46—65 × 2—2,5	—	48—58 × 4—4,5	—	78	—	—
	38—50 × 2—2,5	—	42—53 × 4—4,5	—	—	—	—
Egedesminde	50—70 × 2	22 × 1,5—50 × 2—2,5	—	—	—	—	—
Treurenberg bay	50—68 × 2—2,5		50—67 × 3,5	20+21	71	+	♂ d:?
250 fms. Torell (Locality?)	46—63 × 2—2,5	—	46—58 × 3,5—4,5	—	—	+	—
Duyn Point	48—62 × 2—2,5	—	58—67 × 4,5—5	—	—	+	—
Fiskenæs	—	—	48—60 × 4,5—5	probably decamerous	—	+	♂ d:o
Ikamiut	43—60 × 2,5—3	72 × 1,5—50 × 2	48—55 × 4,5	26+29	90	+?	♂ d:o
Greenland (without distinct locality)	43—55 × 2,5	24 × 1,5—48 × 2,5	43—55 × 4—4,5	20+21	79	?	♂ d:o
Bredefiord	49—60 × 2—2,5	—	53—58 × 5	—	—	—	—
Greenland (without distinct locality)	43—58 × 2	—	—	—	79	—	—
St. 47 (Römer & Schaudinn)	36—54 × 2—3	22 × 1,5—43? × 2,5	43—58 × 4—5	—	72	+	—
St. 32 (Römer & Schaudinn)	43—58 × 2,5	—	46—60 × 4—5	—	72	+?	—
Greenland locality?	46—55 × 2 (2,5)	—	48—55 × 4,5	—	80	+	—
Faroe islands	48—61 × 2—2,5	—	48—55 × 5	—	—	+	—
Sukkertoppen	48—55 × 2—2,5	—	49—58 × 4,5	20+20	—	+	—
–	38—52 × 2,5	—	46—60 × 4,5—5	—	—	+	—
–	46—60 × 2—2,5	—	46—58 × 4,5	—	—	+	—
Murman coast (only tentacles)	55—67 × 2	—	—	—	—	—	—
Ora fiord (small spec.)	31—43 × 2,5		—	—	—	—	—
Finmark	39—55 × 2—2,5	19 × 1,5—46 × 2—2,5	46—55 × 4—4,5	20+?	80	—	no reprod. organs
Egedesminde	43—62 × 2,5	22 × 1,5—53 × 2—2,5	48—62 × 3,5—4,5	20+20	about 78	+?	♀ d +

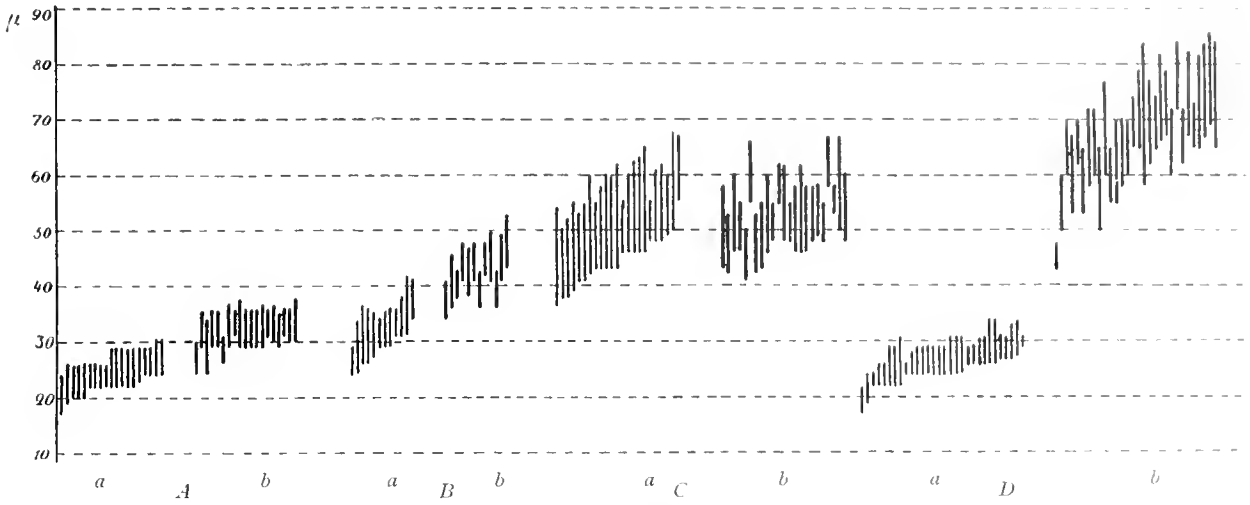
verrucae + = v. present, d +, d:o = reproductive organs on the directives present resp. absent.

Genus **Urticina** Ehr.

Diagnosis: Cribrinidae with well developed pedal disc and rather low body. Column with verrucae or without. Acrorhagi and pseudoacrorhagi absent. Sphincter strong, palmate or pinnate. Tentacles simple, thick, cylindrical, short. Longitudinal muscles of the tentacles from ectodermal to ecto-mesogloeal (mesogloeal?). Radial muscles of the oral disc from ectodermal to meso-ectodermal. Numerous perfect mesenteries decamerously (during the development hexamerously) arranged. Well developed mesenterial muscles. The six primary pairs of mesenteries always sterile. The 10 or the 20 strongest pairs mostly without reproductive organs. Nematocysts in the ectoderm of the tentacles and in that of the actinopharynx of very different size.

As before pointed out, it is very difficult to distinguish *Urticina* from some other genera, especially if the reproductive organs are lacking. The specimens provided with verrucae have certainly been confounded with specimens of *Cribrinopsis*, sometimes also with certain species of *Cribrina*, and the smooth forms with *Epiactis*- and *Leiotealia*-species. To him who has more closely examined the Northern species of these genera, the explanation of such a mistake is very simple, because these genera display a great variation in some of their anatomical characters, as is evident from the description given here. Only through a study of the stinging capsules it has become possible to lay a sure foundation for future works on this family. It has namely been proved that the stinging capsules are good characters of the species, and mostly also of the genera. In my paper of 1902, in which I have described *Rhodactinia crassicornis* and mentioned *Tealia lofotensis* and *coriacea*, I made myself liable to some mistakes because I had not examined the size of the stinging capsules at the time when I wrote my paper. I have for inst. in the description confounded *Cribrinopsis* with some *Urticina crassicornis*, not provided with reproductive organs but with embryos in the coelenteric cavity.

In order to show the difference in the size of the nematocysts of the tentacles (*a*) and of the actinopharynx (*b*) of some examined Cribrinids, I have in the textfigure 170 put together the length of the nematocysts. The size of the nematocysts in *Cribrina stella* (*A*) is measured in 19 specimens, in *Cribrina spetsbergensis* (*B*) in 12, in *Cribrinopsis similis* (*C*) in 23, and in *Urticina felina crassicornis* (*D*) in 30. The length of the lines represents the variation in μ of the length of the nematocysts in the different specimens. While the length of nematocysts in *Cribrinopsis similis* is about the same in the tentacles and in the actinopharynx, it is more or less different in the other species; the difference is especially great in *Urticina felina*. As the table shows, these species are easily identified by examinating the size of the nematocysts. I especially wish to point out how important the nematocysts may be to the systematizing, and to call the attention to the fact that the size of the nematocysts is as good a systematic character as any other.



Textfig. 170. Diagram of the size of the nematocysts in some Cribrinids (compare the text!)

Urticina felina (L.) Marenz.

Pl. 4. Figs. 1—4.

Diagnosis: Number of tentacles and mesenteries unto about 160. Tentacles in contracted state longitudinally sulcated. Nematocysts of the column smaller than those of the tentacles, those of the actinopharynx from two and a half unto three times larger than the larger nematocysts of the tentacles. Nematocysts of the column in fertile specimens partly 12—29 × 1,5—2 μ, partly 8—12 × 1 μ, very sparse, especially the latter; those of the tentacles 17—34 × 2—2,5 μ, partly 12—17 × 1—1,5 μ, the latter very sparse, those of the actinopharynx very numerous, 45—91 × 4,5—7 μ.

The genus *Urticina* now is easily distinguished from other Cribrinids by aid of the nematocysts. It is more difficult to say, whether we have to do with more than one *Urticina*-species in the Northern and Arctic seas. There is no doubt that in those seas there are different *Urticina*-forms which are certainly rather easily distinguished from each other alive, but whether these form are different species (Carlgren 1902) or variations of one and the same species (Mc. Murrich 1911) is a question. For practical reasons it is more suitable to accept the latter view, as the different forms in contracted and badly preserved state are difficult to distinguish. I, therefore, here treat the Northern and Arctic *Urticina*-forms as varieties of a single species: *Urticina felina* (L.). To my mind there are 4 varieties of this species.

1) *Urticina felina crassicornis* = *Rhodactinia davisii* Agas. = "the true *Urticina crassicornis* of the North" (Verrill 1868 p. 470 note). The column of this variety is smooth, without verrucae, the embryos develop unto a stadium with numerous tentacles in the coelenteric cavity, the tentacles are uniformly coloured or almost so. An Arctic and Boreoarctic form.
2) *Urticina felina lofotensis* = *Urticina crassicornis* f. *laevis* Carlgren in Appellof 1900 p. 4). The column is provided with very small verrucae, in contracted state often inconspicuous. The development of the embryos does not take place in the coelenteric cavity. The tentacles are furnished with more or less indistinct transverse bands, or are sometimes uniformly coloured. A large Boreal form from the littoral area, but also from deeper water.
3) *Urticina felina coriacea* = *U. coriacea* Rapp = *U. papillosa* Ehr. The verrucae of the column large. Development of the embryos probably as in the previous form. Tentacles with more or less distinct transverse bands. A Boreal-Lusitanic form of the littoral area.
4) *Urticina felina tuberculata* = *U. tuberculata* Cocks (compare Walton 1908 p. 218). Verrucae smaller than in *U. felina coriacea*. Otherwise as the former variety, but of greater size. A Boreal form from deep-water.

Of these forms *coriacea* and *tuberculata* are probably most closely related. In the review of the literature I have put them together. As the verrucae display a different appearance in different states of contraction it is sometimes difficult to determine the varieties with certainty. I have therefore added *lofotensis* to the list of occurrence of *coriacea* and *tuberculata*. The varieties, which I believe I have been able to determine with certainty, I have designated (c) = *coriacea*, (l) = *lofotensis*. The other forms from deep water are most probably *tuberculata*. I myself have seen only *coriacea* and *lofotensis* (Appellöf's specimens in Bergen, specimens from Drontheim fiord and 1 specimen in Bohuslän) in living state.

From an anatomical point of view these varieties seem to be equal, except as far as the presence or absence of verrucae is concerned. It is possible that the difference in size between the larger nematocysts of the tentacles and those of the actinopharynx is somewhat greater in *coriacea* and *tuberculata* than in *lofotensis* and *crassicornis*, but this question demands a closer examination of numerous specimens, determined in living state. Concerning the size of the larger nematocysts in the tentacles and of those in the actinopharynx it is noticeable that as a rule it increases to a certain degree simultaneously with the growth of the specimens. A smaller specimen has thus smaller nematocysts than a larger specimen, but the proportion between the size of the nematocysts in the tentacles and that of the nematocysts in the actinopharynx is retained, as the following tables clearly show.

Urticina felina coriacea & tuberculata.

Priapus felinus, Linné 1761 p. 510.

Actinia felina L., Linné 1766—68 p. 1088.

Tealia felina L., Fischer 1875 p. 1207/7).

Urticina felina (L.), Haddon 1889 p. 298.

Actinia coriacea Cuv., Rapp 1829 p. 51 Pl. 1 figs. 3, 4, Sars 1835 p. 3 Danielsen & Koren 1856 p. 87.

Cribrina coriacea Cuv., Ehrenberg 1834 p. 40.

Cereus coriaceus Milne-Edwards 1857 p. 264.

Tealia coriacea (Cuv.), Carlgren 1902 p. 43, Walton 1908 p. 219.

Actinia (*Isacmaea*) *papillosa*. *Urticina papillosa* Ehrenberg 1834 p. 33.

Cereus papillosus Milne-Edwards 1857 p. 264.

Actinia tuberculata n. sp., Cocks 1851.

Tealia tuberculata Cocks, Gosse 1860 p. 217, Cunningham 1890 p. 205 Pl. 19.

Actinia crassicornis Müll., Gosse 1853 p. 74, (*Cribrina* v. *Tealia*) Lütken 1861 p. 191. Möbius 1873 p. 100. Lenz 1882 p. 171.

Bunodes crassicornis (Müll.), Gosse 1855 p. 294, Meyer & Möbius 1862 p. 231, 1863 p. 174.

Tealia crassicornis (Müll.), Gosse 1858 p. 417, 1860 p. 209 Pl. 4 fig. 1. O. & R. Hertwig 1879 Pl. 2 figs. 2, 6, 7, 9, 12, Andres 1883 p. 415 fig. 24, Möbius 1883 p. 12, G. Y. & A. F. Dixon 1889 p. 320 Pl. 5 fig. 5, Levinsen 1893 p. 395, Mortensen 1897 p. 316, Grieg 1898 p. 6, Blegvad in Petersen 1914 p. 43.

Urticina crassicornis Ehr.! Verrill 1869 p. 469 (p. p.), (Müll.) Carlgren 1893 Pl. 1 fig. 20 textfigs. 9—13 (p. p.), Appellöf 1905 p. 83, 86, (Ehr.) Pax 1920 p. 7 figs. 3—6. ?(Müll.) Ehr. Mc. Murrich 1901 p. 28 fig. 2 Pl. 1 fig. 6.

?*Rhodactinia davisii* Agas. Verrill 1864 p. 18 (p. p.).

Tealia grenii n. sp. Wright-Perceval 1859 p. 122.

Actinia holsatica n. sp. Müller 1806 p. 23 Pl. 139.

Compare further Andres 1883 and Carlgren 1893.

Diagnosis: Compare above.

Colour of *coriacea* very variable. Column now crimson, now with green streaks and crimson flakes, now ochreous-coloured or olive-brown, now grayish. Warts gray or bluish-gray. The main colour of the tentacles is white or gray, shading off into bluish-gray or pale crimson. An opaque white band across the base of the tentacles and a broad crimson-coloured band in the middle, below and sometimes above outlined by a narrower band of opaque white colour. Sometimes these bands are indistinct. Oral disc grayish or glaucous-olive, around the inner tentacles with radial bands, now white or yellowish-white, now ochreous-coloured; between the bands the oral disc is crimson-coloured. Mouth generally with crimson or red-brown tinges. Gonidial tubercles crimson-coloured. (Gosse, Carlgren).

Dimensions: *tuberculata* in contracted state: breadth unto 9 cm, height unto about 6 cm, *coriacea* is smaller.

Occurrence: Norway. Lofoten Saltströmmen 90 fms. (*l*) (Norw. N. Atl.-Exp.), Dronthjem fiord Skarnsund 60—200 m (*l*) (Östergren, Pettersson), Beian (Huitfeld-Kaas), Florö (*c*) (Sars), Vaagsfiord (teste Grieg), Bergen, Godösund (*l*) (Nordgaard), Bergen (*l*) (Appellöf), Bergen Sölsvig (Sars), Jäderen 100 fms. (Olsson), Flekkefiord 150—200 fms. (Fjörsvaag), Farsund.

North Sea. Great Fisher Bank N. W. of Bergen 60—200 fms. (Swedish fishermen), W. N. W. of Bergen 80—170 fms. (Lambert), S. W. of Haugesund at Bergen 15—24 miles from land 100—170 fms. (Swedish fishermen), N.W. of Egersund 100 fms. (Swedish fishermen), Jydske Rev 50—200 fms. (Uddström, Nilsson and other fishermen).

Faroe Isl. (*c*) (Müller), Thorshavn (*c*).

64°27′ N. 13°27′ W. 150 m. Bottom temp. 4,5 (probably *l*) (M. Sars-Exp. 1902 St. 91).

Skagerrak 140 m (Thor-Exp. 1903), Kosterfiord N. Hellsö (*c*) (Aurivillius).

Cattegat. Bohuslän Strömmarne, Gåsöränna and other localities at a few fms. (*c*) (Carlgren and others), Bohuslän without distinct locality (B. Fries, Stuxberg), Zool. Station 1 sp. from deep water (*l*) (Carlgren), Laholm bay Kattvik 8 m (*c*) (Lönnberg); S.E. of Muldbjergene 12 m (teste Blegvad), E. of Munkegrund 40 m (teste Blegvad), $^1/_2$ $^1/_4$ miles E.N.E. of Lillegrund (teste Blegvad).

The Sound. Hellebæk (*c*) (Jungersen), off Helsingborg 20 fms. (Gunhild-Exp. 1878), Landskrona (*c*) (Örsted), N. of Hven 25 m (teste Blegvad).

Denmark. Livo Bredning (teste Blegvad), Thisted Bredning 11—12 m. (teste Blegvad), Limfiord (teste Mortensen), Samso (Lütken teste Levinsen), Isefiord Frederiksund (Feddersen teste Levinsen), Adelvig (*c*) (Lundbeck), Odensefiord Hofmansgade (*c*) (Steenstrup, Lütken), Little Belt, Strib & Faenö (*c*) (Lütken), Svendborg Sound (Steenstrup, Lütken teste Levinsen).

Baltic Sea. Kieler Bucht, Bülk (teste Meyer & Möbius) Cadetrinne 15,5 fms. (teste Möbius), Travemünde Bucht, Niendorf Haffkrug 2—9 fms. (teste Lenz), S. of Bornholm 8—9 fms. (*l*) (Mortensen 1891).

Further distribution: British Islands, English Channel, Atlantic coast of France, Vendée, Charente-Inférieure; ?Atlantic coast of N. America to Cape Cod. ?West Coast of N. America. Puget Sound Port Townsend. (The North American *Urticina* requires closer examination. Whether the real *Urticina* *felina coriacea* with large warts occurs there, seems a little doubtful to me. Besides *crassicornis*, we probably have to do with *tuberculata* or *lofotensis*).

Exterior aspect: The exterior of this form has before been described by various authors, also by myself (1893). It is not necessary to recapitulate the description here.

Anatomical description. Several authors, also I myself (1893) have described the anatomy of this form. As however several facts can be added, concerning the structure of various organs, it may be practical to make these organs subject to a reexamination.

Concerning the structure of the verrucae I have, after an examination of the maceration preparations, been able to determine the nature of "the pyriform cells", which Mc. Murrich (1889 p. 53) supposed to be "nerve ganglion cells", and on which he later (1911 p. 76) pronounced the opinion that they "may possibly be muscular in character." Already 1899 p. 11[1] I have, however, pointed out that the pyriform cells are granulous gland cells, "die in dem proximalen Theil des Ektoderms langgestreckt birnförmig sind nach aussen dagegen einen sehr feinen Ausführungsgang haben." A comparison between the ectoderm in the middle part of the verrucae, viz. the part, which in contraction is a little concave, and the ectoderm in the side-parts, with which the other ectoderm of the column agrees, shows, that the middle part is constructed in another way than the other parts of the column. The figures 1, 2, Pl. 4 show the cells occurring in the middle part after a treatment with the maceration liquid of Hertwig (osmium & acetic acid. Hertwig 1879). In the figure 1 Pl. 4 the maceration is imperfect, in as much as the cells are still joined in the distal part, while their basal parts are separated. Already here we can see that the ectoderm cells consist of elongated supporting cells and granulous gland cells, which is still more conspicuous as the cells are perfectly isolated (Fig. 2, Pl. 4). The granulous gland cells are thus the pyriform cells. They are namely swollen near the basal part of the ectoderm, while the main part forms a long efferent duct, and recall in their appearance the gland cells of the pedal disc, though the latter are more irregular (Fig. 3, Pl. 4) than the former. There is thus no doubt that the pyriform cells are gland cells. Macerative preparations of the ectoderm outside of the peculiar verrucae, viz. on the rim of the concave part and between the verrucae, show the presence of supporting cells, of nematocysts, of mucus-cells (Fig. 4 a, Pl. 4), and of granulous gland cells. These last cells, however, are of quite another structure than the gland cells of the verrucae. As we see from the figure 4 b (Pl. 4), they are shorter and broader in the distal part than in the filiform proximal part, which is devoid of granules, and a little coloured. The secretion of the pyriform cells probably is of small importance to the adhesion of foreign bodies, neither do the gland cells of the pedal disc play any essential part by the adhesion of the pedal disc.

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[1] Wassilieff (1908 p. 99) has proclaimed that in my papers of 1893 and of 1899 I have made myself guilty of an inconsequence concerning my statements of the structure of the verrucae. Concerning the nematocysts he seems to be right. In the main there are no nematocysts in the ectoderm of the verrucae, but where they are adjacent to the other ectoderm of the column, which contains nematocysts, glandcells etc., solitary nematocysts and also common gland cells may pass into the outermost part of the peculiar verrucae, while the main part of the verruca contains no nematocysts. Hence my different statement (sparse nematocysts and no such). Concerning the gland cells in the verrucae I have in my paper 1893 not been able to decide the nature of the pyriform cells, wherefore I also 1893 declared that there were no gland cells in the verrucae. The statement of Wassilieff, that the verrucae of *Cribrina japonica* have the same structure as the other ectoderm of the column, is certainly due to the sections not having hit the middle part of the verrucae. On the other hand, he describes the verrucae of *Anthopleura mc. murrichi* in the same manner as I (1899 p. 11) have described them in *Urticina* and *Condylactis cruentata*. The classification of the verrucae in "Saugwarzen" and "Klebwarzen" (Pax 1914 p. 360) does not hold good. Pax has evidently not observed my statement of 1899.

The structure of the sphincter varies from palmate to pinnate, and affords no good character neither of the species nor of the genus.

The longitudinal muscles of the tentacles are mesogloeal, as already observed by O. and R. Hertwig 1879. They, however, show a certain variation, in as much as they are now ecto-mesogloeal now meso-ectodermal. It was therefore formerly supposed that the mesogloeal tentacle muscles were characteristic of *Urticina felina coriacea*. In fact the variation is still greater, as I have in small, but sexually ripe specimens found a perfectly ectodermal longitudinal muscularity of the tentacles. I have in the textfigure 171 reproduced a transverse section of part of the tentacular muscles and the mesogloea of one of the below named specimens from Hellebæk, which certainly is a real *U. felina coriacea*. The specimen has namely well-developed verrucae, its sphincter is palmate, the mesenteries show the arrangement, characteristic of *Urticina*, and the nematocysts in the actinopharynx and tentacles agree with those of this species. For comparison I have in the textfigures 173, 174 reproduced transversal sections of two pieces of tentacles of an *Urticina* from Heligoland. On one piece we find a comparatively thin mesogloeal lamella outside of the rather fine muscle meshes, the part of the mesogloea facing the ectoderm here and there displays distinct muscles. On the other piece the comparatively few meshes are found wholly within the mesogloea; whether there are muscles to be found also on the ectodermal side, I will leave undecided, as, upon all accounts, if present they are very weak. The two latter figures have been reproduced from the same section, which shows that the variation is very great at the same level of a tentacle. The longitudinal muscles of the tentacles of *Urticina* thus vary from ectodermal to ecto-mesogloeal, possibly to wholly mesogloeal.

Fig. 171

Fig. 172

Fig. 173

Fig. 174

Textfigs. 171—174.
Urticina felina coriacea.
Figs. 171, 173, 174 Transverse sections of a part of some tentacles. Fig. 172 Transverse section of a part of the oral disc. Figs. 171, 172 spec. from Hellebæk, figs. 173, 174 spec. from Helgoland.

The radial muscles of the oral disc agree with the longitudinal muscles of the tentacles. I have before (1893) shown that they are ecto-mesogloeal or perhaps more correctly meso-ectodermal. In the textfigure 172 part of a transverse section through the oral disc of the above named specimens from Hellebæk has been reproduced. As we see, the radial muscles are ectodermal.

Thus longitudinal muscles of the tentacles and the radial muscles of the oral disc vary from ectodermal, in smaller but sexually ripe specimens, to more or less mesogloeal, in middle-sized and large specimens. In other words, the folding of the ectodermal muscle lamella into the mesogloea, or the fusion of the peripheric mesogloeal off-shoots here evidently takes place rather late. Probably we here namely have to do with two different modes of development of the mesogloeal muscles. On the section, reproduced in the textfigure 174, the rather large, at last mesogloeal meshes may gradually have passed into the mesogloea, while on the section, reproduced in the textfigure 173, the peripheric end of the mesogloeal offshoots have fused with each other, the mesogloeal lamella, separating the meshes from the ectoderm, is namely often very thin (compare the figure of *U. felina* = *crassicornis* O. F. Müll. Mc. Murrich 1911 Pl. 2, fig. 4).

Also the distribution of the reproductive organs varies. I have stated 1893 that the 10 first pairs of mesenteries of *Urticina crassicornis* (= *U. felina coriacea*) are sterile. Later on I have examined other specimens and found this statement confirmed, or that also the 10 pairs of the second order are completely or partly sterile. Mc. Murrich (1901 p. 34) declares that in *U. crassicornis* (a verrucous species from Puget Sound) the two first cycles of mesenteries are devoid of reproductive organs. In two more closely examined specimens from Hellebæk (compare above), the size of which in contracted state was 0,7 cm in height and 1 cm in breadth, but still provided with well-developed reproductive organs (testes with spermatozoa), it appeared on sections that of the older mesenteries only 6 pairs were sterile. One specimen was provided with 40 pairs of mesenteries and thus, as to the number of the mesenteries, in the stage, reproduced by Faurot (1895 p. 139). In the proximal part of the actinopharynx there were, however, 6 pairs perfect; whether in the distal part some more mesenteries are perfect, I have not examined. Faurot has shown that the decamerism of *Urticina* is due to the fact that the development of the mesenteries in the ventro-lateral compartments is retarded. Thus in the dorso-lateral and the lateral compartments there is one cycle more than in the ventro-lateral compartment. The 10 first pairs consist of 6 pairs of the first cycle and of 4 of the second (in the dorso-lateral and lateral exocoels). The 10 following pairs, alternating with the former, are formed by 2 pairs of the second order (in the ventro-lateral exocoels) and 8 pairs of the third order (in the other exocoels). The 20 following pairs have arisen as 4 pairs of the third order (ventro-laterally) and 16 pairs of the fourth order. The arrangement of the reproductive organs of the specimens was as follows. The figures indicate the different cycles, if we issue from a species with the mesenteries originally arranged after the number of 6. The decamerism of *Urticina* is namely, as above named, derived from a species with originally 6 pairs of mesenteries. The spaced out figures indicate the fertile mesenteries. *dm*: directive pairs.

dm dm
1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4 1 3 2 3 1 3 2 3 1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4

The arrangement of the mesenteries in the second specimen, having 43 pair, was the following.

dm dm
1 4 3 4 5 2 4 3 4 1 4 3 4 2 4 3 4 1 3 2 3 4 1 3 2 3 4 1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4

In this specimen two pairs of the fourth cycle (in the ventrolateral compartments) and one pair of the fifth (in a dorso-lateral compartment) are added. Here we find, that also the mesenteries of the third cycle in the ventro-lateral compartments, and 3 pairs of the fourth cycle in a primary lateral compartment, are provided with reproductive organs.

If we compare those results with the former observations, we may conclude that the position of the reproductive organs varies with the age of the animal; in the youngest specimen (an examined specimen still smaller than those mentioned above had no reproductive organs developed) the six first pairs are sterile, in older ones the 10 first pairs (the first decade) are devoid of reproductive organs, and in large specimens the sterility sets in with the 20 oldest pairs; in other words the generating region moves during the lifetime of the animal to more and more younger mesenteries, simultaneously with the increase in the number of mesenteries. A similar, though less positive case I have observed in *Allantactis parasitica*, in which the mesenteries of the second cycle sometimes are sterile. Commonly the distribution of the reproductive organs in the Actiniaria is constant or almost so, especially the forms in which the first order of mesenteries is fertile; though it is possible that sometimes such a moving of the reproductive organs takes place. I especially think of such forms as *Bolocera*, in which the distribution of the reproductive organs varies.

The size of the nematocysts is shown on the following table.

Habitat	length and breadth of the spec.		Nematocysts of the tentacles	Nematocysts of the actinopharynx	varieties
1 Skagerrak (Thor)	6,5 cm	9,5 cm	24—34 × 2—2,5 μ	74—85 × 5—6 μ	probably tuberculata
2 Jydske Rev	5	6	24—26 × 2	72—82 × 5,5—6 (7)	» »
3 Faroe Isl	—	—	25—29 × 2	67—79 × 5	coriacea
4.	4	6,5	24—26 × 2	60—79 × 5	»
5. S. W. of Bergen	4	4,5	(21)24—29 × 2 (2,5)	70—74 × 5,5	probably tuberculata
6. Gullmarfiord	2	2	17—22 × 1,5 almost 2	45—60 × 5	coriacea
7. Hellebæk	0,7	1	19—23 × 1,5 almost 2	43—55 × 4,5—5,5	»
8. Gullmarfiord	0,4	0,4	16—23 × 1,5	49—56 × 4,5—5,5	»

The specimens 1 and 6 were rather well expanded, the others much contracted. The size of the spirocysts was in the spec. 1, 24 × 1,5—50 × 2,5 μ, in the spec. 3, 22 × 1—46 × 2 μ, in the spec. 7, 14 × 1—24 × 2 μ. The nematocysts of the column were in the column of the specimen 1, 19—26 × (1,5)—2 μ, in that of the specimen 6, 12—19 × 1,5—2 μ. In the column I have also found scattered spirocysts. Smaller nematocysts than the above named I have observed in the column and in the tentacles, but they are very rare (compare *lofotensis* and *crassicornis*).

Urticina felina lofotensis.

Madoniactis lofotensis n. sp. Danielssen 1890 p. 47 Pl. 1 fig. 5 (p. p.).

Urticina crassicornis f. *laevis* Carlgren in Appellöf 1900 p. 4.

Tealia lofotensis (Dan.) Carlgren 1902 p. 42.

Rhodactinia crassicornis (Müll.) Walton 1908 p. 218, Arndt 1912 p. 124.

?*Rhodactinia davisii* Agas. Verrill 1864 p. 18 (p. p.).

?*Bolocera eques* n. sp. Gosse 1860 p. 351 Pl. 9 fig. 6.

? — — Gos. Norman 1868 p. 318, Stephenson 1918 b p. 112.

Diagnosis: Compare p. 162.

Colour: Column and pedal disc yellowish-red with dark-red partly stripes and partly patches. Tentacles transparent, pale yellowish-red with 1 to 2 broad, red annuli besides the one at the base. Oral disc rose-coloured with fine, red folds, issuing from a red annulus round the mouth and extending towards the tentacles, where they form a bright-red annulus (*Madoniactis* Danielssen). Column dirty-yellow, brownish or brown-red, sometimes with red or reddish, longitudinal spots. Tentacles sometimes uncoloured, sometimes dirty-yellow, brownish or brown-red, frequently with more or less distinct, paler or darker transverse bands, sometimes the tentacles are crimson-coloured (*U. crassicornis* f. *laevis* Appellöf). Compare also Walton 1908 p. 218—219.

Dimensions in contracted state unto about 5,5 cm broad and 2,5 cm high.

Occurrence, compare *U. felina coriacea.*

Exterior aspect. The type-specimen, dredged by Danielssen, was much contracted in oral-aboral direction. Therefore I cannot decide, whether the column is furnished with small verrucae or not, but Danielssen declares that there are such. Besides, the description of the species, given by Danielssen, has been compilated also from *Metridium senile* (*dianthus*) (compare Carlgren 1902 p. 42). Appellöf's specimens (Appellöf 1900 p. 4) as also those collected by Nordgaard, are provided with small verrucae. In the not sexually ripe specimen, dredged by Mortensen S. of Bornholm, I cannot see any verrucae by aid of a magnifier, but on the sections there are scattered excavations in the column, indicating the presence of small verrucae. Therefore I think that this specimen is forma *lofotensis* and not *crassicornis.*


Fig. 175


Fig. 176

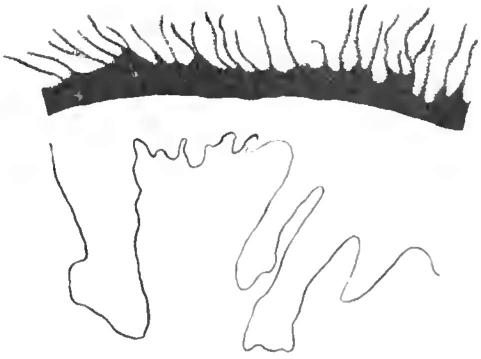


Fig. 177

Textfigs. 175—177. *Urticina felina lofotensis* from Bornholm. Transverse sections of the sphincter (fig. 175) of a part of the oral disc (fig. 176) and of a part of a tentacle (fig. 177).

Anatomical description: Concerning the anatomy of this form I have not much to say. Small specimens agree with such of *U. felina coriacea*, in as much as the longitudinal muscles of the tentacles and the radial muscles of the oral disc are ectodermal (textfig. 176, 177). The sphincter of the Bornholm-specimen (fig. 175) differs somewhat from the typical appearance of the sphincter of *Urticina*. The size of the nematocysts (*n*) and spirocysts (*sp*) of some specimens I have given below.

Habitat	length and breadth of the specimens		column *n*	tentacles *n*	tentacles *sp*	actinopharynx *n*
Saltstrommen (type)	1,5 cm	5 cm	20—23 × almost 2 μ	24—29 × 2—2,5 μ	45 × 2,5 μ	62—77 × 5—6 μ
Bergen (Appellöf)	2,5	5	22—26 × about 2	26—31 × 2—2,5		60—80 × 5—5,5
Bornholm	0,3	2,2 × 1,5	17—22 × almost 2	22—26 × almost 2	17—[illegible] × 2	43—55 × 5
Drontheim fiord	2,5	5,5	19—24 × almost 2	24—29 × 2	—	70—82 × 6—7

In the column of all species I have found also smaller nematocysts, 7—12 × 1,5 μ. The nematocysts of the column are sparse, especially the smaller ones. Scattered spirocysts are also observed in the column. In the tentacles I have sometimes observed smaller nematocysts of about the same size as those of *U. felina crassicornis.*

Urticina felina crassicornis.

Actinia crassicornis n. sp. Müller 1776 p. 231, Fabricius 1780 p. 348, 1797 p. 52, Lütken 1875 p. 186.
Urticina crassicornis Ehr.! Verrill 1868 p. 469, 1885 p. 534 (p. p.), Müll. Carlgren 1893 p. 58 (p. p.), 1901 p. 470 fig. 2 a, b.
Rhodactinia crassicornis Müll., Carlgren 1902 p. 40 figs. 4, 5 (p. p.).
— *davisii* n. sp. Agassiz 1847 p. 677.
— — Agas. Verrill 1863 p. 57, 1864 p. 18 Pl. 1 fig. 9 (p. p.), Agassiz 1865, 1871 p. 13 fig. 10, Packard 1865 p. 263, ? Pax 1915.
Urticina (Rhodactinia, Tealia) davisii Agas. Carlgren 1916 p. 1.
Tealia davisii Agas. Breitfuss 1904 p. 6, Carlgren 1905 p. 511 fig. 1.
— *crassicornis* (Müll.) Parker 1900 p. 752 (p. p.).
Tealia sp.? Carlgren 1893 b p. 213.
Leiotealia spetsbergensis n. sp. Kwietniewski 1896 p. 134 (p. p.).
Actinia obtruncata n. sp. Stimpson 1853 p. 7.
Actinia (?) *felina* L. Milne-Edwards 1857 p. 242.
Urticina felina L. Marenzeller 1877 p. 23, Stuxberg 1886 p. 163, 186, Mc. Murrich 1911 p. 65 Pl. 1, 2, 3 fig. 1.
Bolocera tuediae Johns. Aurivillius 1886 p. 52.

Diagnosis: Compare p. 162.

Colour: Column uniformly red or else with a ground colour of pale red or yellowish, upon which were closely set, irregular blotches and streaks of carmine, so that the general effect was that of a brilliant carmine. Tentacles of a beautiful translucent pink, sometimes uniform throughout, in other cases deepening somewhat in tone at the tips and also at about the middle, where an indistinct band occurred. At the base each tentacle was surrounded by a pair of deeper pink streaks, which were prolonged some distance upon the disc. Oral disc pink in colour, peristome dotted and streaked with crimson, gonidial angles flesh-coloured (Mc. Murrich). Column red, oral disc pale, tentacles chestnut-brown with pale apex. Column orange-red (spec. from Recherche bay). Pale red or reddish yellow (Römer & Schaudinn St. 46).

Dimensions: The largest examined specimens (from the Kara Sea) was about 3,5 cm high and 8 cm broad at the base.

Occurrence: North America. New Foundland 46°5′ N. 51°44′ W., 45°5′ N. 51°49′ W. 56 fms. 45°53′ N. 51°56′ W., 46°6′ N. 52°3′ W. 46—50 fms. (Ingegerd & Gladan-Exp.). George's Bank 42°23′ N. 60°23′ W. 141 fms. (Albatross-Exp. 1883). Eastport, Maine.

West-Greenland. Upernivik (Kraul 1909); Sakrak Vaigattet (Traustedt 1892). Discofiord Middlefiord 100—200 fms. (Ingegerd & Gladan-Exp.). 69°29′ N. 55°26′ W. 116 fms. (Tjalfe-Exp. St. 179 1908). Jacobshavn (Ryder 1892). Claushavn 20 fms. Fortune bay 12—25 fms. (Öberg 1870). Nordre Strømfiord 325—330 m. Bottom temp. —0,1, Salinity 3°7 (temp. + 3) (Nordmann 1911 St. 3 a). Store Hellefiskebanke (Holm 1887). Holstensborg (Ingegerd & Gladan-Exp. 1871, Holm). Godthaab 100 fms. (Ammondsen). Bredefiord 24—100 m (Rink-Exp. 1912). Kvanefiord 290—400 m, 34—40 m (Rink-Exp. 1912 St. 12, 13). 69°46′ N. 51°22′ W. 250 fms. (Tjalfe-Exp. 1908 $^{27}/_{7}$).

East-Greenland. The sound between Maatten and Renskær 25—30 fms. (Danmark-Exp. 1898). Angmasalik (Søren Nielsen 1901), Locality? (Ryder 1892 $^{16}/_{3}$).

Jan Mayen. 70—90 fms. (Michael Sars-Exp. 1900); 100 m. Bottom temperature —0,4 (Michael Sars-Exp. 1900 St. 25); 55 fms. (Søren Jensen).

Iceland. Berufiord 63°17′,5 N. 17°39′ W. 87 fms. (Beskytteren, Johansen 1905). Vestmannö (Sæmundsson). 64°27′ N. 13°27′ W.

West-Spitzbergen. Low Isl. 16 fms. (Sw. Spitzberg-Exp. 1861); 80° N. 17°5′ E. 40 fms. (Sw. Spitzberg-Exp. 1861). Treurenberg bay 6—30 fms. (Sw. Spitzberg-Exp. 1861). Danish Gat 20—30 m (Wulff 1899). King's bay 200 fms. (Sw. Spitzberg-Exp. 1861), Bell Sound 30—40 fms. (Torell) 3—35 fms. (Sw. Spitzberg-Exp. 1873). Icefiord: Save harbour 20—40 fms. (Malmgren 1864). Entrance to Dickson bay 14—44 m (Sw. Spitzberg-Exp. 1908). Recherche bay 20—30 fms. (Klinckowström), 0—20 m (Sw. Spitzberg-Exp. 1898), off Fox's glacier 75—90 m (Sw. Spitzberg-Exp. 1898), 77°30′ N. 14°36′ E. 30—40 m (Sw. Spitzberg-Exp. 1898).

East-Spitzbergen. Foster Isl. 40 fms. (Sw. Spitzberg-Exp. 1861). Waygat Isl. (Sw. Spitzberg-Exp. 1861). Bismarck strait 78°58′5 N. 20°35′ E. 35 m. Unicorn bay 78°40′ N. 21°31′ E. 60 m (Römer & Schaudinn St. 45, 46). Whales point 20—30 fms. (Malmgren 1864). Devee Bay 12—15 fms. (Kükenthal & Walter). Entrance to Devee bay 77°23′ N. 21°20′ E. 28 m (Römer & Schaudinn St. 8). Wolter Thymen strait 30—40 fms. (Malmgren 1864). 78°14′ N. 21°45′ E. (Römer & Schaudinn St. 47). Ryk-Yse Isl. 77°49′ N. 25°12′ E. 60—80 m (Römer & Schaudinn St. 49). King Charles Land between Jena and Abel Islands 40 m (Römer & Schaudinn St. 32).

North Atlantic. 64°53′ N. 10° E. 600 m. Bottom temp. —0,69° (Michael Sars-Exp. 1910 St. 10).

Norway. Finmark. Kvaenangen (Aurivillius). Ögsfiord 100 m. Bottom temp. 2,1° (Nordgaard). Kvalsund 20 fms. (Sw. Spitzberg-Exp. 1861). Grötsund 70 fms. (Goës & Malmgren). Grötsund Finkroken low-water stand (Sw. Spitzberg-Exp. 1861). Ulfsfiord. Kjösen low-water stand (Sw. Spitzberg-Exp. 1861). Vardö.

Kola peninsula. Ladigino. 66°36′5 N. 41°23′ E. 65 m. Kildin Sound 69°21′ N. 34°5′ E. 86 m (Römer & Schaudinn St. 56, 59). W. of Kolgujew 69°14′ N. 46°39′30 E. 62 m (Andrei Perwoswanny-Exp.). Chewanna 30 fms. (Sandeberg 1877).

Kara Sea. 49 fms. (Dijmphna-Exp.).

Arctic Sea of Siberia. 69°32′ N. 177° 41′ E. (Vega-Exp.). 67°7′ N. 173°24′ W. 9—15 fms. (Vega-Exp.). 2 miles N. of the winter-harbour of the Vega 12 fms. N. N. W. of the winter-harbour of the Vega 12 fms. (Vega-Exp.).

Behring's Sea. Behring Isl. 65—75 fms. (Vega-Exp.); 65°14′ N. 168°35′ W. 29 fms. (Vega-Exp.); 62°39′ N. 177°5′ W. 55 fms. (Vega-Exp.)

Further distribution: Arctic America to Cape Cod (teste Verrill. This statement needs confirmation). George's and Brown's Banks (teste Verrill). Passammoqvoddy Bay (teste Mc. Murrich). Grand Menan (teste Stimpson). Labrador (teste Packard). Murman Sea 79°5′ N. 61°23′ E. 203 m (teste Marenzeller)? Olenja Guba. ?Pala Guba (teste Pax).

This form, "the true *Urticina crassicornis* of the north" (Verrill 1868 p. 470) has undoubtedly been described by Mc. Murrich 1911. I have not much to add to the description given by Mc. Murrich. The column of all specimens was smooth without verrucae. Only in one specimen (from Recherche Bay) the column was provided with spots, recalling contracted verrucae. A nearer examination of these formations, however, showed that they were not verrucae but probably only pigment spots. Like Mc. Murrich I have found that the longitudinal muscles of the tentacles are sometimes ectodermal. In a small specimen, examined by myself, the longitudinal muscles of the tentacles, as well as the radial muscles of the oral disc, were ectodermal. The greatest number of the tentacles was about 160, that of the pairs of mesenteries 83 (in a specimen from the Tjalfe-Expedition). The number of mesenteries was sometimes different in both sides of the directive plane (compare the table). Concerning the distribution of the reproductive organs I cannot decide whether the same mesenteries as in *U. felina coriacea* are fertile. In a specimen from Greenland there are probably 10 primary pairs of mesenteries sterile. Commonly the 20 first pairs are sterile, in the specimen with 83 pairs of mesenteries the reproductive organs were probably present only on the mesenteries of the fourth cycle (compare Mc. Murrich 1911 p. 73). Thus it is probable that the generating region moves during the lifetime of the animal as in *U. felina coriacea*. In many specimens there were numerous embryos in the coelenteric cavity.

The following table shows the size of the spirocysts and nematocysts in a series of specimen and also some other statements.

Habitat	Tentacles			Actinopharynx nematocysts	Pairs of mesenteries	Number of tentacles	Distribution of the reproductive organs	[illegible]
	nematocysts		spirocysts					
Eastport	24—29 × 2 μ	12—17 · 1 μ	. .	65 71 · 5 μ	20 22	. .	. . .	+ present
»	24—31 × 2-2,5	. .	. . .	58 84 · 5	. .	. .	. . .	. .
»	24—28 × 2	. .	. .	60 77	.	. .	. . .	. .
New Foundland	26—31 × 2(2,5)	. .	to 55 · 2,5 μ	72 84 · 6-7	. .	. .	. . .	. .
Greenland (without distinct locality)	26—29 · 2	12—14 · 1	22 × 1—48 · 2	66—82 · 5	20?	. .	10? primary sterile	o
» »	26—29(34) × 2	. .	. .	62—72 × 5-5,5	. .	110	no reprod. org. small spec.	o
» »	24—26 × 2,5	. .	. . .	50—65 · 5	. .	. .		o
» (Tjalfe-Exp. 250 fms.)	26—31 · 2	.	19 · 1,5—53 · 2,5	60—72 · 5	40 · 43	. .	probably only on the mesenteries of the last cycle	o
» Kvanefiord	22—29 × 2-2,5	. .	. . .	53—65 × 5	36 · ?	. .		o
» » (290—320 m)	22—26 × 2,5	. .	—55 · 2,5	53—67 · 5-5,5	.	. .		. .
» Angmasalik	. . .	.	. .	53—77 · 5	.	. .		+
» Claushavn (young, height 0,15 cm, breadth 0,3 cm	17—22 × 1,5	. .	. . .	43—48 · 4-4,5	.	. .	no reprod. org.	
» Hellefiskebanke	22-29(31) · 2-2,5	. .	. . .	60—72 · 5	. .	. .		+
» (Nordm. St. 3 a)	24—29 · 2	14 · 1	. .	65—70 · 5	. .	. .		. .
» »	26—29 · 2-2,5	. .	. .	67—70 · 5	20 · 18	. .	♀ 10 · 10 ster.	o
» 62°29′ N 55°26′ W.	22—26 · 2,5	. .	22 · 1,5—43 · 2,5	62—70 · 5-5,5	. .	. .		. .
N. E. Greenland Renskær	. . .	. .	. . .	55—67 · 5-5,5	. .	. .		. .
Jan Mayen	27—31 × 2	. .	. . .	65—73 · 5	. .	. .		+
»	24—31 · 2-2,5	17 × 1,5	22 · 1—53 · 2,5	62—77 · 5-6	. .	. .		. .
Iceland Berufiord	22—24 × 2	. .	—43 × 2,5	60—70 · 4,5-5	. .	. .		+
64°27′ N 13°27′ W	27—34 × 2	. .	. . .	79—86 · 6	. .	. .		. .
Spitzbergen (Leiotealia spetsberg.)	24—29 · 2	. .	22 · 1—48 · 2,5	55—70 · 4,5-5,5	. .	. .		. .
» Recherche bay	27—31 · 2	12 14 · 1	—46 · 2	65—82 · 4,5-5,5	20 · 21	82		o
Kola peninsula (Chewanna)	24—29 × 2	. .	. .	60—70 · 5-6	. .	. .		. .
Kara Sea	26—31 · 2,5	14—17 · 1,5	. .	65—84 · 5-5,5	40 · ?	150—160	♀ 10 · 10 ster.	o
»	27—33 · 2,5	. .	24 × 1,5—60 × 2-2,5	67—84 · 4,5-5	42 · ?	about 160	♀ 10 · 10 ster	o
»	26—34 × (2)2,5	. .	24 · 1,5—58 · 2-2,5	67 82 4,5-5	40 · ?	. .		o
»	22—29 × 2	. .	. . .	58—72 · 5	. .	. .		. .
»	. . .	. .	. . .	60—72 · 5	. .	. .		. .
» (very large specimen)	—36 · 2,5	. .	—65 · 2,5	77 91 · 5,6	40 · 40	. .	10 · 10 sterile.	. .
2 miles N of the winter-harbour of the Vega	24—29 × 2-2,5	.	. .	58—70 · 5	. .	. .		
62°39′ N 177,5° W.	24—31 · 2,5	. .	. . .	65—74 · 4,5-5,5	38	80		+
Norway. North Cape (small spec.)	19—25 · 1,5-2	. .	—41 2,5	50—60 · 4,5-5	. .	. .		.
Norway Finmark	. . .	. .	. . .	60—72 · 5				
» Vardö	24—26 × 2	. .	. .	67 77 5-6	. .	. .		

Urticina felina crassicornis × Cribrinopsis (or Cribrina)?

Dimensions in strongly contracted state: height 2,2 cm, largest breadth 5 cm.

Occurrence: Greenland without distinct locality, 1 sp.

In a bottle, containing, among others, *Urticina felina crassicornis* and *Cribrinopsis similis,* I found a specimen, which I must for the present consider as a hybrid between these two nearly allied genera, or possibly between *Urticina* and *Cribrina.* In most characters it agrees with *Urticina felina crassicornis.* The column was devoid of sucking warts. The nematocysts in the ectoderm of the tentacles were 25—31 × (2) 2,5 μ, in the actinopharynx 58—67 × 5 μ. The spirocysts of the tentacles variated from 22 × 1—1,5 μ to 48 × 2,5 μ. The longitudinal muscles of the tentacles and the radial muscles of the oral disc were of the same appearance as in *Urticina.* The sphincter was palmate (without a distinct main lamella). The pairs of mesenteries were 10 + 10 + 16 = 36. Among the pairs of the last cycle two on each side of the directive plane were not developed. On one side the pairs 1 and 9 were wanting, on the other the pairs 8 and 9. In the lower part of the actinopharynx 10 pairs were perfect, more distally 20 pairs; the mesenteries of the last cycle almost reached the actinopharynx. In the coelenteric cavity there were numerous embryos. The mesenteries contained numerous small eggs and such were present also on the mesenteries of the first and second cycles, which I have verified also on sections. The distribution of the reproductive organs thus agrees with that in *Cribrinopsis* and *Cribrina,* but not with that in *Urticina.* In this last genus the first 10, or in very large specimens the 20 oldest pairs namely commonly are sterile; in small specimens of *U. felina coriacea* I have found only the six first pairs to be without reproductive organs (compare *Urticina felina coriacea*). As the specimen was comparatively large, I think that it is difficult to consider it as a pure *Urticina.* An *Urticina* of the same size as our specimen has namely at least the 10 first pairs of mesenteries sterile. It is true that in certain genera, as in *Urticina,* a displacement in the appearance of the reproductive organs takes place, so that with the increasing age of the animal a cycle of mesenteries, which was fertile in young individuals, becomes sterile in older ones, in other words, the reproductive organs appear in older individuals in a later cycle than in younger ones, but I have never observed that a species beginning by developing the reproductive organs on the mesenteries of the first cycle afterwards loses this capacity, so that in a later reproductive period the fertility appears first on the mesenteries of the second cycle. I also think that a hybridisation between *Urticina* and *Cribrina* or *Cribinopsis* may be admitted, as the species occur together (compare p. 156).

Genus **Epiactis** Verr.

Diagnosis: Cribrinidae with smooth column, without warts, acrorhagi and pseudoacrorhagi. Column with (or without?) a cuticle. Tentacles simple, cylindrical or conical, short. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Mesenteries hexamerously arranged (always?). Reproductive organs found on the mesenteries of the first cycle and on the other stronger mesenteries.

The diagnosis given by Stephenson (1918 a p. 24) of the genus is too comprehensive, as, according to that formation, the genus *Isotealia,* as well as *Urticina felina crassicornis,* and possibly certain specimens of *Cribrinopsis similis,* may be arranged into the genus. Therefore I have set up a new, somewhat more distinct diagnosis, by which also the genus *Pseudophellia* Verr. may be included (compare p. 145—146). Concerning the species placed by Stephenson with *Epiactis*, the systematic position of some of them is questionable, and *E. fecunda*, *dubia*, *badia* and *nymphaea* are only provisionally to be referred to *Epiactis*. According to me, *E.* (*Leiotealia*) *spetsbergensis* must be dropped, as this species includes at least two, possibly a few more, species, belonging to different genera. I have before put forth, that *L. spetsbergensis* perhaps for the greater part is an *Urticina felina crassicornis*. Sections through the tentacles of some specimens and a closer examination of part of a specimen clearly show that we have to do with this species. The longitudinal muscles of the tentacles were namely principally mesogloeal, the distal end of the primary folds are fused together, so that a thin band of mesogloea is formed next to the ectoderm (the sections recall the figure 4 Pl. 2, given by Mc. Murrich 1911). The nematocysts also agree with those of *Urticina*. The description, given by Kwietniewski, of a specimen — or maybe compiled from several specimens — indicates that the species is heterogeneous, which I am able to confirm after having examined another specimen. This specimen possibly may be a *Cribrina spetsbergensis*, though the sucking warts seem to be absent (compare this species p. 155). I have before (1901 p. 43) suggested, that *Leiotealia* might be identical with *Epiactis*(?) *fecunda* — an opinion, which I based principally on the presence of a broodroom in a specimen of Kwietniewski's species, and on the absence of sucking warts. This suggestion however, requires, confirmation. On all accounts, Kwietniewski's species contains at least two species, belonging to two different genera. Under such circumstances I prefer to abolish *Leiotealia spetsbergensis*.

Among the Arctic Cribrinids I have found 4 species: *Epiactis marsupialis* Carlgr., *E. arctica* (Verr.), *E. nordmanni* n. sp. and *E. incerta* n. sp.

Epiactis marsupialis Carlgr.

Epiactis marsupialis n. sp. Carlgren 1901 p. 482.

Diagnosis: Column in contracted state generally conical, the height often twice the diameter of the body. Column with a slightly developed cuticle; with distinct fossa. Sphincter generally of palmate type, strong. Tentacles conical, not or slightly longitudinally furrowed, in number to about 48 (6+6+12+24). Gonidial tubercles distinct. Actinopharynx long with about 24 longitudinal furrows and two well developed siphonoglyphes with rather well developed aboral prolongations. Mesenteries in three cycles (6 + 6 + 12 pairs), often more numerous than the tentacles, most of them perfect. Longitudinal muscles of the mesenteries well developed, broad. Parieto-basilar muscles very strong, reaching at most to the sphincter. Basilar muscles rather strong. Oral and sometimes marginal stomata present. Dioecious. 6 symmetrically placed pairs of the last cycle smaller than the others of the same cycle, without reproductive organs and mostly without filaments. The embryos develop in excavated pits on the outside of the aboral part of the column. Nematocysts in the ectoderm of the column 22—32 × 2,5—3 μ, in the tentacles 18—26 × about 2 (1,5—2,5) μ, in the actinopharynx 24—34(35) × 3—4,5 μ. Spirocysts of the tentacles from (14) 17 × 1—31 × 2,5 μ.

Colour in alcohol: Tentacles pale rose-red (1 spec.). The ectoderm of the column was brownish.

Dimensions: The strongly contracted, in 1901 reproduced specimen, furnished with brood-pits, had a length of 1,8 cm, its largest breadth was 2,2 cm. Two other specimens were 3 cm resp. 1,4 long and 1,7 cm resp. 0,7 cm broad.

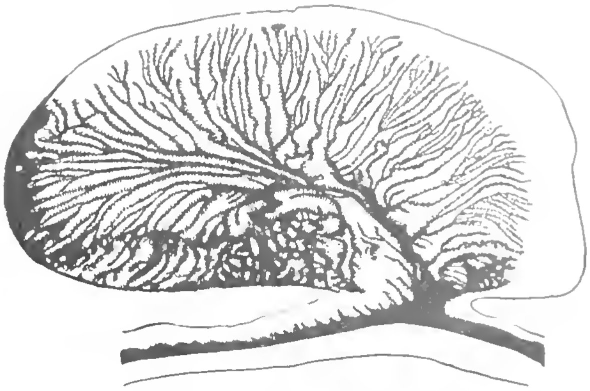
Occurrence: Arctic sea of Sibiria. 20° E. off Cape Jakan 12 fms. Sand and clay with stones (Vega-Exp.), 67°7′ N. 173°24′ W. 9—15 fms. mud and stones (Vega-Exp.), 2 miles N. of the winter station of the Vega 12 fms. sand (Vega-Exp.).

Exterior aspect. The column was in contracted state generally conical, its length was often twice its breadth; the single specimen with extended tentacles was elongated, cylindrical. The pedal disc was as a rule a little involved and radially sulcated. The column was quite smooth in some expanded specimens, in others furnished with longitudinal and transversal ridges, and devoid of sucking warts, acrorhagi and pseudoacrorhagi. Its ectoderm is furnished with a weak cuticle, sometimes a little incrusted, and which seems easily deciduous (compare below). In three specimens (from Cape Jakan) there are brood-rooms developed in the lower part of the column (compare Carlgren 1901), in the other specimens, among which there were some females, no brood-rooms appear. The fossa is distinct. The tentacles were short, strongly contracted and conical, about as long as broad, in one specimen more elongated, the outer tentacles a little shorter than the inner ones. Their surface was in preserved state smooth or weakly sulcated. They were hexamerously arranged, and the number in the examined species variates between 35 and 47 (35, 36, 41, 41, 43, 43, 44, 45, 47). The number of the tentacles was, as a rule, smaller than that of the mesenteries, in other words, the mesenteries grow forth from below upwards. The actinopharynx was long and furnished with about 24 longitudinal furrows and ridges. The 2 symmetrically placed siphonoglyphes were broad, in the upper part with 2 distinct gonidial tubercles, aborally a little prolongated.

Anatomical description. The ectoderm of the column is high and contains numerous nematocysts like that of the tentacles and the actinopharynx. The nematocysts of the column are longer and a little broader than those of the tentacles, as the following table shows.

	column nematocysts	tentacles nematocysts	tentacles spirocysts	actinopharynx nematocysts
Sp. 1 from Cape Jakan	24—31 × 2,5—3 μ	19—22 × 2(2,5) μ	14 × 1—20 × 2 μ	20—34 × 3—3,5 μ
- 2		22—26 × 2	17 × 1—29 × 2	20—34 × 3—3,5
- 3		18—24 × (1,5) 2	17 × 1—27 × 2	20—34 × 3—3,5
- 4	26—31 × 2,5—3	19—24 × 2—2,5	16 × 1—31 × 2	24—31 × 3,5—4,5
- 5	24—31 × 2,5	20—23 × 2	26 × 2	20—34 × 3—3,5
- 6		19—23 × 2	—	—
- 7 67°7′ N		19—24 × 1,5—2	17 × 1—29 × 2,5	24—34 × (2,5)—3,5
- 8	26—32 × 2,5	19—25 × 1,5—2	17 × 1—28 × 2,5	25—32 × 3—3,5
- 9 the winter station of Vega	22—29 × 2,5	19—22 × 1,5	—	—
- 10		(17)19—22 × 1,5—2	—	26—35 × 3—3,5

The homogeneous gland-cells of the column are very numerous, the granulous gland-cells fewer. The ectoderm of the column is furnished with a weak, easily deciduous cuticle. In some specimens it is lost, in the type-specimens there were fragment of a cuticle incrusted with foreign bodies; the cuticle appears most distinctly in the brood-rooms, from where it was not easily rubbed off. The mesogloea is rather thick and contains small protoplasma-poor cells. The endodermal circular muscles were very well-developed and the folds of the muscle layer ramificated. The sphincter was strong, of palmate type; in one examined specimen the sphincter was proximally furnished with a main lamella which, however, soon became branched (textfig. 178, transverse section of the sphincter), in another specimen there was no main lamella in the sphincter. The longitudinal muscles of the tentacles and the radial muscles of the oral disc are ectodermal, but the folds are rather low and only take up a small part of the height of the ectoderm. The folds are arranged like palisades, and at the insertions of the mesenteries on the oral disc considerably weaker and not as closely packed as in the middle parts. The ectoderm of the actinopharynx is very high in the ridges, in the furrows considerably lower.



Textfig. 178. *Epiactis marsupialis*. Transverse section of sphincter.

The mesenteries were in 5 examined specimens 48 (6 + 6 + 12 pairs). The pairs of the third cycle were unequally developed. 6 pairs were strong, perfect and had well-developed reproductive organs and filaments, the other 6 pairs were weak, imperfect, in certain cases not reaching to the tentacular region, were devoid of reproductive organs and generally also of filaments. The six weaker pairs were in all specimens likewise arranged. If we use numbers to designate the different cycles of mesenteries and begin with the one directive pair (*dm*), the weaker pairs (designated by spaced out figures) were grouped in the following manner:

$$\overset{\text{dm}}{1}\ 3\ 2\ \mathbf{3}\ 1\ 3\ 2\ \mathbf{3}\ 1\ 3\ 2\ \mathbf{3}\ \overset{\text{dm}}{1}\ \mathbf{3}\ 2\ 3\ 1\ \mathbf{3}\ 2\ 3\ 1\ \mathbf{3}\ 2\ 3$$

In the largest specimen (with 47 tentacles) the weaker pairs of the third cycle were in the distal part furnished with small filaments. Therefore it is possible that these mesenteries in still older specimens obtain longer filaments and perhaps also reproductive organs. All the stronger mesenteries were perfect. The mesenteries of the first cycle were coalesced with the actinopharynx to a larger extent than the mesenteries of the second order, the mesenteries of the third cycle were the least expanded on the actinopharynx. The longitudinal muscles form rather strong pennons with folds of about equal height. The parieto-basilar muscles were very broad in the proximal part and almost reach the sphincter. Oral stomata and sometimes marginal stomata were present, probably the latter are not permanent. The species is dioecious. All the stronger mesenteries are fertile. The ova are very large and rich in yolk. Of 9 examined specimens 3 were males and 6 females, 3 of the latter were furnished with brood-rooms.

Epiactis arctica (Verr.).

Pl. 3, Figs. 8—10. Pl. 4, Fig. 9.

Phellia arctica n. sp. Verrill 1868 p. 328. 1868 p. 490. Andres 1883 p. 342.

Pseudophellia arctica Verr. Verrill 1899 p. 376 textfig. 34.

Diagnosis: Column elongated, covered with a well-developed but easily deciduous cuticle, and sprinkled with spots of special structure. Fossa distinct. Sphincter of palmate or palmate-pinnate type. Tentacles conical, not or slightly longitudinally furrowed, in numbers from 31—38 (6 + 6 + 12 + an imperfect 4th cycle). Gonidial tubercles distinct. Actinopharynx long with at least 24 longitudinal ridges and two well-developed siphonoglyphes with no aboral prolongations or with short ones. Mesenteries in those cycles (6 + 6 + 12 pairs) more numerous than the tentacles. Longitudinal muscle-pennons rather strong, broad. Parietobasilar muscles very strong almost reaching the sphincter. Oral stomata but no marginal stomata. Dioecious. 6 symmetrically placed pairs of the mesenteries of the last cycle without filaments and reproductive organs. The embryos develop in excavated pits on the outside of the aboral part of the column. Nematocysts in the ectoderm of the column 29—37 × 2,5—3 μ, in the tentacles 24—30×2—2,5 μ, in the actinopharynx (26)29—36 × 3—3,5 μ. Spirocysts of the tentacles 19 × 1 μ to 34 × 2,5 μ.

Colour in alcohol: In a specimen the ectoderm of the column was dark brown especially in the distal part, and sprinkled with small white spots. Another specimen was more light brown, and a third in the distal part dark brown (in the proximal part the ectoderm was lost). The ectoderm of the column in the other specimens was uncoloured, here and there fragments of darker parts (cuticle?) were however present.

Dimensions: A specimen, the column of which was much expanded, measured in height and breadth 3 cm. The largest specimen with involved tentacles and of a cylindrical-conical appearance was 3,4 cm long and 2 cm broad. The smallest specimen with visible tentacles was 2,1 cm long and 0,9 cm broad.

Occurrence: 64°53′ N. 10°0′ W. 630 m. Temp. at 600 m — 0,69 (Michael Sars-Exp. 1900).
Arctic ocean north of Behring's strait 30 fms. (North Pac. expl.-Exp.—teste Verrill).

Exterior aspect. Of the 10 specimens three were comparatively slightly contracted. Their column was cylindrical and their tentacles unfolded. Four specimens were strongly expanded, their breadth and height about equal, the form of the others was like a drawn-out cone. The pedal disc was well-developed. The column was in the contracted specimen often a little longitudinally wrinkled. In a specimen, the colour of which was the best preserved, there were small, light, irregularly scattered spots, the largest spots appeared in the distal part, though also there they were almost inconspicuous to the naked eye; the smallest spots, scattered between the larger, and especially very numerous in the lower part of the column, were only conspicuous under strong magnifying powers. Traces of such spots were present also in another specimen. Some of the others show fragments of a thick cuticle (compare below). Near the base of an expanded specimen there were several large circular spots reaching those I have observed in a specimen of *E. marsupialis*. In this species the spots were certainly marks of embryos, having evidently passed some time upon the parent after emigrating from their brood-rooms. From this I conclude that also this specimen of *E. arctica* has been furnished with brood-rooms. The fossa was distinct. The tentacles were conically drawn out, between 31 and 38 in number, hexamerously arranged, the last cycle was imperfect. Commonly they were smooth, sometimes a little longitudinally sulcated. The number of the tentacles was smaller than that of the mesenteries. The actinopharynx was long and furnished with at least 24 longitudinal ridges, sometimes more. The two symmetrically placed siphonoglyphes show distinct gonidial tubercles, I am not able to find any perspicuous aboral prolongations.

Anatomical description: The ectoderm of the column is high and contains very numerous nematocysts, which are longer than those of the actinopharynx. Their size variates between 29—37 × 2,5-3 μ. In a specimen I found a capsule, 43 × 4,5 μ in size. The above named small spots on the column of the best preserved specimen display another structure than the other parts of the body-wall. They are built up mainly of supporting cells (Pl. 4 fig. 9), here and there a granulous gland cell was observed: on the other hand, there were no nematocysts, excepting in the rim of the spots, where they are, however, very rare. In the other part of the columnar ectoderm, the nematocysts, as well as the gland cells, were numerous. Of the gland cells some, the fewer, were more homogeneous, the others, the more numerous, contained a multitude of small brownish granulae. Whether the latter, which often reach a considerable size, are gland-cells of the same kind as the former, but in a different state of secretion, I cannot with certainty decide. Possibly the circumstance that I have not observed any such in the unpigmented specimens, speaks in favour of this suggestion, though I hardly believe this to be the case. In the unpigmented specimens the homogeneous gland-cells were, however, numerous, but the ectoderm of these specimens was not as well preserved as in the specimens with spots. As above mentioned, there were in some specimens fragments of a cuticle which is evidently easily deciduous. The cuticle seems to be very thick but incompact and cracked, and not of typical appearance. The mesogloea of the column is thick and contains rather sparse protoplasma-poor cells. The endodermal circular muscles are very well developed and form high, delicate, ramificated folds; in the region of the sphincter the muscle layer is weaker. The sphincter is strong and of a somewhat variable type. In a specimen it was on transverse sections round and distinctly palmate without a main lamella, and with a tendency (on some sections) to form meshes, in two other specimens it was compressed and of variable structure in different sections of the same specimen, now there was no distinct main lamella but rather several longitudinal lamellae in the middle of the sphincter, now these latter were fusing in the middle part, or finally the sphincter was almost palmate. If a main lamella was present, it was always more weakly developed at the base than in the middle part (textfig. 179 from the specimen with spots). The ectoderm of the tentacles was very high with numerous nematocysts 24—30 × 2 (2,5) μ and numerous spirocysts, 19 × 1 μ to 34 × 2,5 μ in size. The longitudinal muscles of the tentacles (textfig. 180 transverse section of a part of tentacle from Michael Sars-Exp. St. 10) were ectodermal with rather high folds, in transverse sections often of a palisade-shaped appearance. In the apex the folds were often a little branched. The structure of the radial muscles in the oral disc is the same as that of the longitudinal muscles of the tentacles; the folds were, however, lower here, and so was the ectoderm. The ectoderm of the actinopharynx was, in the ridges, very high and contained very closely packed nematocysts, (26)29—36 × 3—3,5 μ in size, in the furrows considerably lower and with sparser nematocysts. The size of the nematocysts and spirocysts in four specimens was as follows (p. 181).

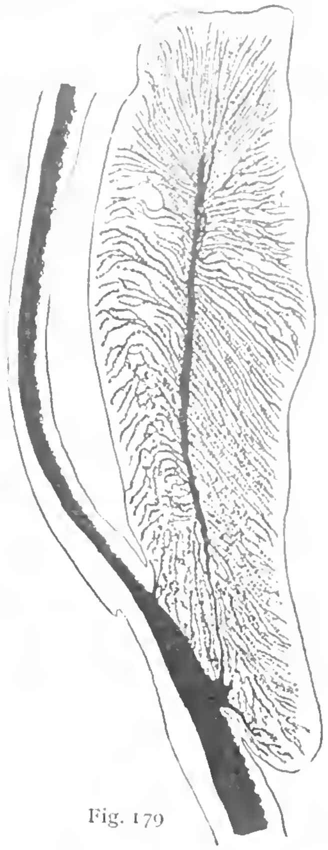


Fig. 179

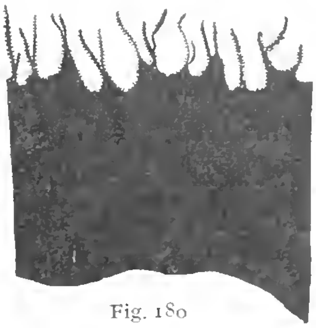


Fig. 180

Textfigs. 179—180.
Epiactis arctica.
Transverse section of sphincter (fig. 179) and of part of a tentacle (fig. 180).

The pairs of mesenteries were in 5 examined specimens 24 (6 + 6 + 12). The mesenteries of the third cycle showed the same differentiation as in *E. marsupialis*, in as much as half the pairs had reproductive

Size of the body	Nematocysts of the column	Tentacles nematocysts	Tentacles spirocysts	Nematocysts of the actinopharynx	Number of tentacles
Sp. 1. length 2,7 cm. breadth 1,7 cm . .	31—37 × 2,5—3 μ	25—30 × 2—2,5 μ	19 × 1—32 × 2,5 μ	29—36 × 3,5 μ	—
- 2. — 3 - — 3 - . .	29—36 × 2,5—3	26—30 × 2	19 × 1—31 × 2,5	(26)29—35 × 3—3,5	36
- 3. — 2,1 - — 0,9 - . .	31—37 × 2,5—3	24—27 × 2	19 × 1—34 × 2,5	31—36 × 3—3,5	31
- 4. — 3,1 - — 1,7 - . .	30—36 × 2,5—3	24—30 × 2	19 × 1—34 × 2,5	29—34 × 3—3,5	38

organs and filaments, the other half none. The latter occupied the same place as in *E. marsupialis*. The mesenteries with filaments commonly were perfect, the mesenteries of the third cycle, however, did not always reach the actinopharynx, which may be concluded from the number of tentacles. The longitudinal pennons commonly were broad with palisade-shaped, rather high folds. The parietobasilar and the basilar muscles were like those of *E. marsupialis*. Oral stomata were present; I have not observed any marginal stomata. Three examined specimens were females, two males.

The above description is based on the material from the expedition of "Michael Sars".

Systematic remarks. I have, though with some hesitation, identified this species with Verrill's *Pseudophellia arctica*, especially on account of Verrill's description of the cuticle ("thick and soft") and the presence of brood-rooms in the proximal part of the body. Verrill, however, declares that his species has a greater number of mesenteries ("24 perfect pairs with a few imperfect ones"). Still Verrill's description is rather imperfect. A control examination of the mesenteries, as well as a study of the nematocysts, are necessary, to decide whether Verrill's species is identical with the species, described here.

The species is very nearly allied to *E. marsupialis*, and I was at first inclined to place them together. On account of the different appearance of the cuticle in both species, in *marsupialis* it is thin and solid, in *arctica* thick and soft, and of the greater length of the nematocysts in the column in *arctica*, I think that they are not identical. The above named nematocysts of *E. arctica* are namely also in small specimens shorter than those of *E. marsupialis*. Also in some other characters the species seem to disagree. The species described below is also nearly related to both these species, from which it differs by a regular development of the mesenteries of the third cycle.

Epiactis nordmanni n. sp.

Diagnosis: Column in contracted state conical, in height surpassing the diameter of the body. Column without a cuticle(?). Fossa distinct. Sphincter palmate. Tentacles conical, rather small, not or slightly longitudinally sulcated, 48 in number, hexamerously arranged. Actinopharynx long, with about 24 longitudinal ridges and two well developed siphonoglyphes with distinct gonidial tubercles, but without aboral prolongations. Pairs of mesenteries 24, all perfect in three cycles. Longitudinal muscle pennons of the mesenteries rather strong, broad, the muscle folds of uniform breadth. Parietobasilar muscles strong, almost reaching the sphincter. Oral stomata present but no marginal stomata. Dioecious. All mesenteries with reproductive organs and filaments. Nematocysts in the ectoderm of the column 26—31 × 2,5 μ, in the tentacles 22—26 × 2 μ, in the actinopharynx 31—36 × 3—3,5 μ. Spirocysts of the tentacles 19 × 1—24 × 1,5 μ.

Colour in alcohol: Column olive-brown, tentacles pale salmon-coloured.

Dimensions: Length of the column 2,2 cm, largest breadth 1,2 cm. Length of the tentacles about 0,4 cm.

Occurrence: Greenland. Nordre Stromfjord, 325—330 m. Temperature at the bottom − 0,1 (Nordmann 1911 St. 3 a) 1 sp.

Exterior aspect: The form of the body is the same as in the former species. The single specimen was a little contracted, one part of the tentacles was however conspicuous. The column was a little longitudinally wrinkled, the fossa was deep. The tentacles were 48, hexamerously arranged, as many as the mesenteries, and all of about equal length, the inner, however, thicker, conical. Their surface was smooth or indistinctly longitudinally sulcated. The oral disc was inconsiderable, the actinopharynx long with distinct siphonoglyphes, having well developed gonidial tubercles, but no aboral prolongations.

Anatomical description. The ectoderm of the column is rather high and contains numerous nematocysts, finely-grained gland-cells and sparser mucus-cells. Concerning the size of the nematocysts and spirocysts, compare above. I have not observed any cuticle, nor any of the spots on the column, which are present in *E. arctica*. The mesogloea is thicker than the ectoderm, the endodermal circular muscles strong, and recall those of the former species. The sphincter is palmate and much recalls the reproduced sphincter of *E. arctica* but is devoid of a main lamella and, on account of the contraction, a little compressed. The longitudinal muscles of the tentacles and the radial muscles of the oral disc agree with those of the former species.

The pairs of mesenteries are 48 in number (6 + 6 + 12). All the mesenteries of the third cycle were of about the same size and had well-developed filaments and reproductive organs. All mesenteries are perfect. The longitudinal pennons were somewhat broad, with rather high folds, all of about the same length. The parieto basilar and basilar muscles are not different from those of *E. arctica*. The specimen was a male, with well developed reproductive organs.

Systematic remarks. The species is distinguished from *E. marsupialis* and *arctica* by the consistency of the column, and by all the mesenteries of the third cycle being equally developed. The tentacles are also a little more numerous, and the size of the nematocysts of the column differing from that of *E. arctica*. As the specimen was considerably smaller than the larger specimens of *E. arctica* and *marsupialis*, but nevertheless had all the mesenteries of the third cycle equally developed and furnished with filaments and reproductive organs, I think that it may be a particular species. It is most nearly allied to *E. marsupialis*.

Epiactis incerta n. sp.

Diagnosis: Column not elongated, without a cuticle and particularly differentiated spots. Fossa distinct. Sphincter strong, palmate. Tentacles from conical to cylindrical, rather broad, smooth, 28 in number. Actinopharynx sulcated with two siphonoglyphes. Pairs of mesenteries 14 $(6+4+4;\ \overset{\mathrm{dm}}{1}321321\overset{\mathrm{dm}}{1}123123)$. Longitudinal muscle pennons very strong with high and concentrated folds. Parieto-basilar muscles very strong, almost reaching the sphincter. Oral stomata and marginal stomata present. Dioecious. Nematocysts in the ectoderm of the column 24—31 × 2—2,5 μ, in the tentacles 22—26 × 2 μ (also smaller 15—17 × 1,5 μ), in the actinopharynx 36—46 × 3,5—4,5 μ. Spirocysts of the tentacles 19 × 1,5—36 × 2 μ.

Colour?

Dimensions in contracted state: length and breadth about 2,2 cm.

Occurrence: 20′ E. off Cape Jakan 12 fms. Sand and clay with stones (Vega-Exp.) 1 sp. Together with *E. marsupialis.*

Exterior aspect. The pedal disc is well developed and the column smooth, without spots. The fossa is deep, the tentacles from conical to cylindrical, smooth and rather thick, in number probably as many as the mesenteries. Only about 20 tentacles were, however, perspicuous, but as I have observed some involved tentacles in the weakest compartments, I think that the number of tentacles and mesenteries is the same. Concerning the appearance of the actinopharynx I cannot give any perfect informations, as it was very contracted and badly preserved, and partly in a mess with the reproductive organs. It is, however, distinctly longitudinally sulcated.

Anatomical description: The ectoderm of the column is high and contains numerous mucus-cells and nematocysts (size compare the diagnosis). The mesogloea is thick, and the endodermal circular muscles much weaker than those of the former species. The sphincter is of a decidedly palmate type (textfig. 182), on transverse sections round and well-developed. The ectoderm of the tentacles is high, the nematocysts and the spirocysts (compare the diagnosis) numerous. Their longitudinal muscles (textfig. 181) are strong, and recall those of *Cribrina spetsbergensis*, but are ectodermal; there is but rarely a mesogloeal mesh at the base of the muscle folds. The radial muscles of the oral disc are weaker, especially at the insertions of the mesenteries. Here the muscles seem to show a tendency to become mesogloeal, whereas they are ectodermal between the mesenteries. The nematocysts of the actinopharynx are numerous (size compare above). The ectoderm and also the endoderm of the siphonoglyphes are very high, an ectodermal longitudinal muscle layer is present.

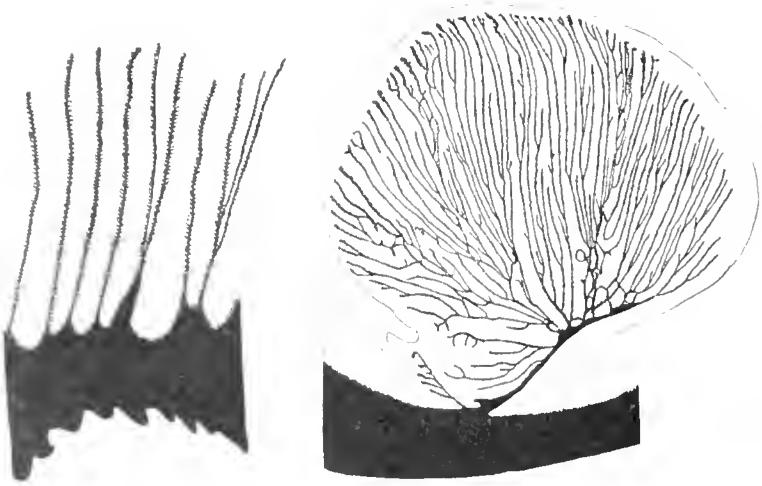


Fig 181

Fig. 182

Textfigs. 181, 182. *Epiactis incerta.* Transverse sections of part of a tentacle (fig. 181) and of the sphincter (fig. 182).

The mesenteries are hexamerously arranged, though even at the origin of the second cycle the development of certain pairs of mesenteries is checked. If we mark with figures the different cycles of mesenteries and begin with the one directive pair (*dm*), the arrangement is the following.

$$\overset{\text{dm}}{1}\ 3\ 2\ 1\ 3\ 2\ 1\ \overset{\text{dm}}{1}\ 1\ 2\ 3\ 1\ 2\ 3 = 14 \text{ pairs } (6+4+4).$$

The pairs thus were equally checked on both sides of the directive plane. In two primary exocoels, one on each side of the one directive pair, there are no mesenteries of the second and third cycles, and in the other primary exocoels the mesenteries of the third cycle are present only in the exocoels of the second order next to the other directive pair. Supposing that the mesenteries are developed according to the same rule as in *Urticina*, the ventro-lateral mesenteries of the second cycle are absent, and among the mesenteries of the third cycle only the dorsal pairs in the primary dorso-lateral and lateral compartments are developed. All mesenteries seem to be perfect; possibly one or other pair of the third cycle may be imperfect, but I cannot decide this, because of the bad preservation of the specimen. The longitudinal muscle pennons are strong, the folds are very high and palisade-shaped, the main folds often have small secondary folds, issuing from both sides. The parietobasilar muscles are strong and recall those of the former species. Oral and marginal stomata are present, though not large. The single specimen was a female with numerous, very large ova. The mesenteries of the first and second order incl. the directives were fertile, on the microscopically examined mesenteries of the third cycle I have not observed any reproductive organs. All mesenteries are furnished with filaments, most weakly developed on the mesenteries of the third cycle.

Systematic remarks. This species is most nearly related to *E. marsupialis* and *arctica*, because of the arrangement of the mesenteries. I think that it is a distinct species, as also the nematocysts of the actinopharynx differ from those of the former species.

Fam. *Paractiidae*.

Diagnosis: Basilaria with a commonly smooth, rarely tuberculated column, which is devoid of sucking warts (present in "*Tealidium*" *cinctum?*) and acrorhagi. Sphincter weak or strong, always mesogloeal. Tentacles commonly short, on the outside of the base often bulbous, sometimes (in *Anthosactis* and *Tealidium*) with a stinging battery in the same place. Mesenteries now typically arranged, but sometimes after another cardinal number than 6, with both mesenteries in the same pair of the younger cycles either equivalent or differently developed, now arisen bilaterally only in 12 exocoels, when the 24-mesenteries stadium has been reached. Always without acontia.

The following genera have been placed in this family by various authors:

Actinernus Verr.
Actinostola Verr.
Alloactis Verr.
Ammophilactis Verr.
Antholoba R. Hertw.
Anthosactis Dan.
Antiparactis Verr.
Archactis Verr.
Raphactis Verr.
Sicyonis R. Hertw.
Aulorchis R. Hertw.
Cymbactis Mc. Murr.
Hormosoma Steph.
Kadosactis Dan.
Kyathactis Dan.
Lilliella Steph.
Marsupifer Carlgr.
Ophiodiscus R. Hertw.
Stomphia Gosse.
Synanthus Verr.
Paractinia Andr.
Paractis M. Edw.
Paranthus Andr.
Parantheoides Carlgr.
Phelliomorpha Carlgr.
Phelliopsis Verr.
Pycnanthus Mc. Murr.
Polysiphonia R. Hertw.
Tealidium R. Hertw.

The new genera I have proposed are:

Epiparactis Carlg.
Parasicyonis Carlgr.
Synsicyonis Carlgr.

Some of the old genera are imperfectly known, some others do not belong to the family, and still others are to be regarded as synonyms. It is, therefore, necessary to discuss the genera more closely.

Actinernus: I have (1918) shown that the type *A. nobilis* Verr. belongs to the Halcuriidae = Endocoelactiidae. For *A. saginatus* (Verr.), *plebeius* (Mc. Murr.) and *aurelia* (Steph.), which are really Paractids, we must establish a new genus[1].

Actinostola (type *A. callosa* Verr.) is a good genus, characterized by various authors and treated also in this paper.

Alloactis (type *A. excavata* (R. Hertw.)) is a synonym for *Anthosactis* and must be dropped (compare *Anthosactis* p. 191).

Ammophilactis (type *A. rapiformis* Les.). The diagnosis, given by Verrill (1899 p. 213), shows that the genus is different from *Paranthus*. "The reduced and feeble base" possibly indicates that the genus does not belong to this family but to the Halcampidae. A closer examination is desirable.

Antholoba (type *A. reticulata* Couthony = *achates* (Drayton)) is a good genus and characterized by Hertwig (1882), Carlgren (1898) and Mc. Murrich (1904).

Anthosactis (type *A. jan mayeni* Dan.) is a distinct genus and easily identified (compare this paper).

Antiparactis (type *A. lineolata* (Dana? Mc. Murr.) = *dubia* n. nom. Verrill (1899 p. 212)). Concerning this genus compare the genus *Pycnanthus* in this work, where a diagnosis of the genus is given.

Archactis Verr. (type *A. perdix* (Verr.)) Verrill has (1899 p. 209) proposed this genus for *Urticina perdix*. I have had the occasion to examine a specimen of this species, which the "Riksmuseum" in Stockholm has received from the United States National Museum, wherefore I can supply the statements of Verrill concerning its organisation. In fact, it agrees very well with Antholoba. The sphincter is reticular and very long in both genera, the longitudinal muscles of the tentacles are weak and ectodermal in *Archactis* as well as in *Antholoba*, in the latter genus with a little tendency to be ecto-mesogloeal in their basal parts. The radial muscles of the disc are of a similar appearance in both genera and are ecto-mesogloeal (I wrote 1898 p. 29 that these muscles are mesogloeal in *Antholoba*, it is more correct to designate them as ecto-mesogloeal). The whole organisation of both species is the same; the appearance of the column, the undulated disc, the numerous small tentacles and mesenteries, of which a great deal are perfect, the muscles of the mesenteries, all agree. I have stated 1898 that the mesenteries of the first to the third orders are sterile in *Antholoba*. As far as I can see, the fertile mesenteries only begin, also in *Archactis*, on the mesenteries of the fourth order (on the other hand Verrill declares that all mesenteries in *A. perdix*, belonging to the first five cycles except the directives, are fertile). Thus I think that *A. perdix* is an *Antholoba*.

The nematocysts of the column of this species were 19—26 × about 2 μ, those of the tentacles partly 14—19 × 1 μ, partly 24—29 × 1,5 μ, partly 29—34 × 2,5 μ, those of the actinopharynx partly 14—17 × 1 (1,5) μ, partly 24—30 × 2,5 μ. The spirocysts of the tentacles were 19 × 1,5 μ to 38 × 2,5 μ.

Aulorchis (type *A. paradoxa* R. Hertw.) belonging, according to Hertwig, to his family Liponemidae. The exterior of this genus, the number and structure of the tentacles (the suppositional weak development of these latter is certainly connected with their being more strongly contracted and more badly preserved than in *Sicyonis crassa*), the structure of the oral disc and the appearance of the siphonoglyphes agree with the corresponding facts in *Sicyonis*. Hertwig has not been able to determine how the mesenteries are grouped,

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[1] Stephenson (1920 b p. 540) called this new genus *Actinoscypha*.

but he adds that he is convinced that they are hexamerously arranged. The peculiarity of this genus should be that "the generative organs are modified into a single tube perforating the oral lip". Hertwig's description of this tube is, however, founded on an examination of bad material and makes the impression that an abnormal formation was present. Though it is difficult to decide its nature on basis of the observations of Hertwig, I will, however, give as my opinion that the genital tube has arisen by regeneration and probably represents an additional actinopharynx, developed in a reproductive region (compare Carlgren 1904 p. 11—12). The whole formation is, however, so peculiar that a closer examination of it is necessary, before Hertwig's statement can be accepted. Disregarding this formation, I think that it is possible to place *Aulorchis* in the vicinity of *Parasicyonis* or *Sicyonis*.

Cymbactis (type *C. faeculenta* Mc. Murr.). The description of the type (Mc. Murrich 1893 p. 174) is in some respects incomplete. Still I think that we have to do with a distinct genus, characterized as follows:

Paractiidae with well developed basal disc and thick crateriform body, with smooth, in contracted state rugose, column which is devoid of tubercles and acrorhagi. Sphincter muscle relatively weak, placed close to the endoderm. Margin tentaculate, not lobed. Tentacles short, acuminate and slender, not bulbous at the base, numerous. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 siphonoglyphes. Mesenteries hexamerously arranged, at least the first 2 cycles perfect. Longitudinal muscles of the mesenteries form no special pennons. Distribution of the reproductive organs? Mesenteries more numerous in the upper part of the column than in the proximal part.— This genus is separated from *Pycnanthus* by a richer development of mesenteries in the distal than in the proximal part, while in *Pycnanthus* it is the opposite. From Mc. Murrich's description of *Cymbactis* we namely may conclude that it is so. Mc. Murrich speaks of the presence of 48 mesenteries (twenty-four pairs) but of 96 tentacles. As in *Actininae* we are not able to suppose a richer development of tentacles than of mesenteries, Mc. Murrich must have overlooked weak mesenteries in the most distal part of the body. Perhaps also the reproductive organs are differently arranged in the two genera. Of the other known *Cymbactis* I have placed *C. actinostoloides* Wassil. and *maxima* Wasill. to *Parasicyonis*, and *C. gossei* Steph. to *Sicyonis* (compare these genera).

Hormosoma (type *H. scotti* Steph.). This seems to be a distinct genus (compare Stephenson 1918 a p. 29). It is easy to give a more complete diagnosis on basis of Stephenson's description.

Kadosactis (type *K. rosea* Dan.). I have examined the single type-specimen. Owing to the bad preservation, especially of the filaments, which were totally macerated, I cannot definitively confirm the real position of this genus. The animal has a very strong sphincter and very strong longitudinal muscle pennons. I am inclined to consider this form as a *Phellia*. I will come back to this genus in the second part of this work.

Kyathactis (type *K. hyalina*) is an *Actinostola* (compare *Actinostola spetsbergensis*).

Lilliella (type *L. lacunifera* Steph.). The position of this genus, proposed by Stephenson (1918 a p. 33) is dubious. The only specimen was namely badly preserved in the inner parts. The whole exterior of the species and the presence of only six perfect mesenteries indicate that the species belongs to the Chondractiniinae, viz. to a family with acontia.

Marsupifer (type *M. valdiviae* Carlgr.) is synonymous with *Halianthella* Kwietn. belonging to the family Halcampidae, and the species probably is the same as *H. kerguelensis* (Stud.). A closer examination of the species has namely proved that the weak basilar muscles, which I supposed to be present, are not such muscles but the undermost part of the parietal muscles. The conclusion in my preliminary report of this genus that it was provided with basilar muscles, was somewhat hastily drawn, as the one species was flattened in the basal end and the other one, the contracted column of which was very low, was with a very broad base attached to a shell. This species thus has the power to considerably alter its basal end from rounded physa-like to a flattened wide basal plate, as it is also the case with *Cactosoma* and *Milne-Edwardsia carnea* (compare these forms). Thus the only criterion, if a genus is provided with a real pedal disc, is the presence of real basilar muscles.

Ophiodiscus (type *O. annulatus* R. Hertw.). This genus agrees with *Sicyonis* in the presence of considerably fewer tentacles than mesenteries, in the structure of the tentacles and of the oral disc, and in the differentiation of the mesenteries into sterile, filament-bearing and fertile, filament-loose mesenteries. Hertwig, however, (1882) does not mention a different development of both mesenteries of the same pair, which is possibly due to his having overlooked it, as the specimen was badly preserved. This is rather important, as Hertwig probably has also overlooked the same case in *Sicyonis crassa*. The only obstacle put in the way of a conjunction of *Ophiodiscus* and *Sicyonis*, would be, that the tentacles of *Ophiodiscus* are arranged in a cycle and that they are very long. It ought, however, to be observed that the tentacles were for the greater part torn off and that only bad fragments of them remained. Hertwig's figure of the exterior of *Ophiodiscus* is also very reconstructed. For my part I think that no conclusion, as to the real length of the tentacles, can be drawn on basis of the presence of the long tentacle-thread, as I have observed how very much prolonged perfectly slack tentacles of several Actinians can be. Finally, as to the supposed presence of pseudo-tentacles in *Ophiodiscus annulatus*, it has not been proved that the single pseudo-tentacle observed belongs to the animal[1]. Neither has Hertwig dared to add it to the genus nor to the species characters (compare also Simon 1892 p. 9). The presence of pseudo-tentacles in a deep-sea form is also very unlikely. On basis of the named cases I think that *Ophiodiscus* is identical with *Sicyonis* or at least nearly allied to it. Several authors as Mc. Murrich have referred *Ophiodiscus* to the family *Lebruniidae*. In reality this genus has nothing to do with *Lebrunia*, the structure of which is quite another.

Paractinia (type *P. striata* (Riss.). During a visit in Turin 1899 Professor Rosa presented me with 2 specimens which he had seen living, and determined as this species. The exterior of both specimens agrees well with the description by Andres, and there were no acrorhagi. An examination of the sphincter showed that it was well developed diffuse, but endodermal and different from that of *Actinia*. As no reproductive organs were developed its definite position is somewhat uncertain, but I think that *Paractinia* is the same genus as *Gyrostoma*.

Paractis type? It is questionable, which species of *Paractis*, enumerated by Milne-Edwards, may be regarded as the type. Only when this has been determined, we may proceed to characterize the genus.

Paranthus (type *P. chromatoderus*) (Schm.) and *Parantheoides* (type *P. crassa* Carlgr.). I have shortly characterized these genera (1898 p. 27). Concerning *Paranthus* I have shown, on basis of an examination of the type and of a species from N. America, that at least 12 pairs of mesenteries are perfect and that the reproductive organs arise already on the mesenteries of the first cycle. In opposition to this, Maguire (1898

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[1] Stephenson (1920 p. 566—567) is of the same opinion.

p. 723) has stated that only six mesenteries were perfect in the type and that the mesenteries of the first order were fertile in one examined specimen, sterile in another. I have controlled my earlier observations and examined in all three specimens of *P. chromatoderus*. All three specimens were provided with 12 perfect pairs of mesenteries; the mesenteries of the second order do not reach as far down on the actinopharynx as the six first pairs. The two first cycles of mesenteries were fertile (2 specimens examined). Maguire has probably not sectionized the whole animals but drawn his conclusions from solitary sections. In the second *Paranthus*-species there were 3 cycles of mesenteries perfect, some of the mesenteries of the third cycle were perfect only in the uppermost part of the actinopharynx.

Concerning the genus *Parantheoides* I think that we may place it together with *Paranthus* as synonymous with this genus. The only difference between the two genera is that *Parantheoides* is shorter than *Paranthus*, but as the only dredged specimen was rather strongly contracted, it is possible that the difference is not so considerable as might be supposed from the exterior.

Phelliomorpha (type *P. crassa* (Dan.)) is synonymous with *Cactosoma*, belonging to the family Halcampidae (compare p. 124).

Phelliopsis (type *P. panamensis* (Verr.)). If this genus, proposed by Verrill 1899 p. 214), really is devoid of acontia but has basilar muscles, which will have to be verified first, it may belong to the family Paractiidae and form a distinct genus. Perhaps it is related to "*Paractis*" *ferax* (Stuckey 1909 p. 387).

Pycnanthus (type *P. maliformis* (Mc. Murr.)). This genus, characterized by Mc. Murrich (1893 p. 172) is a good genus. I have here given a more complete diagnosis of the genus and described two new species (compare further this genus).

Polysiphonia (type *P. tuberosa* R. Hertwig (1882 p. 56)). This peculiar genus has been explicitly described by myself (Carlgren 1918 p. 36).

Raphactis (type *R. nitida* Verr.) probably does not belong to this family. Possibly the genus is related to *Korenia*, *Amphianthus* etc. (compare *Synanthus*).

Sicyonis (type *S. crassa* R. Hertw.) placed by Hertwig 1882 into a special family Sicyonidae, is, as I have before suggested (1899 p. 40), a Paractiidae (compare this genus).

Stomphia (type *S. coccinea* (O. F. Müll.) = *S. Churchiae* Gos.) is, as I have before shown (1893), a distinct genus among the Paractiidae (compare this genus).

Synanthus (type *S. mirabilis* Verr.). On the basis of Verrill's short and imperfect original description (1879) of this genus, Andres (1883 p. 584) has suggested that it is a Zoanthid. It is probable that this suggestion is correct, which, however, cannot be decided until the type-specimen has been examined. On the other hand, I can verify that the species, which Verrill later (1883 p. 48 Pl. 5 fig. 9) describes as *P. mirabilis*, belongs to the Zoantharia (s. str.). The very description indicates that we have to do with such an animal and a control examination of a specimen, received by The United States National Museum, proves the specimen to be an Isozoanthus. I here give a short diagnosis of this species, still making the observation that the description of its exterior is imperfect, on account of the scarceness of the material:

Polyps solitary or connected with each other by inconsiderable, thin coenenchyme. Basal plate wide. Column cylindrical or conical. Tentacles well developed. Ectoderm of the column very high, continuous, very little incrusted (by spicula of sponges), provided with numerous oval nematocysts with very twisted threads, 19—25 × 7—8 μ in size. Mesogloea of the column thin, homogeneous, with sparse, scattered cells and cell-islets. Sphincter rather strong, endodermal, with few but rough folds. Nematocysts of the tentacles partly of the same kind as in the column and 17 × 7—22 × 8 (26 × 6) μ in size, partly narrower and broader in the basal end 22—24 × 3,5—4(5) μ, the spirocysts of the tentacles 17 × 1,5—2 to 26 × 3,5 μ. Ectoderm of the actinopharynx high, provided with nematocysts recalling those of the tentacles, the former 19—22 × 8—7 μ, the latter 23—26 × 3,5 μ. A well developed siphonoglyphe. Mesogloea of the whole actinopharynx thin. Mesenteries 28, symmetrically arranged according to the macro-type, thickened in the distal part. Microcnemes well developed. Longitudinal muscles relatively strong in the macrocnemes as well as in the microcnemes.

The species, described by Verrill (1899 p. 211) as *Synanthus mirabilis*, is, on the other hand, no Zoanthid. Though I have not seen this species, I am inclined to think that we have to do with a species of the genus *Stephanactis* R. Hertw. (*Stephanauge* Verr.) = ?*Amphianthus* R. Hertw. = *Korenia* Dan., which are all provided with acontia, though, according to my examination, in small numbers. The family Amphianthidae, proposed by R. Hertwig (1882), cannot be maintained. The directive plane namely is not constant in relation to the longitudinal axis of the pedal disc or to the axis of the Gorgonian skeleton. Besides, I have found that the mesenteries of the first order, except the directives, are fertile in these genera. I will come back to these genera in the second part of this work.

Tealidium (type *T. cingulatum* R. Hertw.) is a well marked genus. *T. cinctum* Stuck. does not belong to the genus (compare below).

According to this discussion, I think that the number of genera belonging to the family Paractiidae[1] must be considerably reduced.

I have before (1893, 1898) divided the Paractiidae into two subfamilies, Paractiinae[2] and Actinostolinae. The Actinostolinae is also 1893 (Nachschrift) proposed as a special family). To these subfamilies I have (1918) added that of Polysiphoniinae, all based on the different development of the mesenteries. Of these subfamilies Polysiphoniinae is well limited. It is more difficult to have the two former distinctly separated. It is true, that it is easy to separate the typical Actinostolinae, *Actinostola* and *Stomphia*, perhaps also *Sicyonis* from the typical Paractiinae, but as we find traces of the Actinostolid-development in such

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[1] Since this was written, Stephenson (1920 p. 504) sketches the line of evolution for the old Paractiidae and the old Sagartiidae, and derives both these families from an hypothetical ancestor, *Eosagartia*, at the same time dividing the Paractiidae into three, the Sagartiidae into five partly new families. I will not enter on a closer critical discussion of Stephenson's hypothesis now, but keep it for the second part of this work. Meanwhile, I think that Stephenson's conclusions will have to be considerably modified. According to my statements above, the division of the old Paractiidae into three families cannot be accepted. The representatives of the Marsupiferidae are Halcampids, and also the family Actinoscyphiidae must be dropped, based as it is on the presence of only 6 pairs of perfect mesenteries, while the new Paractiidae should have more than 6. The genus *Anthosactis* namely has 6, 8 or 12 perfect pairs of mesenteries. The genus, *Tealidium*, nearly related to *Anthosactis*, has at least 6 or 12 perfect pairs of mesenteries. Accepting Maguire's examinations of *Paranthus* as correct, this genus and even one and the same species should have now 6, now 12 pairs or in the Tybee-species 24 pairs of perfect mesenteries (compare above). It is evident that under such circumstances the relations between the Sagartiidae and the Paractiidae will have to be seen from another point of view than that of Stephenson. Concerning the family Sagartiidæ and Diadumenidae compare p. 19 and p. 21.

[2] I need not here further discuss Hertwig's formation of a special tribus Paractiniae for the genera *Sicyonis* and *Polyopis*, as this tribus was abolished long ago, nor the affinity supposed by Hertwig between the Sicyonidae and the Tetracorallia. It is inconceivable that such a well differentiated genus as *Sicyonis* should be nearly related to the primitive Tetracorallia. If a relationship between the Tetracorallia and the Actiniaria really is a fact, it must be between such primitive Actinians as the Halcuriidae and the Tetracorallia (compare Carlgren 1918).

forms as *Pycnanthus* and possibly also in *Parasicyonis* (compare below) it is questionable, if the subfamily Actinostolinae may be maintained.

The exterior of the Paractiidae is rather uniform, especially that of the column which is smooth or in a few forms tuberculated. Also the tentacles in the genera seem to agree well. They are commonly short, smooth, or in contracted state wrinkled, or sometimes longitudinally sulcated. In several forms they are more or less bulbous on the outside of the base as in *Actinoscyphia, Pycnanthus laevis,* but not in *P. densus* and *maliformis, Sicyonis crassa, tuberculata* and *ingolfi* (but not in *S. variabilis*), *Ophiodiscus* and some *Actinostola*-species. As they sometimes appear only in certain species of a genus, their occurrence is rather insignificant as a genus-character, even in certain cases as a species character: I have namely in *Actinostola callosa* found all transitory stages between tentacles with bulbous thickenings (*A. atrostoma*) and tentacles without such (compare *A. callosa*). This variation of a species does, however, not prevent that the bulbous thickenings may be more constant in other species or in certain genera. In the genera *Anthosactis* and *Tealidium* we meet with a special differentiation of the tentacles. At the sometimes thickened base of the outside of the outer tentacles there is a well developed stinging battery, containing large, closely placed nematocysts of a special appearance (compare these genera). Similar capsules, though considerably smaller, appear in *Actinostola* and *Stomphia*, but are here arranged mainly in the apex of the tentacles.

The tentacles are commonly hexamerously grouped, in *Anthosactis jan mayeni* octomerously. In *Stomphia* the tentacles of the second cycle are twice the usual number or almost so, and the arrangement 6 + 12 + 18 etc. or 6 + 10 + 16 etc. Also in *Sicyonis* the tentacles are probably arranged in a similar manner. In *Actinoscyphia* they are found close by the margin of the oral disc in only two cycles. Possibly that is the case also in *Epiparactis*. In *Polysiphonia* the tentacles are placed in 12 triangular, continuous groups with the largest tentacles, corresponding to the first and second cycles of endocoels, in the innermost parts of the groups.

The longitudinal muscles of the tentacles are wholly ectodermal in *Actinoscyphia, Archactis* (*Antholoba*?) *perdix, Anthosactis ingolfi, Antiparactis, Epiparactis, "Paractis" ignota* and *ferax* and *Paranthus*, ecto-dermal to meso-ectodermal in *Antholoba* and *Anthosactis jan mayeni*, meso-ectodermal to ecto-mesogloeal? in *Anthosactis* (*Alloactis*) *excavata*, and mesogloeal in *Actinostola, Aulorchis, Cymbactis, Hormosoma, Ophiodiscus, "Paractis" papaver* and *polaris, Parasicyonis, Pycnanthus, Polysiphonia, Sicyonis, Stomphia* and *Synsicyonis*.

The genera and species, with the longitudinal muscles of the tentacles either ectodermal or mesogloeal, have the radial muscles of the oral disc arranged in a similar way. In *Antholoba* and *Archactis perdix* they are more enclosed in the mesogloea and thus ecto-mesogloeal, in *Anthosactis jan mayeni* meso-ectodermal and in *A. excavata* ecto-mesogloeal.

The siphonoglyphes are always present and well-developed.

The mesenteries in most genera show a regular development and are commonly hexamerous, in *Anthosactis jan mayeni* octamerous. Both mesenteries of the same pair are for the greater part equivalent: in *Actinostola, Stomphia, Sicyonis* and perhaps also in some other genera they show a different development of the younger cycles. In the latter case they follow the *Actinostola*-rule. Traces of such an arrangement we find also in other genera (compare above). In *Polysiphonia* there are, when 12 pairs of mesenteries have regularly arisen, 12 development zones, in which the origin of new mesenteries takes place bilaterally from both sides of the exocoels towards the centre of these latter.

Some genera show a richer development of mesenteries in the distal than in the proximal part. This is the case with *Cymbactis*, *Synsicyonis* and probably also with *Antholoba* (*Archactis*), in other genera the reversed takes place as in *Stomphia*, *Pycnanthus*, *Parasicyonis*, *Sicyonis* and probably also in *Ophiodiscus*.[1] Only six pairs of perfect mesenteries are present in *Actinoscyphia*, *Epiparactis*, *Paranthus*? (sometimes), *Antiparactis* and "*Paractis*" *ferax*. In the genus *Anthosactis* we meet in *ingolfi* 6 pairs of perfect mesenteries, in *jan mayeni* 8 and in *excavata* 12. In the other genera there are 12, or commonly more, perfect mesenteries.

Also the distribution of the reproductive organs varies in the different genera. In the following genera (and species) the reproductive organs begin to develop on the mesenteries of the first cycle.

Ammophilactis, *Anthosactis*, *Hormosoma*, "*Paractis*" *ferax*, *ignota*, *polaris*, *papaver*, *Paranthus*, *Phelliopsis* and *Tealidium*.

The producing of reproductive organs begins on the second cycle in *Actinoscyphia* and *Antiparactis*, on the third in *Pycnanthus*, *Actinostola*, *Polysiphonia* and *Stomphia* (partly), and on the fourth in *Antholoba*. In the following genera, *Ophiodiscus*, *Parasicyonis*, *Sicyonis* and *Synsicyonis*, as a rule only the mesenteries of the last order are fertile. In *Parasicyonis* these mesenteries are provided with filaments, in the other three genera not.

The longitudinal muscles of the mesenteries are, in comparison to the size of the animal, rather weak and commonly form weak pennons or none. More developed they are for inst. in *Hormosoma* and *Stomphia*. The best developed pennons we find in elongated forms, such as in *Paranthus* and "*Paractis*" *ferax*. The parieto-basilar muscles are commonly well-developed, and so are also the basilar muscles.

Genus Anthosactis Dan.

Diagnosis: Paractiidae (Paractininae) with well developed basal disc, with smooth, rather low body-wall, which is devoid of tubercles, acrorhagi and spirocysts, but more or less distinctly longitudinally sulcated (in contracted state). Sphincter strong to very strong, not stratified, on transverse sections partite in small meshes. Tentacles short, not particularly numerous, broad at the base, thinner at the apex, often longitudinally sulcated, the inner longer than the outer ones or all of almost equal length. Outer cycles of tentacles on the exterior side at the base with a well-developed stinging battery containing very large, particular nematocysts. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal to meso-ectodermal, those on the inner side at the base considerably stronger than those on the outer side. Oral disc very wide, in contracted state of the body strongly excavated. Actinopharynx short, with few

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[1] It is true that Hertwig speaks of the presence of only 48 pairs of mesenteries and of almost 100 tentacles in *Ophiodiscus annulatus*, but a closer examination of the figure (3 Pl. 10), encluding about one fourth of the oral disc, shows, that Hertwig has overestimated the number of tentacles so as to double the number. Probably this mistake is due to the bad preservation of the tentacles or rather to an error in writing. If we namely consider the following suggestion by Hertwig, concerning the muscle-mesenteries (not the with these latter alternating fertile mesenteries) in *O. sulcatus* (1882 p. 55): "Da im Ganzen 48 Tentakeln vorhanden sind, so wird sich die Zahl der Muskelsepten gleichfalls auf 48 oder auf 24 Paare belaufen", we find, that the number of mesenteries in this species is probably twice that of the tentacles.

longitudinal furrows and 2 siphonoglyphes. Few (6, 8 to 12) perfect pairs of mesenteries. Longitudinal muscles of the mesenteries comparatively weak. Reproductive organs present, at least on all stronger mesenteries.

Danielssen (1900) declares that the genus is provided with cinclides, and refers it to the family Sagartiidae. According to my examination of the type-specimen, no such cinclides are present (compare below!). The genus is besides a typical Paractiidae and easily recognizable on the structure of the tentacles, for one thing. Their longitudinal muscles are namely at the base much weaker on the outside than on the inside, and ectodermal to meso-ectodermal, perhaps sometimes ecto-mesogloeal (in *A. excavata* (R. Hertw.)). Furthermore, outer tentacles are at the base on the outside provided with a strong battery of very long and broad nematocysts of a characteristic type, an arrangement, observed by myself only in the genera *Anthosactis* and *Tealidium*. Probably this battery has the same function as the acrorhagi.

To this genus I have before (1912 p. 43) placed *Paractis excavata*, described by R. Hertwig (1882), for which species Verrill (1899 p. 144) has proposed the name *Alloactis excavata*. The whole habitus and the anatomical structure of this species indicate that we have to do with a species of *Anthosactis*. It remains, however, to be ascertained, if the outer tentacles are provided with the above named particular nematocyst batteries.

Anthosactis jan mayeni Dan.

Pl. 2. Figs. 6—7.

Anthosactis jan mayeni n. sp. Danielssen 1890 p. 24, Pl. 2 fig. 1, Pl. 10 fig. 1.

— — — Dan. Carlgren 1912 p. 21, 1916 p. 1.

Diagnosis: Pedal disc with a cuticle. Column with more or less distinct longitudinal furrows. Tentacles conical, longitudinally sulcated in contracted state, not hamiform, in 4 or 5 octamerously arranged cycles, of which the first and the second are very close. Inner tentacles thicker and longer than outer ones. Outer tentacles a little swollen at the base. Longitudinal muscles on the outside almost exclusively ectodermal and not as strong as on the inside, where they are even meso-ectodermal. Oral disc with weak radial ridges and weak, partly mesogloeal muscles. Actinopharynx with few, longitudinal ridges. Pairs of mesenteries arranged octamerously (8 + 8 + 16 + an imperfect fourth cycle in large specimens). Only 8 pairs perfect. Small oral stomata, no marginal stomata. Parietobasilar muscles broad but only a little folded, about two thirds as long as the mesenteries. Ectoderm of the column with nematocysts 22—24 × about 4 μ (seldom 29 × 6 μ) in size. Ectoderm of the tentacles with extraordinarily numerous spirocysts of variable size, unto 53×4—6 μ, and with very sparse nematocysts (26—29 × 4 (5) μ). Stinging capsules in the battery of the outer tentacles very numerous 74—93 × 12—13 μ. Typical nematocysts in the ectoderm of the actinopharynx few 22 ×3,5 μ, its nematocysts with distinct basal part to the spiral thread very numerous, 26—34 × about 5 μ.

Colour of the column pale reddish-white, but on account of the red oesophagus it acquires a reddish tinge, while the uppermost margin is white. Tentacles rose-red, shading off a little into yellow. Oral disc darker yellowish-red with paler yellowish-white rays, radiating from the mouth towards the middle of the disc. The gonidial grooves yellowish-white. When the animal is placed in alcohol the fluid becomes bright brownish-violet, and also the animal itself acquires a deep violet colour (Danielssen).

Dimensions in preserved state unto 3,4 cm broad at the base; length of the column 2,5 cm, length of the inner tentacles 0,8 cm, that of the outer ones 0,6 cm. Danielssen states the breadth to 4 cm.

Occurrence: West Greenland. Baffin bay 75°26′ N. 67°27′ W. 250 fms. (Sofia-Exp.). Umanak 250 fms. (1860).
East Greenland. 76°6′ N. 13°26′ W. 100—125 fms. (Danmark-Exp.); 72°25′ N. 17°56′ W. 300 m (Sw. Polar-Exp. 1900).
Greenland without distinct locality.
Jan Mayen (Norw. N. Atlantic-Exp. 1877).
Kara Sea. 72°19′ N. 55°54′ E. 90 m (Duc d'Orleans-Exp. 1907). 73°34′ N. 57°56′ E. 60 fms. (Nova-Zembla-Exp. 1875). 73°38′ N. 63°45′ E. (Nordenskiöld's-Exp. 1876).

Exterior aspect: This species has been described by Danielssen before (1890), but in several respects erroneously. The pedal disc is provided with a well developed cuticle and is enlarged, but it is surpassed in breadth by the oral disc, when the latter is expanded. The column is smooth, in contraction more or less wrinkled, without distinctly marked longitudinal furrows, corresponding to the mesenteries. As the animal is wholly extended the folds between the furrows disappear, wherefore the surface becomes smooth (Danielssen). A specimen, reproduced in the figure 6 Pl. 2, is provided with some irregular apertures in the column. As far as I can see, these apertures are no cinclides, as Danielssen has supposed, but artificial products, and probably apertures, remaining after the specimen's having been damaged and regenerated. In the other specimens I have not found any apertures, which speaks for the opinion that they are not normal formations. Besides, the column is rather thin (according to Danielssen, in extended state almost membraneous and transparent); in the distal part it, however, reaches a considerable thickness, owing to the strong development of the sphincter. No fossa is present. The tentacles are, as a rule, octomerously arranged in four cycles (8+8+16+32). The two inner cycles are, however, so close by one another that we can say that there are only three cycles, as Danielssen states. In the type-specimen and in a specimen, taken during the "Danmark"-Expedition, the number of tentacles was 64, in a third specimen there were 68 tentacles; among these, four tentacles were of a fifth cycle, developed close by the one pair of directives, in a fourth there were 80 tentacles. In the last case there were 16 tentacles of a fifth cycle, in two octants, one of each side of the one pair of directives. The inner tentacles were only a little longer than the outer, but much broader. The form of the tentacles as usual conical, the outer tentacles were a little swollen on the outside at the base. All tentacles were in contracted state provided with distinct longitudinal furrows and with a distinct aperture in the apex.

The oral disc was strongly excavated in the contracted state of the animal (fig. 6 Pl. 2) and provided with distinct radial furrows, corresponding to the insertions of the mesenteries. As the oral disc is wholly extended, its diameter may be twice that of the pedal disc.

The actinopharynx is short and provided with few (5—8) furrows and ridges on each side (Pl. 2 fig. 7). The two, symmetrically situated, siphonoglyphes are broader in the oral part than in the proximal and, as Danielssen states, of an almost triangular form. In their uppermost part they are provided with distinct gonidial tubercles.

Anatomical description. The pedal disc has a rather thick cuticle. The ectoderm of the column is somewhat low and contains rather numerous nematocysts 22—24 × about 4 μ in size, and numerous mucus-cells. The mesogloea is in the proximal part thin or of ordinary thickness, corresponding to the different state of contraction, but swells out in the region of the sphincter and there forms a thick layer; it contains small protoplasma-poor cells. The endodermal circular muscles are weak, the mesogloeal sphincter, on the other hand, is very strong and juts out, during certain states of contraction, as a strong thickening towards the ectoderm, about as the sphincter of *Tealidium cingulatum* (Hertwig 1882 Pl. 6 fig. 2). In the upper part and in the greater part of its length it occupies almost the whole breadth of the mesogloea, proximally it decreases rapidly and takes up only the inner part of the mesogloea. The muscle meshes are very small, in certain parts very close, in other parts separated by larger lamellae of the mesogloea. Any distinct stratification of the sphincter is, however, not to be seen (textfig. 183).


Fig. 183

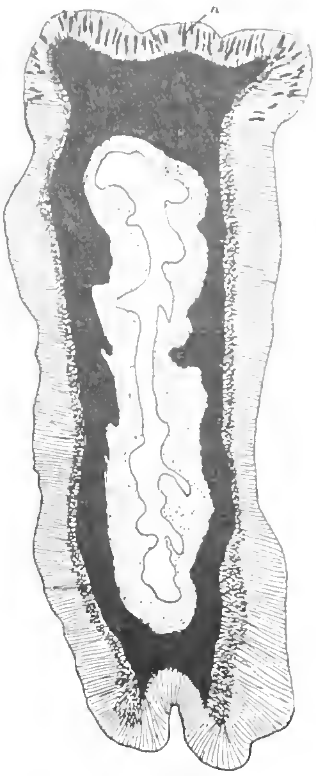


Fig. 184


Fig. 185

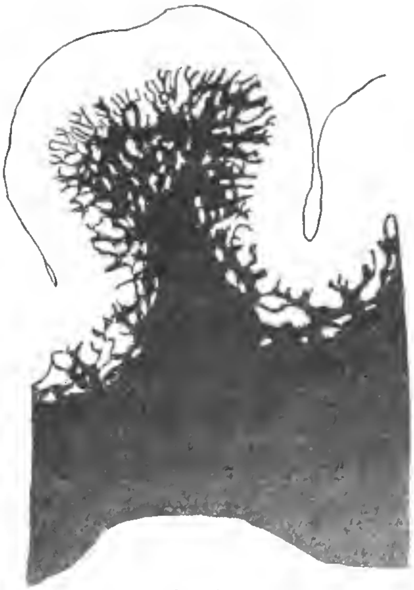


Fig. 186

Textfigs. 183—186. *Anthosactis jan mayeni.*
Fig. 183: Transverse section of sphincter. Fig. 184: Transverse section of an outermost tentacle, at the basis showing the battery of nematocysts (*n*). Figs. 185—186: Transverse section of an inner tentacle fig. 185 at the abaxiale, and fig. 186 at the adaxiale side.

The ectoderm of the tentacles is very high and contains very numerous spirocysts of very variable size, unto 53 × 4—6 μ; on the other hand, the typical nematocysts are very sparse and 26—29 × 4—(5) μ in size. In the swollen basal part, on the outside of the outermost tentacles, there is a specific stinging organ developed (textfig. 184), which I have also observed in *Tealidium jungerseni*. This battery contains very numerous, closely packed nematocysts (fig. 184 *n*) of considerable size (74—93 × 12—13 μ), which are, however, smaller than those of *Tea-*

lidium but larger than those of *Anthosactis ingolfi*. The thread of the nematocysts is very twisted but is often scarcely visible in the maceration preparations; for the greater part it is only the very close points of recurvation of the thread which are seen through the wall of the capsule. The inner tentacles are devoid of such a stinging battery. The longitudinal muscles are, on the abaxial side at the base, weaker than on the adaxial, though also on the former side rather strong; further upwards the muscles of both sides are of about equal strength. On the abaxial side the muscles are mostly ectodermal, though also here and there muscles, enclosed in the mesogloea, appear (textfig. 185); towards the adaxial side the mesogloeal muscle-meshes are more numerous, so that the muscles may be called meso-ectodermal here (textfig. 186). The radial muscles of the oral disc recall those on the adaxial side of the tentacles and are meso-ectodermal and more strongly developed in the outer parts than in the inner, where they are rather weak. The ectoderm of the actinopharynx is somewhat low, especially in comparison to the mesogloea, and contains few nematocysts of typical appearance, about 22 × 3,5 μ long; on the other hand, the nematocysts with discernible basal part to the spiral thread are rather numerous. They are broader in the basal end and 26—34 × about 5 μ in size.

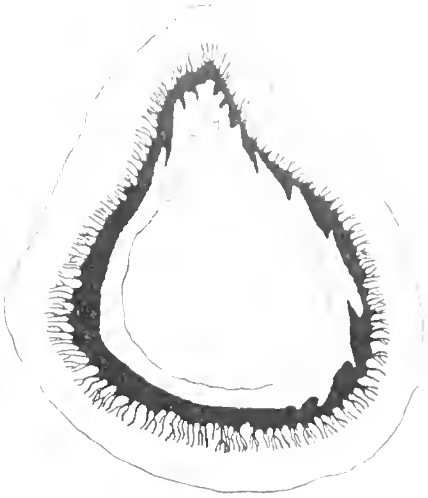
The mesenteries are octomerously arranged, which I have ascertained by the examination of several specimens and also of the type-specimen. **Danielssen**, however, declares that the mesenteries are hexamerously arranged, but that is not the case and does not correspond with the arrangement of the tentacles, the agroupment of which **Danielssen** has correctly stated. In the specimens with 64 tentacles the pairs of mesenteries were 32 (8 + 8 + 16), in those with 80 tentacles there were in one half, counted from the one directive pair, 20 pairs (4 + 4 + 8 + 4) developed. The four pairs of the last cycle are arranged in an octant next to the one directive pair. The arrangement of the tentacles on the other half indicates that also this part has the mesenteries grouped in the same manner. The eight first pairs of mesenteries are perfect. The longitudinal muscles of the mesenteries are not very strong and form no distinct pennons. The folds are however, numerous but low, with the exception of the innermost part, where they show a little tendency to form weak pennons; in the other parts of the stronger mesenteries they are uniformly developed. The parietobasilar muscles are distinctly marked, but the muscle lamella is not folded, it is extended over two thirds of the length of the column. The transversal muscles are rather well-developed in the distal part. The basilar muscles are well-developed and folded. A small oral stoma is present on the perfect mesenteries, on the other hand, there are no marginal stomata; I have, however, found a rather large aperture about in the middle of one mesentery. The ciliated tract of the filaments is strong, its mesogloea thick and containing numerous cells. The species is dioecious; all mesenteries, at least in the specimens with 32 mesenteries, are fertile. The statement of **Danielssen**, that the 6(!) first pairs of mesenteries are sterile, is wrong. The acontia are absent.

Anthosactis ingolfi n. sp.

Diagnosis: Pedal disc without a cuticle. Column in contracted state with longitudinal furrows in the upper part. Tentacles conical, not longitudinally sulcated, in numbers 48 (6 + 6 + 12 + 24), of which the first and the second cycle are very close. Inner tentacles thicker and longer than outer ones. Longitudinal muscles of the tentacles ectodermal, on the inner side at the base very strong. Oral disc with weak ectodermal, radial muscles. Actinopharynx with few (about 10) longitudinal ridges. Pairs of mesenteries arranged hexamerously (6 + 6 + 12); only 6 pairs perfect. Parietobasilar muscles like those of *A. jan mayeni*. Typical nematocysts in the ectoderm of the column?, in the tentacles absent (? or if present very sparse). Particular stinging capsules of the stinging battery very numerous 53—75 × 11—13 μ. Spirocysts of the tentacles very numerous, from 22 × 2 μ to 55 × 3 (3,5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx rather numerous, 26—34 × 5 μ.

Colour?

Dimensions: Breadth of the pedal disc 2,4 resp. 2,7 cm, length of the column in contracted state about 1,3 cm.



Textfig. 187. *Anthosactis ingolfi*. Transverse section of inner tentacle.

Occurrence: 66°08′ N. 16°02′ W. 729 fms. Bottom temp. — 0,8 (Ingolf-Exp. St. 125) 2 sp.

Exterior aspect: The pedal disc is broad and does not seem to form any cuticle. The form of the body is in contracted state rather low and almost hemispheric. The surface of the body-wall is smooth; in the distal part there were indistinct longitudinal furrows present. The tentacles are short, the inner considerably broader and larger than the outer, in number 48, probably hexamerously arranged (6+6+12+24), the two first cycles are, however, very close. Because of the strong contraction of the specimens it was difficult to get a satisfactory diagram of the arrangement of the tentacles. The form of the tentacles varies from cylindrical to a little conical; I have not observed any longitudinal furrows on the tentacles, only indistinct transversal furrows, arisen by the contraction. The oral disc is very wide and smooth, and in contracted state deeply excavated. The actinopharynx is short and, on account of the contraction, transversally wrinkled, with aboral prolongations on the 12 perfect mesenteries, and provided with 10 longitudinal furrows between the insertions of the mesenteries. Two siphonoglyphes are present.

Anatomical description: The ectoderm of the column is thin and almost totally lost, so that I cannot give any information of its structure. The mesogloea is thin or of ordinary thickness, in the region of the sphincter, however, very thick. The sphincter is very strong and recalls that of *A. jan mayeni*. The muscle meshes are small and now very closely packed, now more sparse; the sphincter shows, as far as I can see, no tendency to stratification. The endodermal circular muscles are weak. The ectoderm of the tentacles is high and probably contains no typical nematocysts, if really present they are very sparse. The outer tentacles are on the outside of the base provided with a stinging battery as in *A. jan mayeni*. The nematocysts are, however, smaller here and variate in both specimens between 53 and 75 μ in length and 11—13 μ in breadth. The spirocysts of the tentacles are extraordinarily numerous, between 22 × 2 to 55 × 3,5 μ in size. The longitudinal muscles of the inner tentacles are much weaker on the outside of the base than on the inside. The inner folds are namely much closer and often more than double as high as the outer folds. They are often branched (textfig. 187 transverse section of inner tentacle). In contradistinction to

A. jan mayeni and *A. excavata* the muscles are not enclosed in the mesogloea but ectodermal. In the upper part of the tentacles the longitudinal muscles are weaker and uniformly distributed. The radial muscles of the oral disc is weak and ectodermal. The ectoderm of the actinopharynx contains rather few nematocysts with discernible basal part to the spiral thread, 26—34 × 5 μ in size. I have besides in the maceration preparations found some small nematocysts and some spirocysts, but whether they belong to the actinopharynx or stick to the ectoderm, I cannot decide. The siphonoglyphes do not seem to be as sharply marked as in *A. jan mayeni*.

Both specimens had 24 pairs of mesenteries, hexamerously arranged. Only the 6 first pairs were perfect. The mesenteries were in both specimens much thinner than in *A. jan mayeni*, the folds of the longitudinal muscles are low and form no pennons. The parietobasilar muscles recall those of *A. jan mayeni*, but are weaker. The filaments have the same appearance as in this species. All mesenteries are fertile and provided with filaments. The animal is dioecious.

Genus **Tealidium** R. Hertw.

Diagnosis: Paractiidae with well-developed, enlarged basal disc. Column with numerous small papillae of the mesogloea, all of the same size, with more or less distinct longitudinal furrows, in contracted state very low, disc-like. Sphincter mesogloeal, very strong, in certain states of contraction issuing as a strong circular fold in the uppermost part of the column. Tentacles short, conical, hexamerously arranged, not numerous, the inner longer than the outer or almost of the same length. Stinging battery on the outer tentacles as in *Anthosactis*. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Oral disc wide. Actinopharynx short with two distinct siphonoglyphes. Pairs of mesenteries few, hexamerously arranged, thin and with probably weak muscles. 6 pairs, or a few more, perfect. Reproductive organs appearing already on the mesenteries of the first cycle incl. the directives.

The genus *Tealidium* is nearly related to *Anthosactis* with which it agrees in most characters, among others in the presence of the stinging batteries on the outside of the outermost tentacles. The nematocysts of these batteries are also of the same type as in *Anthosactis*. In contradistinction to *Anthosactis* its column is provided with very numerous, small mesogloea-papillae. Concerning the ectoderm of these papillae I cannot give any informations, as the ectoderm was lost in the specimens of *T. ingolfi*, as well as in the type-species.

The diagnosis of the genus, given by R. Hertwig, is not good, as among the proposed genus-characters only one — the presence of the above named papillae — is preservable. The tentacles of the species, described below, are namely of different length. It is also questionable, if in *T. cingulatum* the form of the sphincter may serve as a diagnostic. I, for my part, am more inclined to regard the wall-shaped thickening of the mesogloea in the sphincter region as due to a strong contraction of this part, because in the species, described below, and in one and the same specimen, the appearance of the sphincter varies in different places, evidently according to the state of contraction, and now recalls the sphincter of *T. cingulatum*, now is typically elongated.

The species *Tealidium cinctum* (Stuckey, Trans. New Zeeland Instit. 41. 1908-1909, p. 389) is certainly no *Tealidium*. Stuckey namely declares that the species is provided with "verrucae, which act as suckers, by which the animal covers itself with bits of shell and other debris." In the real *Tealidium* no sucking-verrucae are present, the papillae are namely here, as I have stated before, thickenings of the mesogloea. If this species really is a Paractid, it must have a new genus name. I provisionally propose *Paratealidium*.

Tealidium jungerseni n. sp.

Diagnosis: Basal disc very thin. Body-wall in the distal part with rather distinct longitudinal furrows. Sphincter now concentrated, now more elongated, not longitudinally stratified. Tentacles 48, conical, not longitudinally sulcated, with somewhat thickened mesogloea on the outer side at the base. Longitudinal muscles of the tentacles rather well developed also on the outer side, though weaker here than on the inner side, with closely packed, palisade-shaped folds. Actinopharynx very short with about 6 longitudinal furrows on each side. Pairs of mesenteries 24, of which at least 6 pairs perfect. All mesenteries fertile. Nematocysts in the ectoderm of the tentacles very sparse, 36 × 2,5—3 μ, its spirocysts very numerous, 19 × 2—46 × 3 μ. Nematocysts of the stinging battery on the outermost tentacles very large, 106—134 × 11—15 μ. Typical nematocysts of the actinopharynx partly 29—30 × 3 μ, partly 20—25 × 2,5 μ. Nematocysts with discernible basal part to the spiral thread, 26—36 × 4—5 μ.

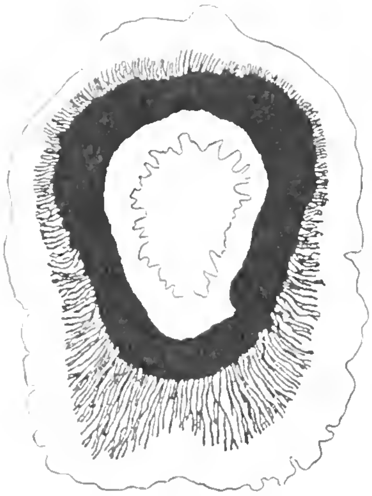
Colour?

Dimensions: Height of the largest specimen 0,3 cm, breadth 3,5 × 2 cm. Inner tentacles 0,5 cm long.

Occurrence: Danmark Strait. 64°34′ N. 31°12′ W. 1300 fms. Bottom temp. +1,6° (Ingolf-Exp. St. 11) 3 sp.
Davis Strait. 59°12′ N. 51°05′ W. 1870 fms. Bottom temp. +1,3° (Ingolf-Exp. St. 38) 1 sp.

Exterior aspect: The pedal disc is very wide. The body is in contracted state disc-like, in one specimen a little elevated in the middle (in the sphincter region), in the specimen from the station 38 the body forms a low cone. The column is provided with very numerous, closely packed, small mesogloea-papillae, all of about the same size, towards the distal end they are somewhat scarcer and seem, at least partly, to be lacking in the region of the sphincter (in the capitular region). In the two largest specimens this region was provided with some irregular protuberances, which may possibly have arisen by the strong contraction. The column is besides longitudinally sulcated, the furrows correspond to the insertions of the mesenteries and appear most distinctly in the distal, not involved part of the body. Sometimes transversal furrows are to be observed, they are certainly due to the contraction of the animals. The tentacles are thick at the base, tapering towards the apex, not longitudinally sulcated, and incurvate. In one specimen — I have examined two specimens concerning the tentacles — the tentacles were a little swollen at the outside of the base. The number of tentacles was 48, probably (6 + 6 + 12 + 24). The oral disc is very wide and thin, I cannot determine its structure as it was strongly extended, and its ectoderm lost. The actinopharynx is very short and provided with about 6 longitudinal furrows on each side of the sagittal axis. The two symmetrically placed siphonoglyphes are provided with aboral prolongations.

Anatomical description: The ectoderm of the column is lost, but to judge from fragments it seems to have been low. The mesogloea is in the greater part of the column rather thin and provided with the above named papillae; in the distal part, where the sphincter is situated, strongly thickened as in *Anthosactis*. The sphincter recalls that ot *Anthosactis*, sometimes it is wall-shaped, thickened towards the ectoderm as in *Tealidium cingulatum*. As the sphincter in different regions of the same specimens of *ingolfi* displays both these appearances, I cannot find that the wall-shaped sphincter is efficient as a characterization of the species *T. cingulatum*. The endodermal circular muscles are weak. The ectoderm of the tentacles is high and contains very numerous spirocysts of varying size from 19 × 2 μ to about 46 × 3 μ. The typical nematocysts are very sparse here as in *Anthosactis jan mayeni*, and 36 × 2,5—3 μ in size. That also here stinging batteries appear in the same places as in *Anthosactis* I have ascertained on maceration preparations. The nematocysts were very close and were much larger than in *Anthosactis*, in as much as they vary from 106 to 134 μ in lenght and 11—15 μ in breadth. They were of the same structure as in *Anthosactis*. The inner tentacles are not provided with stinging batteries. It is true, that I have at the apex of these tentacles found some scattered, large nematocysts of the same size as in the stinging batteries, but a closer examination proved that the nematocysts were sticking to the ectoderm and thus not belonging to this part. The longitudinal muscles of the tentacles are ectodermal[1] and recall those of *Anthosactis ingolfi* (textfig. 188 transverse section of tentacle) as regards the distribution of the muscles. The folds are closer than in *A. ingolfi*. The mesogloea of the tentacles is from thick to rather thick, and somewhat swollen on the abaxial side at the base. The radial muscles of the oral disc was badly preserved and, as far I can see, ectodermal. The ectoderm of the actinopharynx contains typical nematocysts partly 29—30 × 3 μ, partly 20—25 × 2,5 μ in size, besides these, there are sparse nematocysts with discernible basal part to the spiral thread (length 26—36 μ, breadth 4—5 μ).


Textfig. 188. *Tealidium jungerseni*. Transverse section of tentacle.

The mesenteries were in both specimens badly preserved and thin, so that I cannot give any information concerning the muscles, on all accounts there are no distinct longitudinal pennons. Probably the muscles of the mesenteries agree with those of *Anthosactis ingolfi*. The number of mesenteries was 48, 6 + 6 + 12 pairs, among these two directives, symmetrically situated. The first pairs are perfect, it seems, however, that also a few of the second order reach the actinopharynx; the mesenteries of the third order occupy one half of the oral disc. The filaments were also badly preserved, the cnido-glandular tract contains very large mucus cells. The species is dioecious, and all mesenteries have reproductive organs.

Genus **Epiparactis** n. gen.

Diagnosis: Paractiidae with well-developed pedal disc. Column not much elongated, smooth, with thick cartilaginous mesogloea, without distinct margin. Sphincter not strong. Tentacles rather short, the inner longer than the outer, conical, comparatively thin, whithout basal thickenings and stinging batteries on the outside of their base, closely packed on the outer rim of the wide oral disc, arranged in at least two, probably in three cycles. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal.

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[1] Possibly some few folds may fuse together.

2 distinct siphonoglyphes. Mesenteries numerous, thin, but only 6 pairs perfect. Muscles of the mesenteries weak. Distribution of the reproductive organs?

The below described species is probably nearly related to "*Actinernus*" *saginatus* and *aurelia*, but is distinguished from them by the tentacles being devoid of basal thickenings. Unfortunately, on account of the bad preservation of the specimen, I can neither decide, whether the tentacles are arranged in two or three cycles (compare below), nor how the reproductive organs are placed in the mesenteries. So far, it is the most practical to propose a new genus. If it were to be found out afterwards, that "*Actinernus*"[1] sometimes can be devoid of tentacle-tubercles, *I. dubia* probably belongs to this genus.

E. dubia n. sp.

Diagnosis: Pedal disc with a cuticle. Sphincter comparatively weak, filling up only part of the mesogloea, not longitudinally stratified, consisting of small meshes, showing a tendency to transversal stratification, distinctly separated from the endodermal column muscles, and not continued in those latter. Tentacles smooth to indistinctly longitudinally sulcated, numerous (about 124). Longitudinal muscles of the tentacles and radial muscles of the oral disc ordinarily developed. Oral disc with radial ridges and furrows, especially well developed in the outer part. Actinopharynx of ordinary length. Siphonoglyphes with aboral prolongations. Pairs of mesenteries hexamerously arranged in five cycles (6 + 6 + 12 + 24 + about 24, of which the last as a rule are developed only in the outer exocoels). Only 6 pairs of mesenteries perfect. Longitudinal muscles form weak pennons only in the inner part of the mesenteries. Nematocysts in the tentacles and the actinopharynx numerous, in the former 26—34 × 4—5 μ, in the latter 24—41 × 3,5—5 μ. Spirocysts of the tentacles very numerous 19 × 1,5—2 to 67 × 7 μ.

Colour?

Dimensions: Length and breadth about 3 cm. Inner tentacles about 1,5 cm long.

Occurrence: 60°37′ N. 27°52′ W. 799 fms. Temp. at the bottom 4,5° (Ingolf-Exp. St. 78) 1 sp.

Exterior aspect: The pedal disc is wide and deeply excavated, on account of its covering a sponge, of which rests remain behind. On several parts of the disc there are fragments of a cuticle. The column is about as long as broad, smooth and of about the same thickness as in *Sicyonis*. There is no distinct margin. The tentacles are broad at the base, diminishing towards the apex and rather short and thin. They are indistinctly transversally wrinkled; some of them are longitudinally sulcated. They are devoid of basal thickenings and basal stinging batteries. The inner tentacles are longer than the outer ones of which one part was very small. They were about 124 in number, a little fewer than those of the mesenteries. Their arrangement is difficult to determine, as the outer part of the oral disc was contracted and not well preserved, and small tentacles in development disturb their agroupment. Besides, they are closely packed on the outer rim of the oral disc. The tentacle cycles are possibly not more than 2 in number, at any rate not more than three. The oral disc is very wide and its greatest part without tentacles, in the innermost part smooth, in the outer with deep radial furrows. There are no gonidial tubercles. The actinopharynx is of ordinary length and irregularly wrinkled. The siphonoglyphes are distinct and provided with aboral prolongations.

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[1] *Actinoscyphia* (p. 184).

Anatomical description: The ectoderm of the column is almost lost, only in the uppermost part there are some fragments proving it to be thin. The mesogloea is very thick, of the same consistency as in *Actinostola*, fibrillar with scattered, small, often round cells. The endodermal circular muscles are weak. The sphincter is comparatively weak, the meshes placed in groups showing a tendency to transversal stratification; it is the strongest on the upper part and gradually becomes weaker downwards. It occupies only one part of the breadth of the mesogloea and seems to be wholly separated from the entodermal circular muscles (textfig. 189). The ectoderm of the tentacles is high and provided with numerous typical nematocysts, which are rather broad in comparison to their length (26—34 × 4—5 μ), and with very numerous spirocysts of very variable size (from 19 × 1,5—2 μ to 67 × 7 μ). The ectodermal longitudinal muscles are not strong, the folds are rather low and commonly not branched, but rather close (textfig. 191). There is no great difference in the development of the muscles on the adaxial and abaxial sides; at the base the muscles, however, are a little stronger on the adaxial side, and the mesogloea likewise a little thicker on the abaxial side of the base. Still we cannot speak of basal thickenings of the mesogloea. The mesogloea of the tentacles is commonly rather thin. The radial muscles of the oral disc is also ectodermal (textfig. 190), in its outer part stronger than in the tentacles and provided with rather high, close folds, of about the same dimension at the insertions of the mesenteries as at the ridges. The ectoderm of the actinopharynx contains numerous nematocysts, 24—41 × 3,5—5 μ in size.

Fig. 189

Textfigs. 189—191.
Epiparactis dubia.
Transverse sections of sphincter (fig. 189), of part of the oral disc (fig. 190) and of part of a tentacle (fig. 191) *cm*: circular muscles of the column.

Fig. 190

Fig. 191

The mesenteries are hexamerously arranged (6 + 6 + 12 + 24 + an imperfect fifth cycle). Only the 6 first pair are perfect. The imperfect mesenteries have been examined in $^5/_6$ of the animal. The mesenteries of the fifth cycle were weak and generally present only in the outer compartments viz. beside the mesenteries of the first and second orders, sometimes they are lacking in some of those, sometimes they are also developed in the inner compartments beside the mesenteries of the third order. Both mesenteries of a pair were not developed in conformity with the *Actinostola*-rule. The mesenteries form thin lamellae.

Genus **Pycnanthus** Mc. Murr.

Diagnosis: Paractiidae with well-developed, enlarged pedal disc. Column smooth, without tubercles, in contracted state low and thin, sometimes with more or less distinct longitudinal ridges in the upper part. Upper parts of the column capable of involution. Margin tentaculate, distinct, not lobed. Sphincter weak or well developed. Tentacles short, only half as numerous as the mesenteries, the inner considerably stronger than the outer, the latter without stinging battery at the base. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 deep siphonoglyphes. Mesenteries hexamerously arranged, but not always regularly, at least the first 2 cycles perfect. Longitudinal muscles of the mesenteries form no distinct pennons. Parietobasilar muscles more or less strong. Reproductive organs on the mesenteries of the third and fourth cycles, sometimes also on some of the fifth. No differentiation into filament-lacking fertile and filamentous sterile mesenteries. The weaker mesenteries, only in the most proximal part of the body, without filaments and reproductive organs.

The diagnosis which I have given here of the genus differs considerably from the original diagnosis, proposed by Mc. Murrich (1893). That this latter was not suitable, may be concluded from the fact that Mc. Murrich later on (1904 p. 245) has placed to the genus a species *Pycnanthus* (*Paractis*) *lineolatus*, which, to my mind, cannot be conjoined with the type, *maliformis*. In *P. lineolatus* the longitudinal muscles of the tentacles and the radial muscles of the oral disc namely are ectodermal, its perfect pairs of mesenteries are only 6, and its reproductive organs are developed on the mesenteries of the second and third orders, characters which differ so much from the type that they make it impossible to place both species to the same genus. The reason why Mc. Murrich has enclosed them in the same genus, is that both specimens are provided with capitular ridges; I for my part am very sceptical as to the systematic importance of the capitular ridges, at least of such as are here appearing, which may very well have arisen by the contraction of the distal part of the column. Stephenson (1918 b p. 124) has drawn the same conclusion concerning *Cymbactis* (= *Sicyonis* compare p. 211) *gossei*. According to Mc. Murrich, the ridges besides should not be of the same structure in both species, in the type *maliformis* "hollow with rather delicate walls", in the species *lineolatus* "solid." In the below described species *P. laevis*, which in all other important characters agrees with the type, there are no distinct capitular ridges. I therefore think that the capitular ridges are without importance as a genus character, having probably in many cases arisen by contraction. As I have introduced them above in the diagnosis of the genus they might be used; I will, however, declare that they seem to be of small systematic importance. To the genus characters Mc. Murrich also adds, that the tentacles are "not swollen at the base". The below described *P. laevis* is, however, provided with such swollen tentacles.

Mc. Murrich's *Pycnanthus lineolatus* must, to my mind, form a new genus type, with which possibly also *Paractis tenuicollis* may be placed. For this genus Verrill (1899 p. 212) has proposed the name *Antiparactis*, type: *A. lineolatus*, which may be characterized as follows. The diagnosis is based on Mc. Murrich's description of the type.

Paractiidae with well developed basal disc. Column smooth, without tubercles, in contracted state low and thin, sometimes with more or less distinct longitudinal ridges in the upper part. Margin tentaculate, not lobed. Sphincter strong. Tentacles short, only half so numerous as the mesenteries (always?). Outer tentacles without stinging batteries at the base. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Actinopharynx long with two siphonoglyphes. Mesenteries hexamerously arranged, only the 6 first pairs perfect. Longitudinal muscles of the mesenteries forming weak, broad pennons. Reproductive organs on the mesenteries of the second and third orders. No differentiation into filament-lacking fertile and filamentous sterile mesenteries.

Verrill (l. c.) wishes to substitute the name *dubia* for *lineolata*, as he considers it questionable, if the species, described by Mc. Murrich, is identical with Dana's species *lineolata*. Also Mc. Murrich (1904 p. 247) is a little uncertain about the identification of his species with *lineolata*. Verrill suggests that the species is a Sagartiid, which "had lost its acontia." As far as I can understand, there is no reason for such a supposition.

Pycnanthus laevis n. sp.

Pl. 3. Figs. 4, 5.

Diagnosis: Body in contracted state usually disc-like. Column rather thick, in contracted state sometimes with indistinct longitudinal furrows in the upper part. Sphincter strong, longitudinally stratified. Tentacles usually conical or seldom more cylindrical, according to the state of contraction, 96 in five cycles. Outer tentacles at the base, on the abaxial side thickened and without longitudinal muscles. Pairs of mesenteries about 96, the first, second, and one part of the third cycle perfect. Some pairs of the third cycle unequally developed, consisting of a perfect and an imperfect mesentery. Mesenteries of the last cycle, only in the most proximal part of the body, very small, without filaments. Parietobasilar muscles rather well developed. Typical nematocysts in the ectoderm of the tentacles numerous, 22 × 2—31 × 2,5 μ, in the actinopharynx numerous, 25 × 2—31 × 2,5 μ. Spirocysts in the tentacles very numerous, from 7 × 1 to 41 × 4,5 μ. Nematocysts with discernible basal part to the spiral thread in the ectoderm of the tentacles 31—36 × 3—3,5 μ.

Colour in alcohol: uncoloured.

Dimensions of the largest specimen in contracted state: diameter of the basal disc about 3 × 3,5 cm, height 0,6 cm. The smallest specimen was 0,7 cm broad and about 0,2 cm high.

Occurrence: Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3°9 (Ingolf-Exp. St. 32) many spec. on stones.

W. of Faroe Isl. 61°31′ N. 11°36′ W. 720 fms. Bottom temp. 2°4 (Ingolf-Exp. St. 46) several spec.

Exterior aspect: The pedal disc is extended and most frequently thin. The form of the body is flat, almost disc-like when the animal is contracted, sometimes, as in the specimen reproduced in the fig. 5 Pl. 3, the column forms a low cone. The surface of the column is smooth, excepting small irregular invaginations, arisen by contraction. The uppermost part sometimes shows indistinct longitudinal furrows, and, between these, low ridges which are continued in the tentacles. These furrows and ridges are, however, not always distinct, it is thus probable, that they have arisen by the contraction of the distal part of the body-wall. The margin is distinct and not irregular. The outermost tentacles are small, arranged as palisades, and a little thickened quite at the base on the abaxial side; this thickening, being probably a continuation of the columnar ridges, however rapidly disappears. Mc. Murrich declares that the tentacles of the genus are not swollen at the base. As far as I can understand from Mc. Murrich's description of *Pycnanthus maliformis*, there may be a similar thickening as in *P. laevis* at the base of the outermost tentacles. Mc. Murrich (1893; p. 173) namely says: "The ridges upon the upper surface of the column run to the basis of the outer tentacles." The tentacles are conical, sometimes more cylindrical, according to the contraction. The number of tentacles is about 96 (6 + 6 + 11 + 24 + 48), the inner are many times larger than the outer. Sometimes the tentacles are indistinctly longitudinally sulcated. The oral disc is wide, its larger part has no tentacles. It is provided with indistinct radial furrows, corresponding to the insertions of the mesenteries. Actinopharynx is of ordinary length, irregularly wrinkled and provided with 2 deep siphonoglyphes.

Anatomical description: The ectoderm of the column is almost lost, only a few fragments of it were present in several invaginations. In these fragments I found nematocysts, 14—17 × about 1 μ in size. Its mesogloea is thick and shows the same differentiation into two layers, an outer, provided with numerous cells and an inner, fibrillar and poor in cells, as that which I have described more in details for *Sicyonis tuberculata*. The endodermal circular muscles are weak, the distinctly longitudinally stratified sphincter, however, strong. In the uppermost part it occupies almost the whole breadth of the mesogloea, diminishes rapidly and passes into the endodermal circular muscles (textfig. 192, 193). The ectoderm of the tentacles is high with very numerous spirocysts (size: from 17 × 1 μ to about 41 × 4,5 μ) and also rib-like typical nematocysts (size 22 × 2—31 × 2,5 μ). Besides these, there are sparse nematocysts with discernible basal part to the spiral thread (size about 31—36 × 3—3,5 μ). The mesogloea of the tentacles is thinner than the ectoderm. The longitudinal muscles form numerous, closely packed, radially extended meshes in the mesogloea. On the outside of the outermost tentacles, lowermost at the base where the mesogloea is a little thickened, the longitudinal muscles are lacking, the muscle-lacking part, however, being inconsiderable (textfig. 194). Not far from the base, scattered muscle fibres namely appear, rapidly increasing in number. The larger part of the outer tentacles displays uniformly extended muscles. The mesogloeal radial muscles of the oral disc are in the inner part of the disc weak and commonly only separated from the ectoderm by a thin lamella, in the outer parts strong with closely packed meshes, extended in ecto-endodermal direction. At the insertions of the mesenteries the muscles are interrupted by mesogloeal bridges. The ectoderm of the actinopharynx is of ordinary height and contains numerous nematocysts, 25 × 2 to 31 × 2,5 μ in size. Its mesogloea is thicker than its ectoderm, especially in the siphonoglyphes. Concerning the structure, the mesogloea of the actinopharynx agrees with that of the inner part of the column, in the siphonoglyphes and in the vicinity of these latter the mesogloea is not so strongly fibrillar; here as in the Zoantharia there are also scattered cell-islets.

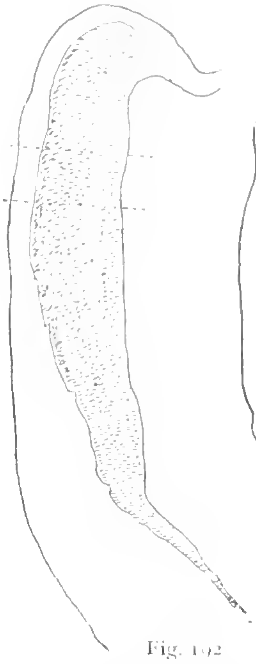

Fig. 192

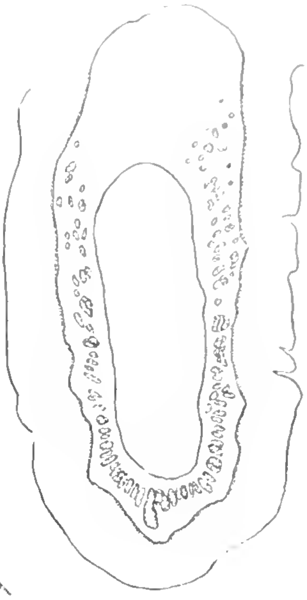

Fig. 194

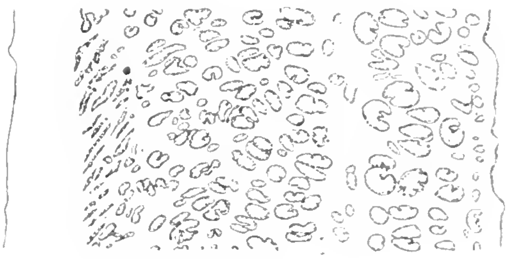

Fig. 193

Textfigs. 192—194. *Pycnanthus laevis.*
Fig. 192: Transverse section of sphincter. Fig. 193: Transverse section of part of the sphincter (in the fig. 192: indicated by dotted lines). Fig. 194: Transverse section of an outermost tentacle, next to its basis.

The number of the pairs of mesenteries is 96 or thereabout. The mesenteries are arranged in five cycles, of which the first and part of the third are perfect. Two examined specimens show the following arrangement of the mesenteries of the third cycle, counted from the one pair of directives *i*: imperfect, *p*: perfect mesenteries.

Sp. 1 (sectioned in transverse sections): *pp*—*pi*—**p***p*—*p***p**—*ip*—*pp*—*ip*—*ip*—*ip*—*pi*—*ip*—*ip*.

The mesenteries, designated by spaced out figures, are weaker than the other perfect mesenteries, and only reaching the actinopharynx with a small off-shoot.

Sp. 2 (the largest specimen) only one half examined: *ip* — *ii* — *ip* — *ii* — *ii* — *ii*. As I have only macroscopically examined this specimen, it is possible that some of the imperfect mesenteries are in reality perfect, but this I cannot with certainty decide as the specimen was rather badly preserved. On all accounts, the size of the mesenteries of the third cycle shows that one mesentery of a pair has grown more rapidly than its partner. A fully regular agroupment of these imperfect weaker and perfect stronger mesenteries does not seem to be present. The weakest mesenteries of the third cycle are, however, as in *Actinostola spetsbergensis*, commonly next to the mesenteries of the first order (compare *P. densus*). Both mesenteries of the pairs of the fourth and the fifth cycles seem to be equally developed. The sterile and filament-lacking mesenteries of the fifth cycle appear only in the proximal part of the body.

The longitudinal muscles form no distinct pennons, though the outermost and innermost parts of the mesenteries show a weaker muscularity than the intermediate parts. The folds of the muscles in the best developed part are not especially strong, only the distal part shows high folds. The parietobasilar muscles are distinctly marked, but hardly form any folds; they almost reach the sphincter. The basilar muscles are distinct, though not strong, with few, rather high folds. Oral and marginal stomata are present on the perfect mesenteries. The ciliated streaks of the filaments are well-developed. The mesenteries of the third and fourth cycles have reproductive organs, the other mesenteries are sterile. The species is dioecious.

Pycnanthus densus n. sp.

Diagnosis: Pedal disc wide. Column thick, with indistinct, irregular longitudinal furrows. Sphincter rather long, reticular, not stratified. Tentacles short, but broad, conical, thick and irregularly, transversely wrinkled in contracted state, about 90 to a little more than 100, and densely packed together, so that some tentacles are sharply outlined from each other at the base. Outer tentacles not swollen at the base. Radial muscles of the oral disc not distinctly interrupted at the insertion of the mesenteries, forming a net-work of large meshes close to the ectoderm. Pairs of mesenteries about 92 to 108, in four primary, symmetrically situated exocoels, more numerous than in the 2 other exocoels, which are situated on both sides of a directive pair. Sometimes there is a difference in size of both mesenteries of the same pair of the third and fourth cycles. Mesenteries of the last cycle only in the most proximal part of the body very small, without filaments and reproductive organs. Parietobasilar muscles distinctly outlined, reaching to the large marginal stomata. Typical nematocysts in the ectoderm of the tentacles numerous, 34—48 × 2,5—3 μ, in the actinopharynx 24—36 × 2—2,5 (3,5) μ. Spirocysts of the tentacles 22 × 1,5—2 to 58 × 3,5 (48 × 4, 5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 20—29 × 3—5 μ.

Colour:

Dimensions: Spec. 1) diameter of the body a little above the pedal disc 4 cm, height 3 cm. Inner tentacles about 1 cm long and broad. The specimen 2 was smaller, but more strongly contracted.

Occurrence: 64°53′ N. 10°0′ E. 630 m. Temp. at 600 m. — 0,69 (Michael Sars-Exp. 1900 St. 10)
1 sp. (Sp. 1).
Norway-Bear Isl. 73°27′ N. 23°11′ E. 460 m. Black, gray clay. Temp. at the
bottom 2,67 (Swed.-Spitsberg.-Exp. 1898) 1 sp. (Sp. 2).

Exterior aspect: The pedal disc was wide, in specimen 1 for the greater part torn off, so that only the outer part was left. The body of specimen 1 was in contracted state conical, of specimen 2 more cylindrical, the distal part of the body of spec. 2 bending outwards and downwards. The ectoderm of the column was lost, the thick mesogloea shows irregular, longitudinal, indistinct furrows. The margin is tentaculate. The tentacles, partly covered by the column, are conical, about as long as broad, and irregularly, transversally wrinkled. The inner are considerably larger than the outer and show no basal thickenings at the outside. The number of tentacles was in specimen 1 about 90, probably 92, in specimen 2 104. The tentacles are very close and sometimes almost fusing together at the base, especially in spec. 1), so that the outlines between them are indistinct; in such cases the mesenteries reach into the tentacles, as textfigure 195 shows. The oral disc is rather wide and radially sulcated. The actinopharynx is well developed, with the deep siphonoglyphes being devoid of gonidial tubercles, but aborally prolongated. The actinopharynx is besides longitudinally sulcated, in specimen 2 there are about 12 longitudinal furrows on each side.

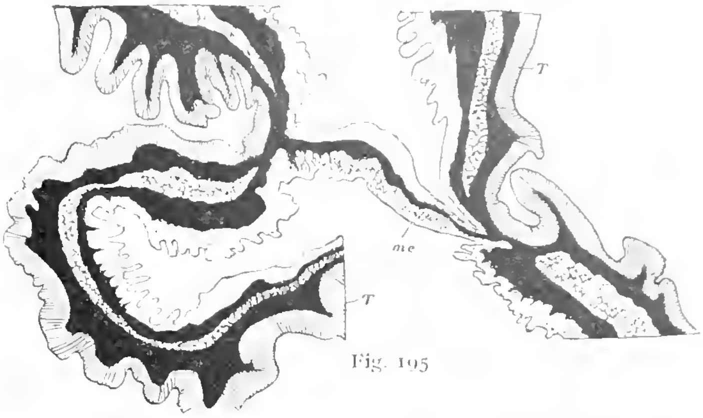

Fig. 195

Fig. 196

Fig. 197

Textfigs. 195—197. *Pycnanthus densus*.
Fig. 195: Transverse section of the basis of two tentacles (*T*) *me* mesentery
Figs. 196—197: Transverse sections of the oral disc fig. 196 in the outer fig 197 in the inner part.

Anatomical description: The ectoderm of the column is lost, its mesogloea is fibrillar and provided with numerous, small, branched, protoplasma-poor cells. The sphincter is strong, and in the distal part it almost fills up the whole breadth of the mesogloea, but rather soon decreases. It is on transverse sections reticular and recalls the sphincter of *Stomphia coccinca*, though it is less strong and less long. I have not observed any distinct stratification of the sphincter. The ectoderm of the tentacles is rather high and contains very numerous nematocysts and spirocysts. The size of the former is in spec. 1 36—48×2,5—3 μ (commonly they are 41—43 μ long), in spec. 2 34—41 × 3—2,5 μ, the latter variates in spec. 1 from 24 × 1,5 μ to 58 × 3,5 μ, in spec. 2 from 22 × 2 to 48 × 4,5 μ. The mesogloea of the tentacles is thicker than their ectoderm, the longitudinal muscles are found in the middle part of the mesogloea and show rather large meshes on transverse sections. The radial muscles of the oral disc (textfigs. 196, 197) are also mesogloeal, but approached to the ectoderm and in the outer part of the disc separated from it only by a thin layer of mesogloea (textfig. 196). The muscles seem to be continuous and not interrupted at the insertions of the mesenteries, the meshes of the muscles are rather large, like those of the tentacles. The mesogloea of the oral disc shows in the parts, which are not occupied by the muscles, a chondroid-shaped structure. The ectoderm of the actinopharynx contains typical nematocysts, the size of which is in spec. 1 29—36 μ long and 2,5 μ broad (a few nematocysts reach a size of 29 × 3,5 μ), in the spec. 2 24—31 × 2—2,5 μ. Besides these, there are here numerous nematocysts with distinct basal part to the spiral thread. in spec. 1 20—24 × 3—3,5 μ, in spec. 2 22—29 × 3,5—5 μ. In the maceration preparation I have found also spirocysts here, which, however, probably do not belong to the actinopharynx, but are attached to the ectoderm.

The number of the pairs of mesenteries was in spec. 1 probably 92. On one side of the animal, counting from one directive to the other, I observed 48 pairs, on the other side I examined only the larger pairs, being 22 in number. As there are pairs, alternating with these latter, of which I have convinced myself by the examination of some compartments, the number of the pairs of mesenteries is on this side probably 44. If we indicate the different cycles by letters — the mesenteries of the first order by Roman figures — the arrangement of the pairs of mesenteries is as follows. (*dm*: directive mesenteries. Concerning the spaced out figures compare below!).

On one side:

$\overset{\text{dm.}}{\text{I}}$ 4 3 5 4 5 2 5 4 5 3 4 I 5 4 5 3 6 5 6 $\overset{*}{4}$ 5 2 5 4 5 3 5 4 5 I 5 4 5 3 6 5 6 4 5 2 5 4 5 3 5 4 5 = 48 pairs,

on the other side:

4 3 5 4 5 2 5 4 5 3 4 I 5 4 5 3 6 5 6 $\overset{*}{4}$ 5 2 5 4 5 3—4— I 5 4 5 3 6 5 6 4 5 2 5 4 5 3—4—$\overset{\text{dm.}}{\text{I}}$ = 44 pairs.

As we see, the arrangement of the mesenteries is almost the same on both sides. The only difference is that 4 pairs of mesenteries of the fifth order are not developed on one side (in the lower line). On closer examination of the arrangement, it appears that it is irregular. In the primary exocoels, on both sides of one directive, we observe mesenteries of the second to the fifth orders, those of the fifth order are, however, developed only between the mesenteries of the third and second cycles, but not between those of the third and first. In the 4 other primary exocoels the mesenteries are numerous and show the same agroupment in all 4, excepting that 4 pairs of mesenteries are lacking on one side. In all these primary exocoels, mesenteries of the second to the sixth cycles are developed, those of the sixth cycle are, however, limited to eight pairs, two in each primary exocoel, on both sides of a pair of the fifth order. Comparing this arrangement with that of the Actinostolids we find a certain agreement. It is true, that both mesenteries of the same pair in the younger cycles of *Pycnanthus densus* generally are of the same size, but the failure or the retardation in the erection of the youngest cycles takes place in the compartments on the side, where the weakest mesenteries of the third order should be situated, if they were developed as in *Actinostola spetsbergensis*. In this species the weakest mesenteries of the third cycle are found next to the mesenteries of the first cycle, the stronger mesenteries next to the mesenteries of the second order. In *Pycnanthus densus* we see that in the first compartments, next to the one directive pair, the mesenteries of the fifth cycle are lacking between the directive pair and that of the third order, while such mesenteries are developed between the pair of the third cycle and that of the second. In the other primary compartments there are mesenteries of the fifth order, except on one side where they are lacking in four exocoels, placed between the mesenteries of the third and first orders. In eight exocoels, four on each side, mesenteries of a sixth cycle are present. If these latter were established in strict conformity with the rule of *Actinostola*, they should appear between the mesenteries of the fourth and second cycles. They have, however, here arisen between those of the third and fourth cycles, which seems to be connected with the fact (in contradistinction to the *Actinostola*) that the weakest mesentery of the fourth cycle (in the scheme marked with a *) stands next to the pair of the second cycle, not as in *Actinostola* next to that of the third. The with a * marked pair of the fourth order namely shows a different development of both mesenteries in the same pair, one being perfect, the other not.

The mesenteries of the second specimen were 216 in number. The arrangement of the 108 pairs agrees well with the agroupment of the mesenteries in spec. 1. The mesenteries of the sixth cycle namely have arisen in the same secondary compartments (between the mesenteries of the first and second orders) as in spec. 1 viz. counted from the one directive pair in the secondary compartments 3 and 5, on each side of the directive plane (compare the arrangement in spec. 1). The number of mesenteries was, however, in two such compartments a little more numerous here than in spec. 1, namely 11 pairs in compartment 5 on one side, and in compartment 3 on the other, instead of 9 in the two other compartments and in the corresponding compartments of spec. 1. In the other secondary exocoels there were mesenteries of the third to the fifth cycles, regularly arranged. Whether a difference in size exists between both mesenteries of the same pair in the mesenteries of the fourth cycle I cannot decide, as I did not want to cut up the specimen. For the same reason I have not examined the number of the perfect mesenteries here.

The mesenteries of the three first cycles were perfect in specimen 1. Two unpaired mesenteries of the fourth cycle besides reach the actinopharynx, as above mentioned. In a couple of cases I have observed a slightly different size of both mesenteries of the third cycle, the weakest mesentery in the pairs is next to the mesenteries of the first order. Though the arrangement of the mesenteries does not quite agree with that of the Actinostolids, it, however, seems to recall the latter.

The mesenteries were provided with comparatively small oral, but with large marginal stomata. Their mesogloea is rather thick. The longitudinal muscles form no distinct pennons and show, on transverse sections, rather coarse folds, scattered over the whole surface. The parietobasilar muscles are distinctly outlined and reach the region of the marginal stomata. Through the growth of the parietobasilar muscles one part of these muscles becomes mesogloeal as in *Stomphia*. The reproductive organs of specimen 1 are found on the third, on the greater part (18 pairs) of the fourth, and on four pairs of the fifth cycle. In the scheme I have marked the fertile pairs with spaced out figures. The younger sterile pairs, 6 of the fourth order, 32 of the fifth and 8 of the sixth, are very weak, appear only in the most proximal part of the body, and are devoid of filaments. In spec. 2 the third and fourth cycles and 6 pairs of the fifth were fertile. The other pairs of the fifth and sixth cycles were sterile and without filaments.

Genus **Parasicyonis** n. gen.

Diagnosis: Paractiidae with a well developed pedal disc. Body more broad than high. Column thick, smooth, without tubercles. Margin tentaculate without fossa. Tentacles rather short but broad, robust, in contractions wrinkled, the inner longer than the outer. Sphincter comparatively weak, so that the column commonly does not cover the tentacles. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. Two deep siphonoglyphes. Numerous perfect mesenteries. Mesenteries often a little irregularly arranged, both mesenteries of the last sterile cycle sometimes differently developed, so that one mesentery is perfect, another not, but not regularly arranged as in *Actinostola*. Number of mesenteries at least twice as large as that of the tentacles. Only the mesenteries of the last cycle fertile. These mesenteries do not reach the oral part of the column and are, like all the other mesenteries, provided with well-developed filaments.

The genus *Parasicyonis* is certainly nearly related to *Sicyonis*, from which it is mainly distinguished through the fertile mesenteries having well-developed filaments with ciliated streaks, while in *Sicyonis* they are devoid of such, though they are sometimes rather well developed. Also the arrangement of the mesenteries seems to be different in both genera. Possibly it may later on be found out that they may be placed together to a genus, for the present I consider it the most practical to separate them. Excepting the type, *P. sarsii*, I place to the genus also *P. actinostoloides* and *P. maxima*, described by Wassilieff (1908) as belonging to the genus *Cymbactis*. The whole of their exteriors namely recalls that of *P. sarsii*, and the imperfect description, given by Wasilieff, in no way contradicts that we have to do with specimens of the genus *Parasicyonis*. According to me, the following specimens belong to the genus:

Parasicyonis sarsii Carlgr.
— *actinostoloides* (Wassil.) Carlgr.
— *maxima* (Wassil.) Carlgr.

Parasicyonis sarsii n. sp.

Pl. 3. Fig. 12.

Diagnosis: Sphincter reticular, thin but rather long, often in the outer parts with traces of stratification. Tentacles commonly 86 to 103. About one half of the oral disc devoid of tentacles. Radial muscles of the oral disc interrupted at the insertions of the mesenteries, strong. Number of mesenteries about twice as many as the tentacles, or more. Mesenteries of the three first cycles and one part of the fourth perfect. Part of these latter consisting of a perfect and an imperfect mesentery. Arrangement of the mesenteries hexamerous but not regular. Longitudinal muscles of the mesenteries rather weak. Parietobasilar muscles broad, but weak. Nematocysts in the ectoderm of the tentacles numerous (26) 29—43 × 2—2,5 μ, in that of the actinopharynx 19—29 (37) × 2 (1,5—2 μ). Spirocysts of the tentacles (14 × 1,5) 22 × 1,5—67 × 3,5—4,5 μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 23—31 × 3,5—4,5 μ.

Colour: pale brick-red, shading off into orange (spec. from Drontheimfiord, Carlgren).

Dimensions of the two largest specimens: length 4 cm, breadth of the pedal disc 8 cm, length of the inner tentacles about 2 cm, the outer not half as long as the inner. The smallest specimen (with only 62 tentacles) is about 2 cm high and 4 cm broad at the pedal disc.

Occurrence: Norway. Finmark Andenes 100—200 fms. (H. Kier 1894) 1 sp., Drondtheimfiord, Garten
250 m (1910) 1 sp., Rodberg 200 m 2 sp., Tautra 250—80 m 2 sp. (Gunnerus 1921)
62°18′ N. 4°14′ E. 370 m (Michael Sars-Exp. 1902 St. 60) 1 sp.
62°54′ N. 9°13′ W. 460 m. Bottom temp. 4,37 (Michael Sars-Exp. 1902 St. 101) 2 sp.
15 miles E. of the northernmost Faroe Islands (taken with a line) (Michael Sars-Exp. 24. 7. 1900?) 1 sp.
S. of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp. 1903 St. 171) 1 sp.

Exterior aspect. The wide pedal disc is somewhat broader than the column. The body is, in comparison to the breadth, low and forms a short cylinder. The column is smooth, firm and thick, sometimes with indistinct furrows, probably arisen by contraction. The margin is tentaculate without a fossa. The tentacles are thick, robust and conical, in contracted state longitudinally and transversally wrinkled, the inner are more than twice as long as the outer and in preserved specimens about half as long as the height of the column. They are not swollen at the base and rather scattered, so that they occupy about one half of the oral disc. The number varies between 62 in the smallest specimen and 103 in the largest. Five examined specimens had 62, 86, 90, 96, 103 tentacles, arranged in several cycles. In four of the specimens the tentacles were wholly visible, in the smallest specimen and in one of the largest the tentacles were partly covered by the column. It is, however, questionable, if the tentacles may be totally covered, as the sphincter is weak, in comparison to the size of the animals. The inner, tentacle-lacking part of the oral disc is provided with radial furrows. Both siphonoglyphes are broad and deep and aborally a little prolongated. The actinopharynx is long and provided with numerous longitudinal furrows.

Anatomical description: The ectoderm of the column was for the greater part lost. It is thin and contains nematocysts, 17—22 × 1,5 μ in size. I have here, besides, found some nematocysts of the same size as those of the tentacles, but it is possible that they are fastened to the surface and thus not belonging to the column. The mesogloea, especially in some specimens, reaches a considerable thickness and shows a fibrillar structure with scattered, rather numerous, small cells. The sphincter is rather weak and somewhat elongated, but thin and only occupying part of the mesogloea. It was in two examined specimens, in all places reticular with small meshes, in the specimen from Andenes and from Station 60 the outer parts bore traces of stratification; the inner reticular part is separated from the outer by a longitudinal, rather thick mesogloeal lamella. The ectoderm of the tentacles is rather high, though not as thick as the mesogloea, and contains very numerous nematocysts. The size of the nematocysts and spirocysts was in the different specimens as follows. a) typical nematocysts, b) nematocysts with discernible basal part to the spiral thread.

Habitat	Tentacles		Actinopharynx	
	nematocysts	spirocysts	*a*	*b*
1. Andenes	34—42 × 2,5 μ	24 × 2—67 × 3 μ	19—26 × 2 μ	26—31 × 3,5—4,5 μ
2. S. of Iceland	29—41 × 2	22 × 2—60 × 4,5	22—26 × 2	26—29 × 3,5—4,5
3. St. 101 "M. Sars"	31—38 × 2(2,5)	22 × 1,5—62 × 3,5	22—26 × 1,5—2	24—26 × 4
4. St. 60 "M. Sars"	(26)34—41 × 2,5	14 × 1,5—58 × 3	24—29 × 2	23—29 × 3,5—4,5
5. E. of Faro Isl.	30—43 × 2	24 × 1,5—58 × 3	25—37 × 1,5—2	26—31 × 3,5

In the specimens 1, 3, 4, 5 I have found solitary typical nematocysts in the actinopharynx. They were a little larger (29—38 × 2,5 μ) than usual. Whether these nematocysts belong to the actinopharynx or are sticking to it, I cannot with certainty decide, in specimen 5 I observed only a few typical nematocysts in the maceration preparations, in the other specimens the nematocysts, put down in the table, were, however, numerous. The mesogloeal, longitudinal muscles of the tentacles on transverse sections show meshes of ordinary size, which are situated now in the middle of the mesogloea, now nearer to the endoderm. In the textfig. 198 I have reproduced a transverse section of a tentacle; the muscles are weaker on the outer side than on the inner one. The radial muscles of the oral disc recall the longitudinal muscles of the tentacles. They are the best developed in the specimens 1 and 5 (textfig. 199). They are distinctly interrupted at the insertions of the mesenteries.


Fig. 198

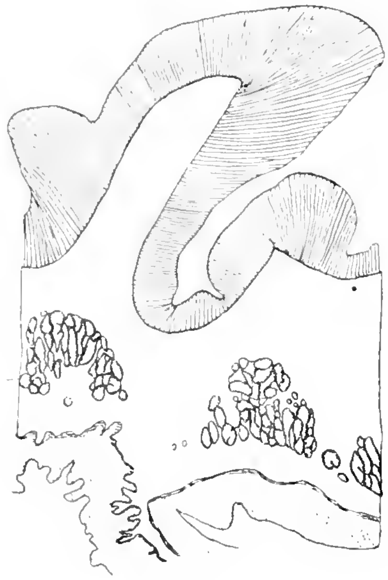

Fig. 199

Textfigs. 198—199. *Parasicyonis sarsii.*
Transverse sections of tentacle (fig. 198) and of oral disc (fig. 199).

The number of mesenteries varies. In one half of specimen 1 with 96 tentacles I counted 54 pairs of mesenteries (27 pairs sterile and as many fertile), in specimen 2 with 90 tentacles the pairs of mesenteries were 94 (22 on one side and 25 on the other, sterile and as many fertile), in specimen 4 with 62 tentacles probably 90 pairs of mesenteries half of which sterile, in the specimen 5 with 86 tentacles 86 (18 pairs on one side and 25 on the other, sterile and as many fertile). As we see, the arrangement of the mesenteries was different on both sides of the directive plane. In one half of specimen 1 the mesenteries of the first to the third cycles were perfect, among the mesenteries of the fourth cycle three pairs reached the actinopharynx, six pairs consisted of a perfect and an imperfect mesentery and three pairs were imperfect like the mesenteries of the fifth and sixth orders. In specimen 4 there were in the whole animal probably 26 pairs perfect and three pairs consisted of a perfect and an imperfect mesentery. In specimen 5 I observed on the less developed side eleven pairs perfect and three consisting of a perfect and an imperfect mesentery, on the other side probably thirteen pairs perfect and four pairs consisting of a perfect and an imperfect mesentery. The pairs, showing a different development of both their mesenteries are, as far as I can see, irregularly arranged. Half the mesenteries are sterile, the other half fertile, the latter are the younger and have well-developed filaments with ciliated streaks like the other mesenteries, but never reach the distal part of the column.

The longitudinal muscles of the mesenteries are rather weak and hardly show any distinct pennons. The parietobasilar muscles are broad and reach far upwards, but consist of a non folded muscle lamella. Oral stomata are present. In two specimens I have also observed marginal stomata, but they do not seem to be constant. The ciliated streaks are well developed.

Genus Sicyonis R. Hertw.

Diagnosis: Paractiidae with well developed, enlarged basal disc and from rather thick to thick, cartilaginous, smooth column, which, in contracted state, is sometimes somewhat sulcated in the upper part and here capable of involution. Sphincter weak or rather well developed. Tentacles short, the inner considerably stronger than the outer ones, often more or less thickened on the outside of the base and in that case with the longitudinal muscles stronger on the inner, weaker on the outer side or disappearing at the base, only about half as numerous as the mesenteries. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 broad siphonoglyphes. The arrangement of the mesenteries is not as regular as in *Actinostola*, variable, but with a strong tendency to a different development of the two mesenteries in the same pair. Often 16 pairs of perfect mesenteries, a variable number of pairs, in which one mesentery is perfect, the other not. Mesenteries with no distinct longitudinal pennons. Parietobasilar and basilar muscles well-developed. Mesenteries differentiated into stronger sterile mesenteries with well developed filaments and into weaker fertile without filaments, the latter appear at the limbus and grow from here in oral direction but do not reach the most distal part of the column.

Among the species described below, *Sicyonis tuberculata* and *ingolfi* are nearly allied to the type-species *Sicyonis crassa*. The agreement is so perfect in important characters, as f. inst. in the presence of mesogloeal muscles in the tentacles and in the oral disc, in the arrangement of the reproductive organs on filament-lacking mesenteries of the last order, in the number of tentacles in comparison to that of the mesenteries etc., that there is no doubt that my species belongs to this genus. It is true, that the tentacles of *Sicyonis crassa*, according to Hertwig, seem to be much more reduced than in my species, but this difference is, however, to my mind, only apparent, as the strong contraction and the bad preservation[1] in connection with a flattening of the tentacles in *S. crassa* have produced the tubercle-shaped appearance of the tentacles in the type. Thus it is to be supposed that the tentacles of *S. crassa* have had about the same appearance as those of *S. tuberculata* and *ingolfi*. Also the large apertures in the apex of the tentacles in the type are certainly artificial products, due to bad preservation (compare further *S. variabilis*). Though *Sicyonis variabilis*, described below, differs from the above named species in the arrangement of the mesenteries, it seems to me that this species manifestly belongs to this genus. To the genus *Sicyonis Cymbactis gossei*, described by Stephenson (1918 b p. 123), probably also may be referred. The whole organisation namely indicates that we have to do with a *Sicyonis*, unfortunately Stephenson does not mention whether the fertile mesenteries are devoid of filaments or not. Concerning the other species of *Cymbactis*, *C. selaginella*, described by Stephenson (1918 a), may be a *Stomphia*[2] (compare this genus), and *C. actinostoloides* Wasil. and *C. maxima* Wasil. belong to the genus *Parasicyonis* (compare p. 208).

R. Hertwig 1888 has described a new species *Sicyonis elongata*. I cannot, however, arrange this species in the series of *Sicyonis*, on account of the comparatively small breadth of the pedal disc and the presence of fertile mesenteries in the distal part of the body instead of in the proximal part, as in the real *Sicyo-*

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[1] The Actinians from the Challenger-Expedition are generally very badly preserved and their original shape often greatly altered by the pressure, of which I have been able to convince myself during a visit in London 1897.

[2] After this was written Stephenson (1920 l. c. p. 559) has come to the same conclusion.

nis-species. Manifestly a reversed case takes place, compared with *Sicyonis*, here we find the mesenteries to be more numerous in the distal than in the proximal part, there they are more numerous in the proximal part, here we probably find a greater number of tentacles, corresponding to the richer development of the mesenteries in the distal body-end, there fewer tentacles in number, corresponding to that of the sterile mesenteries. The arrangement of the mesenteries is, besides, so imperfectly known that we cannot with certainty place this species in the vicinity of the genus *Sicyonis*, though much in Hertwig's description speaks for it. For the present I should like to propose a new genus *Synsicyonis* for *Sicyonis elongata*, which I provisionally characterize as follows:

Paractiidae with the basal disc not enlarged. Column thick, cartilaginous, smooth. Sphincter, tentacles, oral disc and siphonoglyphes as in *Sicyonis*, the number of tentacles, however, about the same as that of the mesenteries. Arrangement of the mesenteries probably recalling that of *Sicyonis* (or of *Actinostola?*) but irregular "owing to the alternation of isolated genital mesenteries with isolated complete ones." Mesenteries differentiated in stronger sterile and weaker fertile ones, the latter only in the distal part and without filaments.

According to me, the following species may be referred to the genus *Sicyonis*:

S. crassa R. Hertw.
S. gossei (Steph.) Carlgr.
S. tuberculata Carlgr.
S. ingolfi Carlgr.
S. variabilis Carlgr.

Sicyonis tuberculata n. sp.

Pl. 3. Figs. 2—3.

Diagnosis: Body, according to the different state of contraction, flat or more cylindrical, commonly not high. Sphincter rather well developed, sometimes weak with groups of small meshes, encircled by stronger stripes of mesogloea. Tentacles about 64 to 68 with very strong, swollen mesogloea on the base of the outside. Apertures in the apex of the tentacles small. Longitudinal muscles of the tentacles on the inner side divided in closely packed, but large, meshes, on the outer side considerably weaker and disappearing at the base. Radial muscles in the outer part of the oral disc developed as on the inner side of the tentacles, interrupted at the insertions of the mesenteries. Actinopharynx longitudinally sulcated. Siphonoglyphes very elongated towards the aboral end. Pairs of mesenteries about 64—68, of which one half stronger, sterile and with well developed filaments and longitudinal muscles, the other half alternating with these latter, with weak muscles, fertile, generally without filaments, and extended only in the proximal parts of the body, from which they reach a longer or shorter way upwards, in as much as the reproductive organs are more or less developed. Commonly 16 pairs of perfect mesenteries. The rest of the filamentous pairs often symmetrically arranged on both sides of the directive plane, but the arrangement is not regular as some mesenteries of one and the same cycle arise earlier in certain exocoels than in others. Mesenteries of the pairs mostly differently developed, some of them reaching the actinopharynx with only one mesentery of each pair. Longitudinal muscles of the mesenteries diffuse. Parietobasilar muscles differentiated, much expanded on the mesenteries. Basilar muscles with rather numerous, closely packed, high folds. Oral stomata present. Marginal stomata as a rule on the stronger mesenteries. Nematocysts in the ectoderm of the tentacles 19—34 × 2,5 μ, in the actinopharynx 24—31 × 2,5 μ, here also nematocysts with discernible basal part to the spiral thread 24—29 × 5 μ. Spirocysts in the ectoderm of the tentacles of variable size 22 × 2 to 55 × 5 μ.

Colour in alcohol white, oral disc brown, actinopharynx dark brown.

Dimensions of the largest specimen. Length 4 cm, breadth 4,5 cm.

Occurrence: Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9°. (Ingolf-Exp. St. 32) 8 spec.

Danmark Strait. 64°34′ N. 31°12′ W. 1300 fms. Bottom temp. 1,6°. (Ingolf-Exp. St. 11) 4 spec.

Exterior aspect: The form of the body varies rather considerably, according to the different state of contraction of the animals, now it is strongly flattened (Pl. 3 fig. 2) now more cylindrical (Pl. 3 fig. 3). The pedal disc is wide, the column smooth and irregularly sulcated, in the uppermost part, in certain specimens, with longitudinal furrows, surpassing the limit of the mesogloeal bridges of the tentacles. Neither a fossa nor a distinctly marked margin are present. The tentacles on the outside display very large thickenings of the mesogloea, prolonged far upwards. The distal part of the tentacles is conical or cylindrical with a small aperture in the apex. In some tentacles the apertures are very large, but they are artificial, due to bad preservations. The tentacles are about 64 to 68, arranged in several cycles and thinly scattered. Owing to the strong contraction of the animals I have not been able to determine their arrangement. The tentacles may be totally covered by the column. The oral disc is wide, provided with radial furrows and, in the state with involved tentacles, strongly excavated. The greater part of the oral disc bears tentacles. The actinopharynx is not long, longitudinally sulcated and provided with two broad, symmetrically placed siphonoglyphes. These latter have well developed aboral prolongations and in the oral region two distinct gonidial tubercles.

Anatomical description. The ectoderm of the column is almost totally lost in all specimens. In a specimen there remain just above the pedal disc some fragments, containing very numerous nematocysts, 17—19 × 2 μ large; the mesogloea was very thick, cartilaginous and unequally structured in the outermost and in the inner parts. The former is namely provided with numerous cavities, containing cells, while the latter are of more typical appearance with scattered protoplasma-poor cells. Unfortunately I cannot give a good description of the former as the mesogloea was not well preserved.

The endodermal circular muscles are rather weak, the mesogloeal sphincter of some specimens rather strong, of others, as well as of the largest specimen, weak. In the latter case it only occupies a small part of the breadth of the mesogloea, in the former it is about half as broad as the mesogloea. Also in one and the same specimen the strength of the sphincter may vary in different parts, possibly owing to a different contraction of the tissue. The sphincter is rather elongated and gradually passing into the circular muscles of the endoderm. It is close by the endoderm and shows no distinct longitudinal stratification, though the muscles seem to have been enclosed in the mesogloea during different periods. The meshes are small and arranged in groups, surrounded by somewhat broader balks of the mesogloea (textfig. 201, transverse section of sphincter in its middle part). The ectoderm of the tentacles is on the base of the outside low, on the inside a little thicker, more upwards the ectoderm of the outside is also thicker. It contains rather numerous to numerous nematocysts, 19—34×2,5 μ large, and very numerous spirocysts of variable length, from 22 × 2 to 55 × 5 μ (3 specimens examined). The tentacles are devoid of longitudinal muscles on the abaxial side at the base, more upwards there are solitary muscle-meshes in the mesogloea (textfig. 200, transverse section of tentacle near its base), and in the distal part, above the swelling of the mesogloea, numerous meshes of the same size as those at the adaxial size, where the muscle-meshes are numerous also at the base. The muscle meshes are more or less delicate and often elongated in radial direction. The mesogloea is considerably thicker than the ectoderm, excepting at the apex of the tentacles. The radial muscles of the oral disc recall the outer tentacle-lacking parts of the longitudinal muscles of the tentacles and form thin meshes, elongated in the direction from the ectoderm to the endoderm. At the insertions of the mesenteries they are interrupted by thicker mesogloeal balks. In the vicinity of the actinopharynx the muscle meshes are small and few. The ectoderm of the actinopharynx is rather high, strongly pigmentous and contains numerous, typical nematocysts, 24—31×2,5 μ in size, and rather numerous nematocysts with discernible basal part to the spiral thread (size 24—29×5 μ. 3 specimens examined).

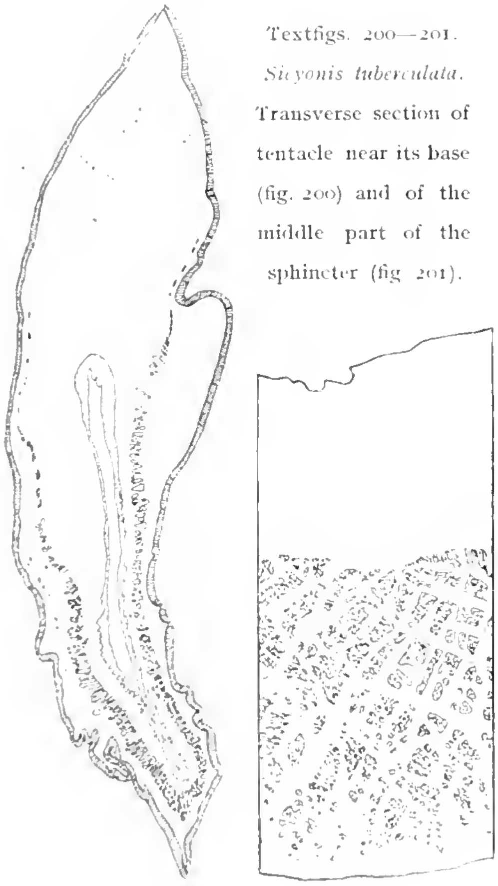

Textfigs. 200—201. *Sicyonis tuberculata.* Transverse section of tentacle near its base (fig. 200) and of the middle part of the sphincter (fig 201).

Fig. 200 Fig. 201

The arrangement of the mesenteries is rather peculiar and shows a tendency to an octomerous development, in as much as often 16 pairs are perfect; there are besides some fewer or more numerous pairs, of which one mesentery is perfect, the other not. We also often may find several imperfect pairs of mesenteries of which one mesentery is more strongly developed than its partner. I have, however, not made any observations, definitely proving the mesenteries to be arranged, according to the same distinct law as in the Actinostolids, though the mesenteries on both sides of the directive plane are often symmetrically grouped. Five examined specimens show the following arrangement of the stronger mesenteries. Issuing from one directive mesentery we follow the mesenteries as the figures on a dial and, if necessary, call the mesentery next to the directive mesentery *a*, its partner *b*. (The reproductive mesenteries are not enumerated in the scheme).

The following pairs of mesenteries were perfect in:

Sp. 1 (St. 32)
Sp. 2 (St. 11) 1, 3, 6, 7, 9, 12, 13, 15, 17, 19, 21, 22, 25, 27, 28, 31 = 16 pairs (textfig. 202 *B*).
Sp. 3 (St. 11)
Sp. 4 (St. 11) 1, 3, 6, 7, 9, 12, 14, 16, 18, 20, 22, 24, 27, 29, 30, 33 = 16 pairs (textfig. 202 *A*).
Sp. 5 (St. 32) 1, 3, 6, 7, 9, 12, 13, 15, 17, 19, 21, 22, 26, 28, 32 = 15 pairs (textfig. 202 *C*).

As we see, in specimens 1—3 the same pairs of mesenteries are perfect. In specimen 5 we find mainly the same arrangement of the mesenteries. At the end of one half, the arrangement of the mesenteries is, however, disturbed by an extra filament-bearing mesentery 25 being intercalated. Besides, one of the pairs of mesenteries, which are perfect in specimens 1—3, does not reach the actinopharynx here. The specimen has only 15 perfect pairs. In specimen 4, which is provided with 34 stronger pairs of mesenteries instead of 32 as in specimens 1—3, part of the perfect pairs of mesenteries are of another number than in the latter specimens. If we imagine that the also here developed extra-mesenteries (*x*) had not arisen, the arrangement of the perfect pairs of mesenteries would be the same as in the three first specimens.

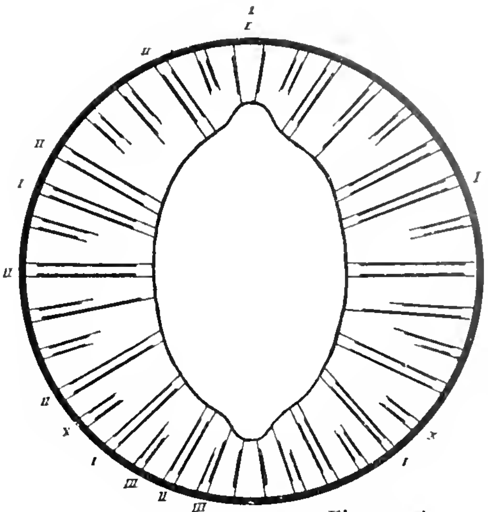


Fig. 202 *A*

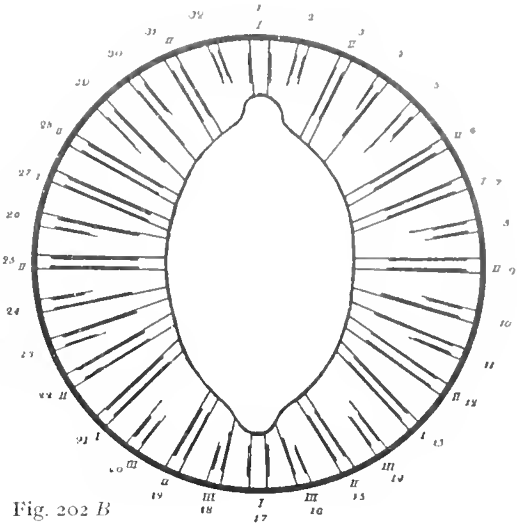


Fig. 202 *B*

Textfigs. 202 *A*, *B*, *C*. *Sicyonis tuberculata*. Diagrams of the arrangement of the mesenteries. In figs. 202 *A* and *B* only the sterile mesenteries are reproduced. Compare the text!

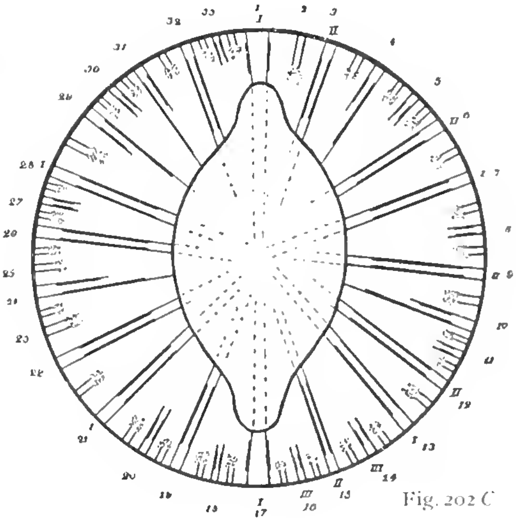


Fig. 202 *C*

The following pairs of mesenteries consist of a perfect and an imperfect mesentery. The letter indicates the perfect mesentery.

Sp. 1.	4b		10b	11a	16b		18a		23b	24a	26b	29b	30a	= 10 pairs	(202 *B*)
Sp. 2.	4b	8a	10b		16b		18a		23b		26b		30a	= 8 —	
Sp. 3.	4b		10b		16b		18a			24a			30a	= 6 —	
Sp. 4.	4b		10b			17b		19a			26a			= 5 —	(202 *A*)
Sp. 5.	4b		10b							24a		29b	31a	= 5 —	(202 *C*)

The three first specimens as well as the greater part of the specimen 5 fully agree. It is true that the same mesentery is not always perfect, owing to the different number of the pairs, consisting of an imperfect and a perfect mesentery which are present in the five specimens, but it is the same a and b mesenteries which are perfect in the pairs. Now one pair, now another thus seems to grow more rapidly. Besides, it ought to be observed that also several pairs of imperfect mesenteries show a different development of both mesenteries in one and the same pair. So the perfect mesentery 8 a in the specimen 2 corresponds to a stronger imperfect mesentery 8 a in the specimen 1. The perfect mesentery 11 a in the specimen 1 is adequate to a stronger imperfect mesentery 11 a in the specimen 2, and this is also the case with the mesentery 24 a. If we disregard the presence of the extra pairs of mesenteries *x* (compare above) in the specimen 4, the arrangement of the mesenteries is also here the same, 17 b corresponds to 16 b, 19 a to 18 a, 26 a to 24 a.

How this peculiar arrangement has arisen, is difficult to decide. As to the place of the mesenteries of the first order I think that I am able to draw a definite conclusion. An examination of the expansion of the mesenteries on the pedal disc in four specimens namely distinctly shows, where the mesenteries of the first cycle are situated. On the textfigures 202 *A*—*C* I have marked these mesenteries with I. On closer examination of these textfigures we find that in two primary exocoels of the first order, one on each side of a directive pair, one pair of mesenteries of the second order (II) and two pairs of the third (III) have been developed (the fertile mesenteries are not included), while the mesenteries are more numerous in the other primary exocoels. In these latter I cannot with certainty determine which mesenteries belong to the second cycle. It is, however, worth noticing that the mesenteries are equally situated in all these four primary exocoels. For my part, I am still inclined to suppose that the mesenteries of the second order have been doubled in these four exocoels. Under this supposition the perfect pairs of mesenteries would consist of 6 pairs of the first and 10 pairs of the second order. If this supposition is correct, the arrangement of the mesenteries namely may be parallelled with that of the Actinostolids. On the above reproduced textfigures the different development of both mesenteries of one pair of the mesenteries of the second order is not discernible at the actinopharynx, which, on the other hand, is the case at the pedal disc. On the textfigure 202 *C* I have designated the approximate extension of the stronger mesenteries ou the pedal disc with spaced-out lines. The mesenteries of the first order reach the nearest to the centre of the pedal disc, the directive pair which is turning downwards on the figure is shorter than the five other pairs. In the remaining pairs — which we suppose to be of the second order — we see both mesenteries of the same pair differently developed. They follow the rule, characteristic of the Actinostolids, the stronger mesenteries namely turn their longitudinal muscles towards the lateral mesenteries of the first order and towards the directive pair, situated upwards on the figure; viz. towards the oldest mesenteries, the first, second and third couple during the development. From this we may conclude that the double number of mesenteries of the second cycle probably has arisen in the lateral and ventrolateral primary exocoels. Supposing this to be the case, we may also explain the different development of the mesenteries in one and the same pair of the mesenteries of the third cycle. Also these mesenteries namely likewise follow the *Actinostola*-rule, though the development in the many exocoels has become more irregular, probably in connection with the doubling of the mesenteries of the second order. Concerning the latest developed (fertile) mesenteries it ought to be observed that I have not always been able to determine a different size of both mesenteries of one and the same pair, on account of the specimens not being well preserved, the thick mesogloea of the older mesenteries causing some difficulties at the dissection, and the reproductive organs sometimes being so strongly developed that they hide the other inconsiderable parts of these mesenteries (compare below). On the textfigure 202 *C* I have therefore marked the fertile mesenteries as if they were equally developed. I have, however, been able to ascertain that also here sometimes traces of a different development of both mesenteries of the same pair are present. For all these reasons I think that *Sicyonis* is rather nearly related to the *Actinostola* and *Stomphia*.

Alternating with the stronger, generally sterile pairs of mesenteries (32 in the specimens 1—3, 33 in the specimens 5 and 34 in the specimen 4) there is a cycle of fertile mesenteries (fig. 202 *C*), which are now very small and provided with few reproductive products, now longer with very large reproductive products. These mesenteries arise at the pedal disc and grow upwards, but never reach the distal body-end. Exceptionally some of the smallest mesenteries of the third cycle bear reproductive organs. This is the case with the pairs 5 and 29 of the specimen 2, and the pairs 2, 23 and 25 of specimen 5; in the latter specimen they agree with the other fertile mesenteries, in the former they were provided with filaments.

The longitudinal muscles of the mesenteries are well-developed with closely packed, high folds, expanded over the whole surface and not forming pennons. The parietobasilar muscles are well marked, broad in the lower part and reaching far upwards as a narrow lamella, their folds are, however, very weak in the lower part, in the upper part the muscles form an even lamella. The mesogloea is thick in the stronger mesenteries, thin in the fertile. The greater part of the latter is occupied by the reproductive organs, only a little part next to the column is muscular. The muscle folds are also here numerous on the longitudinal muscle-side, so that we may say that the muscles of the fertile mesenteries form a miniature of those of the sterile mesenteries. Oral stomata are present. The stronger mesenteries are also generally provided with marginal stomata. The filaments of the sterile mesenteries are of typical appearance, the ciliated streaks are well-developed. The fertile mesenteries, excepting the above named, are completely devoid of filaments, as far as I can see, which is in conformity with Hertwig's observations of the type-specimen, *S. crassa*. The species is dioecious. The ova are numerous but small.

Sicyonis ingolfi n. sp.

Pl. 3. Fig. 1.

Diagnosis: Body rather low. Column in the uppermost part with longitudinal furrows. Sphincter as in the former species feeble with a tendency to stratification. Tentacles about 68, the outer with large, the inner with weak, abaxial, bulbous thickenings at the base. Apertures in the apex of the tentacles small. Longitudinal muscles of the tentacles and radial muscles of the oral disc as in *S. tuberculata*, only feebler. Actinopharynx and siphonoglyphes as in the former species. Pairs of mesenteries 68, 34 with well developed filaments and rather well developed muscles, sterile, 34 without filaments, fertile, only present in the proximal part of the body. 16 pairs perfect. Both mesenteries of the same pair of the other stronger mesenteries sometimes unequally developed, so that one mesentery is perfect, the other not. Muscles of the mesenteries about as in *S. tuberculata*, but feebler. Oral and marginal stomata present, the latter at least on some of the stronger mesenteries. Nematocysts in the ectoderm of the tentacles 36—41 × 2,5 μ, in the actinopharynx 29—36 (38) × about 3 μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 26—29 × 5 μ. Spirocysts of the tentacles from 24 × 2 μ to 62 × 4 μ.

Colour in alcohol: white, the actinopharynx uncoloured.

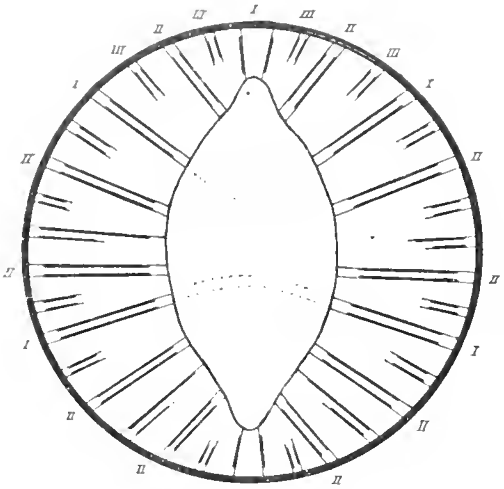
Dimensions in contracted state: Length 3 cm, breadth 4 cm.

Occurrence: South of Greenland. 58°20′ N. 48°25′ W. 1695 fms. Bottom temp. 1°5 (Ingolf-Exp. St. 20) 1 sp.

Exterior aspect. The exterior of this species (Pl. 3 fig. 1) recalls that of *S. tuberculata*. The longitudinal furrows in the uppermost part of the column are more distinct, as in this species. Only the outer tentacles are provided with strong mesogloeal thickenings on the abaxial side, the inner tentacles are also here a little thickened, though by far not as much as in the former species. The tentacles are closer than in

S. tuberculata, wherefore the tentacle-lacking part of the oral disc is large. The actinopharynx is of ordinary length. In the other exterior characters this species agrees with *S. tuberculata*.

Anatomical description: The interior organisation also much recalls that of *S. tuberculata*. The nematocysts are, however, larger, especially those of the tentacles. The ectoderm of the column contains rather numerous nematocysts, 17—22 × 2 μ in size. In the tentacles they reach a size of 36—41 × 2,5 μ and in the actinopharynx 29—36 (38) × about 3 μ. I have in the actinopharynx also observed some nematocysts with discernible basal part to the spiral thread. They are 26—29 × 5 μ in size. The spirocysts of the tentacles vary from 24 × 2 μ to 62 × 4 μ.



Textfig. 203. *Sicyonis ingolfi*. Diagram of the arrangement of the sterile mesenteries.

The arrangement of the mesenteries mostly agrees with that of specimen 4 of *S. tuberculata*. A schematic figure of the arrangement of the stronger mesenteries I have given in textfig. 203. The agroupment of the mesenteries in both the uppermost sextants does not completely correspond with that of *S. tuberculata* nor with that of the middle sextants. The perfect pairs are, however, 16, three pairs consist of one imperfect and one perfect mesentery. Both mesenteries of the imperfect pairs do not differ so much in size as the former species. I have been able to determine with certainty the position of the mesenteries of the first cycle (on the figure designated with I). The four lateral pairs of mesenteries were namely at the base united with each other, two and two (on the figure designated with spaced-out lines), while all other mesenteries, excepting the directives, do not reach so far towards the centre of the pedal disc. The 10 pairs of the second order (II) show the same expansion on the pedal disc as in *S. tuberculata*. The muscles of the mesenteries recall those of the same species, though they are weaker, this is possibly connected with an individual variation, which I cannot decide as I have had only one specimen for examination. The fertile pairs of mesenteries, alternating with the 34 sterile and filament-bearing pairs, were developed only in the proximal part of the body and provided with rather few ova; they were, as in *S. tuberculata*, devoid of filaments.

Sicyonis variabilis n. sp.

Pl. 3. Fig. 11.

Diagnosis: Body in contracted state more broad than high. Sphincter weak, reticular. Tentacles about 70 (67—74) in number, with a thick mesogloea which does not form any basal swellings at the base, cylindrical to conical, in contracted state with irregular, transversal furrows. Longitudinal muscles of the tentacles on the outer and the inner side, at the base, equally developed. Radial muscles of the oral disc interrupted at the insertions of the mesenteries. Actinopharynx ordinarily long. Pairs of mesenteries variable, unto about 100 or a little more. A variable number of perfect pairs (to 21) and a smaller number of pairs, in which one mesentery is perfect, the other not. The arrangement of the mesenteries very variable, unequally developed on both sides of the directive plane. The folds of the longitudinal muscles of the mesenteries as in *S. tuberculata* but not as high. Parietobasilar and basilar muscles and stomata as in *S. tuberculata*. Nematocysts of the tentacles as well as those of the actinopharynx very numerous, the former 31—38 × 2,5 μ, the latter 19—29 × 2 (2,5) μ. Spirocysts of the tentacles very numerous, from 24 × 2 μ to 58 × 4 μ.

Colour in alcohol: uncoloured, actinopharynx brown.

Dimensions of the largest specimen: Breadth of the pedal disc 4,5 × 3,5 cm, height of the body about 2,6 cm, length of the inner tentacles 1,4 cm, that of the outer 0,5 cm. The smallest specimen was 1 cm high and 2,2 × 1,5 cm broad.

Occurrence: 60°37′ N. 27°52′ W. 799 fms. Bottom temp. 4,5° (Ingolf-Exp. St. 78) 9 specimens.

Exterior aspect: The pedal disc is well developed, in contraction wrinkled. The column is like that of the species, described above, sometimes there seems to be an indication of a margin and a fossa, it is, however, probable, that they have arisen by contraction, as in one and the same individual such formations appear in some parts, and are wanting in other parts. The tentacles are from cylindrical to conical, according to the different state of contraction, in contracted state provided with irregular, transverse furrows and devoid of abaxial thickenings at the base. The inner tentacles are at least twice as long and broad as the outer. They are arranged in several cycles, but the agroupment is difficult to decide. The number of the tentacles was in the largest specimen 71, in the smallest 74, and in a third 67. The tentacles occupy the greater part of the oral disc which is provided with distinct, radial furrows. The actinopharynx is longitudinally sulcated, on account of the bad preservation I cannot determine the number of furrows. The siphonoglyphes are distinct and provided with aboral prolongations.

Anatomical description: To judge from the small remaining fragments the ectoderm of the column is low and contains rather numerous nematocysts, about 17 × 2 μ in size. The mesogloea is very thick, fibrillar, with scattered, protoplasma-poor cells. The sphincter is weak, takes up about one third of the breadth of the mesogloea and shows a decidedly reticular structure as in *Stomphia coccinea*. The column, however, seems to be able to cover tentacles, as they were indiscernible in one specimen. The endodermal circular muscles are weak and form low folds. The ectoderm of the tentacles is not particularly thick and contains very numerous nematocysts, 31—38 × 2,5 μ in size, and spirocysts from 24 × 2 μ to 58 × 4 μ. The mesogloeal longitudinal muscles are strong and uniformly developed round about the tentacles and also at the base. The muscle meshes are often elongated in radial direction. The mesogloea is thick. On a longitudinal section (textfig. 204) through the apex of a tentacle the mesogloea was much thinned out about the aperture. If this thin lamella has been torn up by bad preservation, we may easily fancy that the apertures of the tentacles were large. There is no doubt that the large apertures, observed by Hertwig in the tentacles of *Sicyonis crassa*, have arisen through the at the apex very thin mesogloea having been partly macerated by preservation. The radial muscles of the oral disc are very well developed and form closely packed meshes, elongated in the direction from the ectoderm to the endoderm, and interrupted by thick mesogloea-bridges at the insertions of the mesenteries. Its mesogloea is thick, like that of the actinopharynx. The ectoderm of the actinopharynx is rather low, especially in comparison with the mesogloea, and contains very numerous nematocysts: 19—29 × 2—(2,5) μ in size, I have besides observed some larger nematocysts (34—36 × 2,5 μ), which, however, possibly belong to the tentacles.

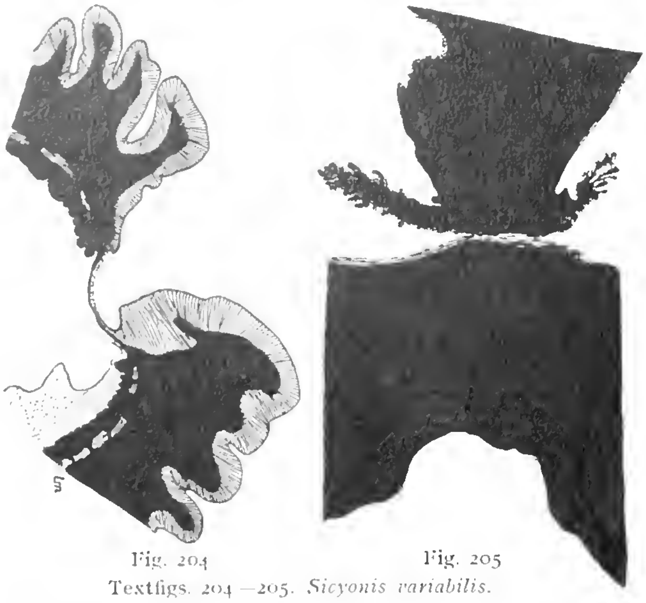


Fig. 204 Fig. 205
Textfigs. 204—205. *Sicyonis variabilis.*
Fig. 204: Longitudinal section of the apex of tentacles.
Fig. 205: Transverse section of the base of a mesentery with basilar muscles.

The arrangement of the mesenteries recalls that of *S. ingolfi* and *tuberculata* but is more irregular. In order to ascertain it, I have examined one whole specimen and half two specimens. The textfigure 206 *A*, *B* shows the arrangement of the mesenteries, each in one half of two specimens, the textfigure 207 that of the third specimen. In *A* and *B* all mesenteries have been drawn, in textfigure 207 the fertile have been left out. In the textfigure 206 *A* the most weakly drawn mesenteries are not provided with longitudinal pennons and reproductive organs, but are certainly future, fertile mesenteries, though the reproductive organs have not yet been developed, owing to the small size of the specimen (the height 1 cm, breadth 2,2 × 1,5 cm). These mesenteries appear only in the most proximal part of the body. I think that I have also in this species been able to determine the mesenteries of the first cycle (I). If we examine the textfigures more narrowly, we find that there are in *A* (in one half of the specimen) 26 stronger pairs of mesenteries, of which 7 pairs perfect and 2 pairs consisting of one imperfect and one perfect mesentery, in *B* 23 sterile mesenteries, of which 11 pairs perfect and 4 pairs built up of imperfect and one perfect mesentery (on the other, not drawn half 10 pairs were perfect and 2 pairs made up of one imperfect and one perfect mesentery). In *C* (fig. 207) we see on one side 21 pairs of sterile mesenteries, of which 9 perfect and 4 made up of one imperfect and one perfect mesentery, on the other side 24 pair, of which 8 perfect and 5 pairs consisting of one perfect and one imperfect mesentery. The arrangement of the mesenteries thus displays great differences, and the mesenteries are not symmetrically grouped on both sides of the directives (compare *B*, *C*). Manifestly, a still greater alteration in the time of appearance of the pairs of the cycles has taken place here than in the other species, whereby some pairs of mesenteries have been checked in their development or wholly suppressed. The perfect pairs of mesenteries are among themselves a little unequally developed, which is seen by their insertion on the pedal disc (on the figure 207 designated with spaced out lines). Also

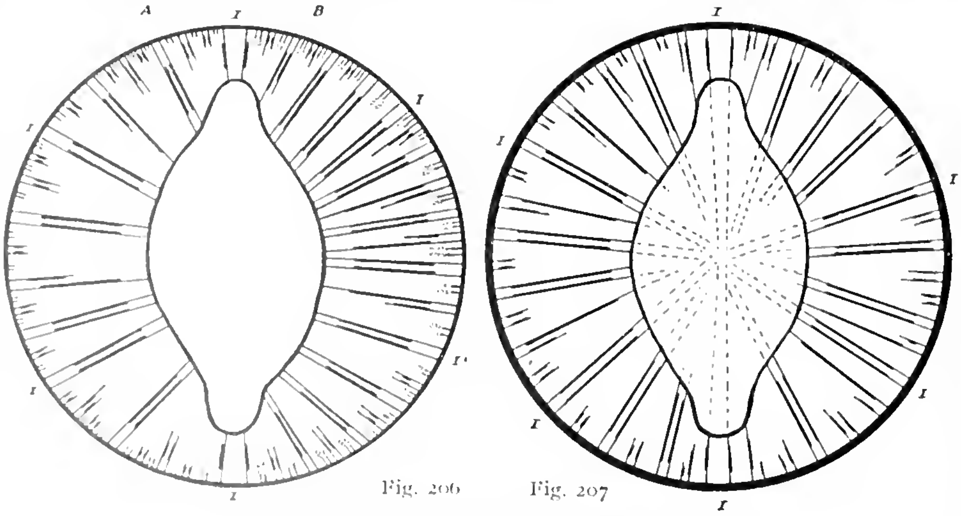


Fig. 206 Fig. 207
Textfigs. 206—207. *Sicyonis variabilis.*
Diagram of the arrangement of the mesenteries. In fig. 207 only the sterile mesenteries have been drawn.

in the weaker of the sterile pairs both mesenteries of one and the same pair sometimes are distinctly different in size. This is probably in reality still more commonly the fact than may be concluded from the figure, as an attempt of ascertaining their size meets with the same difficulties here as in *S. tuberculata*.

The arrangement of the mesenteries thus is distinguished from that of the preceding species by its being more irregular, and this irregularity probably (at least in some cases) appearing in all 6 primary exocoels, not only in 4 as in *S. tuberculata* and *ingolfi*.

Alternating with the sterile mesenteries there are weaker, fertile mesenteries (on figure 207 not drawn, on the figure *A*, reproduced specimen, the reproductive organs (in the weakest mesenteries) have not yet been developed). These fertile mesenteries also here arise at the limbus of the pedal disc and grow more or less upwards, they are the least developed in specimen *A*, the most in specimen *B*, in which they reach the region of the actinopharynx.

The longitudinal muscles of the stronger mesenteries form no pennons, but are about equally expanded over the whole surface of the mesenteries. The folds are rather numerous and of ordinary height, they are weakest at the column. On the directive pairs, the folds of which are stronger, the innermost part displays the highest folds. The parietobasilar muscles are in their lower part broad, but rapidly narrowing and proceed upwards as a thin lamella, but do not reach the sphincter. They are not, or somewhat, folded as in the preceding species. The basilar muscles are rather well developed (textfig. 205), though not strong, as they are supported by a thick mesogloea. Oral and marginal stomata are present. Whether the latter, which are often very small, are present on all mesenteries, I have not been able to determine. The ciliated streaks are well developed, and the filaments in the region of the ciliated streaks strong. The sterile mesenteries bear filaments, the fertile are devoid of such. The species is dioecious.

Genus **Actinostola** Verr.

Diagnosis. Paractiidae (Actinostolinae) with the body either short, cup-like, in the proximal part small, in the distal broad, or long cylindrical. Column mostly thick, firm, slightly rugose or almost smooth or with flat tubercles of mesogloeal thickenings, unlobed in the distal part, without verrucae, acrorhagi and fossa. Sphincter in comparison to the size of the body usually rather weak, so that the body-wall, at the contraction of the animal, for the greater part cannot cover the tentacles. Tentacles short, the inner considerably longer than the outer, about as numerous as the mesenteries, hexamerously arranged, in contracted state almost cylindrical, irregularly rugose, sometimes with mesogloeal thickenings at the base of the outside, with mesogloeal longitudinal muscles. Radial muscles of the oral disc mesogloeal. Two well developed siphonoglyphes. Numerous perfect mesenteries, hexamerously arranged. The two mesenteries in one and the same pair, from the third or the fourth cycle, irregularly developed but as a rule outlined, so that the mesentery, which generally turns its longitudinal muscles towards the preceding cycle of mesenteries, is more developed than its partner. Retractor of the mesenteries diffuse. Parietobasilar and basilar muscles strong. Mesenteries of the first and the second order sterile. Reproductive organs first arise on the mesenteries of the third cycle. The fertile mesenteries have filaments.

Actinostola spetsbergensis Carlgr.

Pl. 2. Figs. 3—4. Pl. 3. Figs. 13—15.

Actinostola spetsbergensis n. sp. Carlgren 1893. Pl. 1 fig. 15. Pl. 8 figs. 9, 10. Pl. 9 fig. 1.
— — Carlgr. Kwietniewski 1898 p. 130. Carlgren 1902 p. 46, 1913 p. 1, 1916 p. 3.
— *sibirica* n. sp. Carlgren 1901 p. 481. 1893 b p. 233 fig. 1.
— *walteri* n. sp. Kwietniewski 1898 p. 130. Pl. 14 figs. 4—6.
?*Kyathactis hyalina* n. gen. n. sp. Danielssen 1890. Pl. 1 fig. 3. Pl. 7 figs. 6—9.

Diagnosis: Pedal disc from wide to small. Body generally in contracted state more broad than high, in expanded state cup-like, in contracted more cylindrical. Column longitudinally furrowed, especially in younger specimens, sometimes also with transversal furrows, so that tubercle-shaped elevations arise, sometimes more irregularly wrinkled. Margin rather distinct, capable of involution. Sphincter strongly reticular, sometimes with a little tendency to become alveolar, seldom with traces of stratification. Tentacles hexamerously arranged, in larger specimens about 130—170 in number, the inner considerably longer than the more or less papilliform outer, without thickenings of the mesogloea on the base of the outside; in young specimens smooth, in older, in contracted state, wrinkled or sometimes feebly longitudinally sulcated. Longitudinal muscles of the tentacles and radial muscles of the oral disc expanded over only a part of the mesogloea, and divided in rather fine meshes. Pairs of mesenteries in 5 cycles, the last cycle more or less perfect. Mesenteries of the three first cycles perfect, sometimes only some of the mesenteries of the third cycle are perfect. Mesenteries of the third cycle of different size in every pair, with the longitudinal muscles of the stronger mesenteries generally directed towards the mesenteries of the first cycle. Parietobasilar muscles very strong. Dioecious. Reproductive organs developed from the mesenteries of the third cycle. Typical nematocysts in the distal part of the tentacles 19—31 × 1,5—2,5 (3) μ, in the actinopharynx 22—31 × 2—2,5 (3) μ. Spirocysts in the distal part of the tentacles from 17 × 1,5 μ to about 65 (70) × 4 (5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 22—32 × 4—5 μ. Often also large stinging capsules in the tentacles, in their distal part from 36 to 50 × 6—7 μ.

Colour: pale reddish-yellow (Michael Sars-Exp. St. 96); pale reddish (Sw. Spitzberg-Exp. 1898). Tentacles pale red (Sw. Spitzberg-Exp. Bremer Sound). *Kyathactis hyalina*: pale rosy-red, the pedal margin yellowish-red, round the mouth a yellowish-red annulus. The tentacles of a somewhat darker rose-colour than the body (Danielssen).

Dimensions: Large specimens unto 2,5—3 cm high and 6—7 cm broad, in contracted state.

Occurrence: New Foundland Bank. 45°53′ N. 51°56′ W. 50 fms. (Ingegerd and Gladan-Exp. 1871).
Rice Strait. 78°45′7 N. 74°56′5 W. 8 fms. (Fram-Exp. 1899). Hafne fiord between 76°25′—76°40′ N and 84°20′ W.—84°45′ W. 2—30 fms. (Fram-Exp. 1900). Gaasefiord 76°44′ N. 88°45′ W. (Fram-Exp. 1901).
North-Greenland. Thule Havn (1914 P. Freuchen).
West-Greenland. Upernivik (Ryder). Nordre Strømfiord 225—230 m. Bottom temp. — 0,5 (Nordmann 1911 St. 3 A). Nordre Strømfiord 14—38 m. 400—410 m. (Nordmann 1911 St. 3 B, 4 A). Akudlek (Traustedt). Hol-

stensborg (Traustedt 1892). Godthaab 100 fms. (Ammondsen). Davis strait 66°45′ N. 59°30′ W. (Sofia-Exp. 1883). Davis strait (Holm). 69°17′ N. 52°50′ W. 225 fms. (Tjalfe-Exp. 1908 St. 117—118). 66°44′ N. 56°08′ W. 175 fms. (Tjalfe-Exp. 1908 St. 100). 66°35′ N. 55°54′ W. 88 fms. Bottom temp. 1,6 (Ingolf-Exp. St. 31). 65°17′ N. 54°17′ W. 55 fms. (Ingolf-Exp. St. 34). Bredefiord 170—140 m (Rink-Exp. 1912 St. 156) 110—180 m (Rink-Exp. 1912 St. 91).

Greenland without distinct locality (Wandel 1890).

East-Greenland. Mackenzie bay 12—35 m (Kolthoff-Exp. 1900). Franz Joseph fiord between Bontekoe Isl. and Mackenzie bay 250 m (Kolthoff-Exp. 1900). The sound between Maatten and Renskær 25—50 fms. (Danmark-Exp. 1908 St. 95). Danmark strait 66°42′ N. 26°40′ W. 590 m. Temp. at 550 m 0,11° (Michael Sars-Exp. 1900 St. 13).

N. W. of Iceland. 66° N. 11°41′ W. 280 m (Thor-Exp. 1903 St. 52). Iceland 5 miles o from Seydysfiord 135 fms. (Wandel 1890).

West Spitzbergen. 80°N. 17°5′ E. 40 fms. (Sw. Spitzberg-Exp. 1898). 79°10′ N. 10° E. (Kolthoff-Exp. 1900). Icefiord, Coal Bay 50 m (Kolthoff-Exp. 1900) Gray Hook 60 fms. (Sw. Spitzberg-Exp. 1861). Recherche bay (Klinckowström 1890).

East Spitsbergen. North East Land 79°35′ N. 28′ E. 66 m (Römer & Schaudinn 1898 St. 36). Hinlopen Strait 79°13′ N. 21° E. 80 m (Römer & Schaudinn 1898 St. 44). King Charles Land, Bremer Sound 105 m (Römer & Schaudinn 1898 St. 33). 100—110 m. Bottom temp. —1,45 (Sw. Spitzberg-Exp. 1898 No. 32). Albrecht Bay 13—15 fms. (Kükenthal & Walter). Cap Melcher 45 fms. (Kükenthal & Walter *Actinostola walteri*), Devee Bay 77°23′ N. 21°2′ E. 28 m. (Römer and Schaudinn 1898 St. 8).

Bear Island. 140 m (Michael Sars-Exp. 1901).

75°49′ N. 24°25′ E. 80 m. Bottom temp. —1,42° (Sw. Spitzberg-Exp. 1898). 75°23′ N. 17°45′ E. 110—140 m (Olga-Exp. St. 54). 74°48′ N. 20°54′ E. 80—86 m (Olga-Exp. St. 59). 73°52′ N. 19°55′ E. 130—200 m (Olga-Exp. St. 54). 66°42′ N. 26°40′ W. 590 m. Bottom temp. at 550 m 0,11° (Michael Sars-Exp. 1900 St. 13). 64°58′ N. 11°12′ W. 550 m. Bottom temp. —0,32° (Michael Sars-Exp. 1902 St. 36). 64°53′ N. 10°0′ W. 630 m. Temp. at 600 m. —0,09° (Michael Sars-Exp. 1900 St. 10).

Coast of Murman. 110—120 fms., 70—80 fms. (Alex. Kowalewsky-Exp. 1909 St.

116, 167 — teste Pax). Pala Guba (teste Pax). Barent Sea 70°21′30 N. 53°50′ E. 105 m. (Andrej Perwoswanny-Exp. 1903). W. from Kolgujew 69°14′ N. 46°39′30 E. 62 m (Andrej Perwoswanny-Exp. 1903).

Kara Sea. 70°90′ N. 64°17′ E. 11 fms. (New-Zembla-Exp. 1875) — (Dijmphna-Exp.).

Arctic Sea of Siberia. 20° E. of Cape Jakan 12 fms. (Vega-Exp. No. 60). 69°32′ N. 177°41′ W. 12 fms. (Vega-Exp.). 67°7′ N. 173°24′ W. 9—15 fms. (Vega-Exp. No. 185). 2 miles N. E. of the winter station of the Vega 12 fms. (Vega-Exp. 1879).

Behring Sea. 64°34′ N. 171°45′ W. 25 fms. (Vega-Exp. No. 1061), 63°39′ N. 177°5′ W. 55 fms. (Vega-Exp. No. 1068).

Exterior aspect: The pedal disc is now rather wide, now of rather small diameter and provided with more or less distinctly conspicuous, radial ridges and furrows, sometimes the central part of it is drawn out in a conical tap as in *Stomphia*. The form of the body varies considerably, according to the state of contraction. Now it is cup-like, now more cylindrical, in preserved specimens the breadth generally is larger than the length, it is rarely the opposite. As the oral disc is wholly unfolded, the distal part is broader than the proximal. In small specimens — such which occur in the coelenteric cavity or in the open sea — the column is provided with distinct longitudinal ridges with deep furrows between. Also in larger specimens traces of these ridges are to be seen. They but rarely appear like a folded longitudinal ribbon; often when the ridges arise, there are also transversal furrows which make the animal look as if it were provided with longitudinal rows of tubercles, such as Kwietniewski 1898 has reproduced *Actinostola walteri*. Sometimes the surface is smooth or irregularly wrinkled. Though no fossa is present, the margin is, however, rather well marked. The region of the sphincter is sometimes thickened and forms a circular wall, in which case the sphincter is strongly concentrated, owing to the contraction. The tentacles are hexamerously arranged in 6 cycles, the last cycle is, however, as far I have seen, always imperfect. The number of tentacles in several large examined specimens varied between 130 and 170. Kwietniewski declares that *A. walteri* has about 192 tentacles. From his description it seems as if he has not counted them. The inner tentacles are considerably longer than the more or less papilliform outer ones. On very small specimens, as on young in the coelenteric cavity, they are smooth or almost so, on larger specimens they are indistinctly longitudinally furrowed or irregularly wrinkled. They have never any thickenings on the outside of the base. The oral disc is wide, and provided with deep or shallow radial furrows, in contracted state also with circular furrows. The actinopharynx is of ordinary length and longitudinally sulcated, the folds are, however, not as numerous as in the *Stomphia*-species described below, amounting to about 10 on each side of the directive plane. The gonidial tubercles are distinct, the siphonoglyphes very well marked, broad and provided with long aboral prolongations.

Anatomical description: The anatomy of this species has been described by myself 1893 and 1902, and I have but little to add now as my latest examinations have been made on a richer material and mainly verify my former observations. Concerning the stinging capsules, there are in the tentacles typical nematocysts in varying numbers, now numerous, now more sparse, in addition to numerous spirocysts; in one part of the specimens there were large specific nematocysts of the same kind as I have found in the other, below described *Actinostola* species. These capsules were now numerous, now sparse. I at first supposed that I had to do with two different species, one with large specific nematocysts, the other without such, as there is, however, no difference in their structure I must regard these specimens as belonging to the same species, the more so as I have found some specimens, the nematocysts of which were so sparse that it was only after repeated examinations of the maceration preparations that I was able to find one or a few capsules in the tentacles. I cannot decide the cause of this difference in the occurrence of these nematocysts. It may be possible that they have in several cases been lost through preservation, though I must confess that I do not find that explanation satisfactory. In the actinopharynx there are, in addition to typical nematocysts, also some such with discernible basal part to the spiral thread. The size of the nematocysts and the spirocysts in a series of specimens was as follows. *a*: typical nematocysts, *b*: large specific, opaque nematocysts, *c*: nematocysts with discernible basal part to the spiral thread. *spi*: spirocysts.

As wee see, the nematocysts of the different specimens agree well in size, it is therefore probable that the specimens with *b*-nematocysts in their tentacles and those devoid of such belong to the same species. The sphincter also varies a little in appearance. In the type-specimen it was strongly concentrated, in other specimens more elongated, as in *Stomphia*. As we may find a concentrated as well as an elongated sphincter in different parts of one and the same specimen, I think that this difference is due to a stronger or weaker contraction of the mesogloea in the distal part of the column. In the type-specimen the sphincter occupies almost the whole breadth of the mesogloea, which was also the case in several examined specimens. In other specimens the part of the mesogloea, outside of the sphincter, was considerably thicker, this is especially the case in specimens having a thick mesogloea. This difference is probably also connected with the more or less strong contraction of the mesogloea. The sphincter also varies a little in structure. Generally the sphincter is reticular, sometimes, especially in the outermost parts, the meshes are more sparse, wherefore the sphincter here shows a tendency to be alveolar. To judge from the

Habitat	Column	Distal part of the tentacles			Proximal part of the tentacles			Actinopharynx	
		a	*b*	*spi.*	*a*	*b*	*spi.*	*a*	
Greenland		19 22×1,5 μ	36—50×6 μ	19×1,5—52×4,5 μ		36—50×6 μ			20 [illegible] 24 [illegible]4 μ
Davis Str. (Holm)		24 26×2—2,5	38 47×7	24×1,5 60×3,5	24 26×2—2,5 μ	38—43×6 7	[illegible]1,5—50×3,5 μ	24 [illegible] μ	24 [illegible]×4
[illegible] St. 100		19—24 26×1,5—2	38—50×7	19×1,5—53×4,5	17 24×2	38—49×6—7	55×4,5	22 2[illegible]	2[illegible]×4
Nordre Strømfjord	17 19×1,5 μ	19—26×2	41—46×6—7	22×1,5—52×5	24×2	38 48×7	[illegible]	22 26 [illegible]	22 [illegible]4
Upernivik		19—24×1,5—2	41—50×7	22×2—55×5					
Siberia (Vega [illegible])		.	.	....	20—24(31)×2—2,5(3)	21—36×5 [illegible]	[illegible]×3,5		24 [illegible]×4
Recherche Bay (type)	18 19×2	24 31×2,5(3)	absent	19×2—58×5		absent		24 3[illegible]	2[illegible]
Ingolf St. 34		20—26×2	»	22×1,5—62×3,5		»		2[illegible] 26×2,5	[illegible]
— — 124		22—26×2		17×1,5 55×3		»		24×2	[illegible]
Thule Havn	16—2[illegible]×1,5—2	21 26×2—2,5	»	22×1,5—58×4		»		22 24 [illegible]	26 [illegible]4
Kara Sea (Dijmphna)		25 30×2,5	»	24×2—65×4	20 27×2	»		[illegible]	[illegible]
Fram [illegible]		24—26×2 [illegible],5		24×2—55×3,5	22—27×2,5	»	24×2 60×4	[illegible]	[illegible]4
King Charles land [illegible]		22 27×2,5		—70×3,5				[illegible]	24 [illegible]4
Behring Sea		23—31×2,5(3)	»					24 [illegible]2,5	2[illegible]
Arctic Sea of Siberia [illegible]		22 26×2—2,5	»	24×1,5—58×4				[illegible] 2,5	[illegible]4
[illegible] Kw[illegible]	16 18 22	2[illegible] 24		—60				2[illegible] 24	

figure of the sphincter of *A. walteri*, reproduced by Kwietniewski (1898) — a species to my mind identical with *A. spetsbergensis* — the sphincter seems to be almost alveolar. In sexually ripe specimens I have but rarely found traces of stratification in the middle part; this stratification is, however, never as distinct as in *Actinostola abyssorum* and *callosa*.

The mesenteries are arranged as in the type-specimen, which I have been able to confirm by several examined specimens. The longitudinal muscles of the strongest mesentery in the pairs of the third cycle face towards the mesenteries of the first cycle. In a single specimen, of which I have examined one half, two mesenteries deviate from this rule, in as much as the longitudinal muscles face towards the mesenteries of the second order. The appearance of the mesenteries as for the rest agrees with that of the type-specimen. The size of the marginal stomata, however, varies considerably, sometimes they are very large as in the reproduced specimen of *A. sibirica* (Carlgren 1893b p. 233 fig. 1), at other times they are small as in the type-specimen. The ciliated streaks were well developed and the mesogloea of the filaments in the middle part provided with rather numerous cells.

Textfig 208

Actinostola (Kyathactis) hyalina
Transverse section of sphincter

The reproductive organs start from the mesenteries of the third order: in a specimen I have, however, found a fertile mesentery of the second order. In a great part of the specimen the ova were large and few, in other parts numerous and smaller. This difference is probably connected with the fact that the reproductive period in the first case had come to its close. I have in several specimens found young in the coelenteric cavity. Sometimes these young reach a considerable size (Carlgren 1893b, 1902 p. 47). The coelenteric cavity thus in this species serves as a brood-room.

As I have before mentioned (1902 p. 47) a parasitic Crustacean, probably *Antheachares dübenii*, sometimes appears in the mesenteries. Sometimes a Nemertin, *Nemertopsis actinophila* Bürger, seems to live symbiotically with this species. From the mouth of a specimen from Coal bay, Spitzbergen such a Nemertin juts out, quite unhurt.

Systematic remarks: As is seen by the list of synonyms, I think that *Actinostola sibirica* Carlgr. and *A. walteri* Kwietn. are identical with *A. spetsbergensis*. The few differences I have found between *A. sibirica* and *spetsbergensis* do not justify the formation of a new species for *sibirica*, as the appearance of the sphincter, of the column and of the stomata may vary. The same is the case with *A. walteri*. Probably *Kyathactis hyalina* Dan. is identical with *A. spetsbergensis* and is only a young of this species; of this I have convinced myself by a comparison of a specimen of this species with young of *A. spetsbergensis*. I reproduce here a transverse section of the sphincter of *Kyathactis* (fig. 208). Upon all accounts, *K. hyalina* is an *Actinostola*-species and nearly related to *A. spetsbergensis*.

Actinostola callosa Verr.

Urticina callosa n. sp. Verrill 1882 p. 224, 315.

Actinostola callosa Verr. Verrill 1883 p. 57 Pl. 7 fig. 2, 1883 b p. 515, 534. Carlgren 1893 p. 71 Pl. 1 figs. 17, 19. Pl. 4 fig. 1. Pl. 8 fig. 3. Pl. 9 figs. 5, 6 textfigures 18, 19. Parker 1900 p. 753 textfig. 11.

— *atrostoma* n. sp. Stephenson 1918 b p. 118 Pl. 14 figs. 5, 7, 8. Pl. 15 fig. 7, Pl. 16 figs. 11, 12, 16—20. Pl. 17 figs. 1—4.

Diagnosis: Body in contracted state cylindrical or somewhat cup-like, generally much more high than broad. Pedal disc not larger than the breadth of the column, in contracted state often excavated. Column thick, cartilaginous, in younger specimens often smooth or with irregular furrows, in larger specimens with tubercle-shaped, rather flat thickenings of the mesogloea in the upper part or over the whole surface. Margin indefinite, often continuous with the base of the outer tentacles, not capable of involution. Sphincter moderately long but narrow, non-concentrated, distinctly longitudinally stratified, reticular to alveolar. Tentacles hexamerously arranged, in large specimens in 7 cycles, rugose, sometimes with rather large thickenings of the mesogloea at the outside of the base, the inner tentacles several times thicker and longer than the outer. These thickenings may appear only on the outer tentacles or on all. Longitudinal mesogloeal muscles of the tentacles and radial muscles of the oral disc of variable size but mostly alveolar. Both mesenteries in the pairs of the third cycle of about the same size. Parietobasilar muscles about two thirds of the length of the column. Dioecious. Reproductive organs on the mesenteries from the third cycle. Nematocysts in the ectoderm of the column (17) 19—24 (29) × 1,5—2 μ, those in the distal part of the tentacles 22—36 × 1,5—2 μ and those of the actinopharynx 22—34 × 2 μ. Spirocysts of the tentacles from 24 × 2 to 72 × 4,5—5 μ. Large stinging capsules in the ectoderm of the tentacles very few (36) 43—51 × 6—8 μ, scarce nematocysts with discernible basal part to the spiral thread, in the actinopharynx 21—26 × 4—5 μ.

Colour generally salmon-coloured or orange, all parts often of nearly the same colour, body-wall almost always pale salmon-coloured or buff, varying to deep salmon-coloured or orange-red with paler tubercles, oral disc most often deep salmon-coloured, or generally of the same colour as the body, but of a darker shade, with paler radii, the large lateral lobes of the lip like the disc, but darker, usually salmon-coloured or orange-brown, the large gonidial grooves whitish or pale yellow, tentacles usually plain deep salmon-coloured or orange-brown, with paler striae or reticulations (Verrill). Body-wall salmon-coloured, shading off a little into blue with yellow-red furrows. Tentacles and the outer part of the oral disc yellow-red, inner part of the disc like the body-wall. Actinopharynx and the gonidial tubercles reddish-brown, especially the upper margin of the actinopharynx (Carlgren). Actinopharynx and the whole ectoderm reddish-brown in alcohol (Michael Sars-Exp. St. 76).

Dimensions: Large specimens often 16 to 18 cm in height, with the expanded disc 20—25 cm broad, larger tentacles about 1,5 cm long and 0,5—0,6 cm broad (Verrill). The largest specimen, observed by myself from the Ingolf-Expedition (St. 65), in contracted state: the expanded oral disc 13 cm, the strongly contracted body-wall 11,5 cm in height. A specimen from Japan: height 12 cm, breadth 8 cm.

Occurrence: East coast of N. America from New-Foundland to Cap Fear 50—640 fms. (teste Verrill).

Baffin Bay. 71°34′ N. 65°55′ W. 306 fms. (Wandel 1880). Davis Strait 66°49′ N. 56°28′ W. 235 fms. (Wandel 1889). 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9° (Ingolf-Exp. St. 32). Kvanefiord S. Greenland 420 fms. (Rink-Exp. 1902 St. 5).

61°33′ N. 19° W. 1089 fms. Bottom temp. 3° (Ingolf-Exp. St. 65).

59°28′ N. 8°1′ W. 1100—1300 m. Bottom temp. at 1000 m. 8,07° (Michael Sars-Exp. 1902 St. 76).

Norway. Finmark Jökel fiord 80—100 m. (Nordgaard). Stönnesbottn 40—80 m (Nordgaard). Drontheimfiord. Dröbak (Carlgren).

Skagerrak. 230—430 fms. (Gunhild-Exp.) 140 m (Thor-Exp. 1903 St. 19).

Sweden. Kosterfiord 210 m (Arwidsson). 220—230 m (Sandberg 1901). Väderöarne. Gullmaren 40—50 m (Carlgren and others.)

S. W. coast of Ireland. 51°36′ N. 11°57′ W., 51°35′ N. 11°55′ W., 51°27′ N. 11°55′W. 540—720 fms. (teste Stephenson *A. atrostoma*).

Further distribution: Japan Kinshin S. off Nagasaki (Bock-Exp. 1914).

Exterior aspect. The exterior of this species has before been described by Verrill, by myself, and by Stephenson. Some of the specimens I have examined, as those from Davis strait, Kvanefiord and the station 65 (Ingolf-Exp.), were provided with rather strong tubercles over the whole surface of the column, while others were tuberculated only in the upper part of the body-wall. It seems as if the specimens, living in deeper waters, are more tuberculated than those, living in shoal waters, my material is, however, too small for deciding this with certainty. The appearance of the tentacles also varies, in as much as all tentacles may be devoid of the mesogloeal thickenings at the base of the outside, as in the specimens from Gullmar-fiord, while several specimens, as those from Baffin bay and Skagerrak, have thickenings only on the outer tentacles, and still others — specimens from the Ingolf-Exp. (St. 65), Michael Sars-Exp. (St. 76), Davis Strait and Kosterfiord (220— 230 m) — are provided with such thickenings on all tentacles. Also in the American forms (from Maine bay and Martha's Vineyard) I have observed specimens with and without tentacle tubercles. I must, therefore, regard Stephenson's *A. atrostoma*, in the main proposed on basis of the presence of tentacle tubercles, as identical with *A. callosa*, as the anatomical characters of *atrostoma* agree with those of Verrill's species. I will besides add that the specimens, taken during the Michael Sars-Expedition, perfectly resemble *A. atrostoma*. Thus, to my mind the species shows a distinct tendency to form tentacle tubercles, as it seems, especially in the specimens living in deeper water[1].

Anatomical description. The anatomy of this species has before been sufficiently described by myself and by Stephenson, so that it is unnecessary to discuss it here. I will, however, give an account of the size of the nematocysts and spirocysts in some specimens. *a*: typical nematocysts, *b*: large specific nematocysts, *c*: nematocysts with discernible basal part to the spiral thread, *spi*: spirocysts.

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[1] The new genus, *Catadiomene*, proposed by Stephenson (1920) for the *Actinostola*-forms with swellings of the mesogloea at the aboral side of the tentacles, thus must be dropped

Habitat:	Column	Distal part of the tentacles			actinopharynx	
	a	*a*	*b*	*spi.*	*a*	
Gullmar fiord............	19-22 × 2 µ	29-34 × 1,5 µ	36-46 × [illegible] µ	26 × 2—60 × 5 µ	25-29 × 1,5 µ	24 × 5 µ
Ingolf-Exp. St. 65.........	22-24 × 2	22-34 × 1,5-2	45-51 × 7-8	26 × 2—72 × 4,5	26-31 × 2	22-26 × 5
Michael Sars-Exp. St. 76...	—	24-32 × 2	43-49 × 6-7	24 × 2—62 × 5	25-29 × 2	21-23 × 4
Baffin Bay...............	17-19(29) × 1,5-2	26-36 × 2	46-48 × 7	67 × 4,5	24-29 × 2	22-26 × 4
Maine Bay...............	—	29-36 × 2	43 × 7	24 × 2—70 × 4,5	22-34 × 2	22-26 × 4,5
Rinck-Exp. St. 5..........	19-22 × 2	27-36 × 2	46-50 × 6-7	24 × 2—67 × 4-4,5	24-34 × 2	22-24 × 4-5
Japan....................	—	26-36 × 2	50-51 × 7	22 × 2—65 × 4,5-5	26-31 × 2	24 × 5
Bohuslän (a little young) ..	—	22-24 × 1,5	29-41 × (5)6	—	—	14-22 × 3,5

In my description of the species (1893) I have stated that no marginal stomata are present. They may, however, appear, though not regularly.

Remarks. As I have above put forth, I regard Stephenson's *atrostoma* as identical with *A. callosa*. On the other hand, I have not added Hertwig's *Dysactis crassicornis* to the list of synonyms. It is true that it is very nearly related to *A. callosa*, but it has a much stronger sphincter and a thinner column than the real *A. callosa*, which I have ascertained by examining one of the type-specimens. At present I dare not place these two species together. In contradistinction to Mc. Murrich (1893) and Rees (1913), who think that they are identical, I have not added the species from the West coast of North America, described by Mc. Murrich as *A. callosa*, either. Probably this species is the same as Hertwig's species. That *A. callosa* nevertheless has a large distribution, is proved by its occurrence at Japan.

Actinostola abyssorum (Dan.) Carlgr.

Bunodes abyssorum n. sp. Danielssen 1890 Pl. 3 fig. 3. Pl. 10 figs. 8—9.

Actinostola abyssorum n. sp. Carlgren 1893 Pl. 1 figs. 5, 10. Pl. 8 figs. 1, 2, 7, 8, 11. Pl. 9 fig. 4 textfigs. 14—17.

Diagnosis: Pedal disc wide, of about the same breadth as the length of the body. Column thick-walled with longitudinal and transversal furrows, whereby tubercle-shaped thickenings arise, which are the largest at the middle. Margin as in *A. callosa*. Sphincter long, but narrow, not concentrated, distinctly stratified, reticular, forming very thin meshes. Tentacles to about 300, hexamerously arranged, conical, irregularly wrinkled, with distinct orifice at the apex, not bulbously swollen at the base, the inner considerably broader and longer than the outer. Longitudinal mesogloeal muscles of the tentacles and the greater part of the mesogloeal meshes of the oral disc are very finely divided. Both mesenteries in the pairs of mesenteries of the third cycle of about the same size. Parietobasilar muscles strong, almost reaching the proximal end of the sphincter. Marginal and oral stomata present. Dioecious. Reproductive organs on the mesenteries from the third cycle. Nematocysts of the column 22—26 × 1,5—2 µ, those of the distal part of the tentacles 32—38 × 1,5 µ and those of the actinopharynx 24—31 × 1,5 (2) µ. Spirocysts of the tentacles from 17 × 1,5 µ to 65 × 5 µ. Large stinging capsules in the tentacles very sparse 48—53 × 5—6 µ, scarce nematocysts with discernible basal part to the spiral thread in the actinopharynx 24—27 × 4,5 µ.

Colour. Column white with a mother-of-pearl lustre, shading off into pale reddish or bluish tinges. Tentacles Havana-brown. Oral disc of the same colour as the column, perhaps slightly darker, and from the mouth thin brown stripes radiate towards the tentacles. Oral labiae and actinopharynx dark chestnut-brown (Danielssen).

Dimensions in extended state about 25 cm in height and 20 cm in breadth, in contracted 15 resp. 23 cm (Danielssen). Preserved specimen from Alten fiord: Height 6 cm. Diameter of the pedal disc 7 cm, that of the oral disc 6 cm. Length of the inner tentacles 1,5—1,75 cm, that of the outer 0,5 cm.

Occurrence: 61°10′ N. 6°32′ E. 1229 m. Bottom temp. 6,7° (Norw. N. Atlantic-Exp. St. 2 teste Danielssen). Tanafiord 70°47′ N. 28°30′ E. 232 m. Bottom temp. 2,8° (Norw. N. Atlantic-Exp. St. 261). Altenfiord 183 m (Jägerskiöld 1890).

Remarks: I have now examined a specimen of Danielssen's *Bunodes abyssorum* (from the station 261) and I am able to confirm that this species is identical with *Actinostola abyssorum*, described by myself. The structure of the sphincter, of the tentacles and of the oral disc agrees with that of the same organs of *A. abyssorum* This is also the case with the stinging capsules. Danielssen's description is not good, there are no acontia, no suckers, the sphincter is mesogloeal etc. For a more detailed description compare my paper (1893).

A. abyssorum is nearly allied to *A. callosa*, and it is a question whether this species is really not a variety of *A. callosa*. I have not seen the specimen from the station 2 and cannot decide, whether it belongs to *A. abyssorum* or to *A. callosa*. Concerning *Actinostola abyssorum* Carlgr. (Pax 1915) compare p. 159.

Actinostola groenlandica Carlgr.

Pl. 2. Fig. 10.

Actinostola groenlandica n. sp. Carlgren 1899. p. 33.

Diagnosis: Pedal disc well-developed. Column cylindrical, in contracted state much higher than broad, from rugose to almost smooth, sometimes with indistinct longitudinal furrows, without tubercles, ordinarily thick. Margin rather distinct, probably not capable of perfect involution. Sphincter rather strong, reticular, sometimes with a little tendency to become alveolar and a little stratified. Tentacles hexamerously arranged, in 6 or 7 cycles, in contracted state rugose, the inner longer than the outer papillar ones, without mesogloeal thickenings at the base of the outside. Longitudinal muscles of the tentacles and especially the radial muscles of the oral disc divided into rather fine meshes. Actinopharynx about half or one third as long as the body-wall. Pairs of mesenteries in 5 or 6 cycle, the last (6th) cycle more or less perfect. Mesenteries of the three first orders perfect. Both mesenteries in the pairs of the third cycle about equally developed. Parietobasilar muscles strong, almost reaching the sphincter. Monoecious. Reproductive organs on the mesenteries from the third to the last or to the last cycles but one. The older mesenteries always with ova, the younger with ova and testes, often both testes and ovaries in the same mesentery. Typical nematocysts in the ectoderm of the tentacles 19—27 × 2—2,5 μ and those of the actinopharynx 22—29 × 2 μ. Spirocysts of the tentacles from 22 × 2 μ to about 60 × 4,5 μ. Large stinging capsules in the ectoderm of the tentacles 38—52 × 6—7 μ, nematocysts with discernible basal part to the spiral thread in the actinopharynx 22—29 (32) × 4—5 (6) μ.

Colour?

Dimensions in preserved state: Length of the largest specimen 6,8 cm, breadth of the base about 3,8 cm, the outer tentacles about 0,3 cm long.

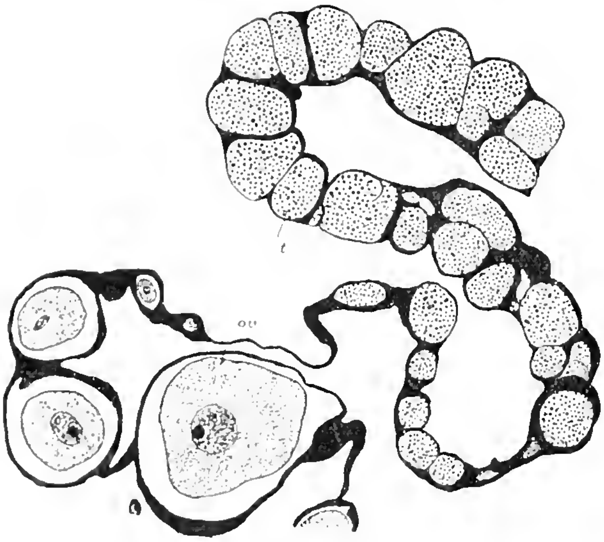
Occurrence: West Greenland. Ritenbenk 15—20 fms. (Öberg). Julianehaab 5—10 fms. (Ammondsen 1865). Davis Strait 60°40′ N. 55°54′ W. 150 fms. (Tjalfe-Exp. 1909). 69°17′ N. 52°50′ W. 225 fms. (Tjalfe-Exp. 1908 St. 117—118).

Greenland without distinct locality.

Exterior aspect. The pedal disc is well developed, though not broader than the diameter of the column. The body is in preserved state cylindrical, in all specimens considerably higher than broad. The column is more or less wrinkled, in one specimen only in the uppermost part, but forms no tubercles. It is comparatively thin, and the insertions of the mesenteries possibly may be seen in wholly expanded specimens; traces of indistinct longitudinal furrows also in preserved specimens are sometimes visible. The margin is rather well marked. The tentacles are hexamerously arranged in 6 or 7 cycles, of which the latter is imperfect and lacking in the smaller specimens. The tentacles are in preserved state wrinkled and devoid of basal thickenings, the inner tentacles are considerably thicker than the outer papilliform ones. No specimen had involved tentacles, and it is a question whether the tentacles may be wholly covered by the column, as the sphincter is comparatively weak, in comparison with the size of the specimens. The oral disc is in contracted state of the animal concave, but not as deeply excavated as in *Actinostola callosa*, and provided with radial furrows, corresponding to the insertions of the mesenteries. The mouth is provided with distinct gonidial tubercles. The actinopharynx is one half or one third of the length of the column and shows longitudinal ridges, amounting to about 10 in its lower part on each side. The siphonoglyphes are very broad and aborally prolongated.

Anatomical description. The ectoderm of the column contains nematocysts, 12—19 × 1,5—2 μ in size, and is thin, in comparison to the mesogloea which is of ordinary thickness and less strong than that of *A. callosa*. It is provided with few protoplasma-poor cells. The endodermal circular muscles of the column are well developed. The sphincter is elongated, reticular, sometimes in several parts with a little tendency to be alveolar; in a specimen I have observed a tendency to stratification not far from the distal end. The sphincter generally much recalls that of *Stomphia*, though it is less broad. Outside of the sphincter there is a rather thick, sphincter-free part of the mesogloea which, however, does not make out one half of the whole breadth of the mesogloea. The ectoderm of the tentacles is high and contains very numerous spirocysts, from about 22 × 2 to 60 × 4,5 and few nematocysts of typical appearance, from 19 to 27 × 2—2,5 μ. There are, besides, also scattered, large specific nematocysts here, from 38 to 52 × 6—7 μ. Also in this species they vary in number. In one specimen I found only a single capsule in the maceration preparations, while in the other specimens they were more numerous, though never common. The mesogloea of the tentacles is thick and the mesogloeal muscles form rather small but numerous meshes. The mesogloeal radial muscles of the oral disc are reticular, in the outer part of the disc very strong, and interrupted at the insertions of the mesenteries. The ectoderm of the actinopharynx contains sparse, typical nematocysts, 22—29 × 2 μ in size, and nematocysts with discernible basal part to the spiral thread, 22—29 (32) × 4—5 (6) μ.

The mesenteries are hexamerously arranged in 5 or 6 cycles. The mesenteries of the three first orders are perfect, though those of the third order do not reach as far down on the actinopharynx as both the first. Both mesenteries in the pairs of the third cycle seem to be about equally developed. From the mesenteries of the fourth cycle the mesenteries are distinctly arranged, according to the *Actinostola*-rule. The 12 first pairs of mesenteries are sterile like those of the youngest cycle, sometimes also one part of the last cycle but one. The species is monoecious, and testes and ovaries were simultaneously developed. As far as I have observed, the mesenteries of the third cycle always have ovaries, those of the fourth cycle now ovaries, now testes, sometimes both mesenteries of this cycle are only provided with testes, sometimes the strongest mesentery of a pair has ovaries, the weakest testes. The mesenteries of the fifth cycle as a rule form testes. I have, however, found specimens, in which testes are present only in a part of the mesenteries, while the others have ovaries. The testes, when found, were always numerous. Rather often testes and ovaries may be found in the same mesentery. There is thus a great variation in the distribution of the testes and the ovaries, still it seems, as if the ovaries appear on the older, the testes rather on the younger mesenteries. In the textfig. 209 I have reproduced a transversal section of a part of a mesentery with ovaries (*ov*) and testes (*t*). The ovaries, as well as the testes were well developed; in a specimen, one of the largest of the collection, the reproductive organs were absent.



Textfig. 209. *Actinostola groenlandica.*
Transverse section of part of a mesentery with ovaries and testes.

The longitudinal muscles of the mesenteries form no pennons but are ordinarily developed, the transversal muscles are distinct and the parietobasilar muscles strong, well marked and almost reach the sphincter. The basilar muscles on transverse sections are of about the same appearance as in *A. spetsbergensis*, though the muscle lamella are more extended along the sides of the mesenteries than in this species. I have not observed any marginal stomata; on the other hand, there are commonly oral stomata. I have found small young in the coelenteric cavity of two specimens, in the one specimen they were very numerous. In this respect the species agrees with *A. spetsbergensis.*

Genus **Stomphia** Gosse.

Diagnosis: Paractiidae (Actinostolinae) with well developed basal disc and rather thin to thick, in contracted state rugose body-wall, which is devoid of tubercles, verrucae, acrorhagi, and fossa. Sphincter strong, so that the body-wall may cover the tentacles. Tentacles short, conical, in contracted state wrinkled or longitudinally sulcated, always without thickenings on the outer side, and like the mesenteries arranged after the number 6 + 10 (12) + 16 (18). Inner tentacles longer than outer. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. Actinopharynx of ordinary length with two well developed siphonoglyphes. 16 to 18 (6 + 6 + 4 (6)) pairs of mesenteries perfect, the last cycle of these latter often consisting of a perfect and an imperfect mesentery. Most mesenteries confined to the proximal part of the body. At least the younger mesenteries developed according to the rule of *Actinostola*. Parietobasilar and basilar muscles well developed. Perfect mesenteries generally sterile; when the perfect pairs are more than 16, the exceeding pairs are often fertile, the weaker mesenteries of the third cycle also often fertile. At least the stronger imperfect mesenteries fertile. The fertile mesenteries have filaments.

The genus *Stomphia* is on one side nearly related to *Actinostola*, on the other side it recalls *Sicyonis* in several characters. The younger mesenteries are f. inst. developed as in *Actinostola*, while in *Sicyonis* the *Actinostola*-rule does not distinctly appear. Furthermore, several cycles of mesenteries have reproductive organs in *Stomphia* as well as in *Actinostola*, while in *Sicyonis* only the last cycle is fertile. The fertile mesenteries are provided with filaments in *Stomphia* and *Actinostola*, but as a rule not in *Sicyonis*. *Stomphia* agrees with *Sicyonis* in the mesenteries being more richly developed in the proximal than in the distal part, and in the double number of mesenteries of the second cycle in four (or six?) exocoels or, with another interpretation, in the rapid growth of the mesenteries of the third order in certain exocoels (compare p. 216). The mesogloea of the column is generally thinner in *Stomphia* than in both the other genera, though also in *Actinostola spetsbergensis*, especially in young specimens, the column may be rather thin. On the other hand the body-wall is sometimes thickened in *Stomphia* (compare below). A peculiarity, often displayed by the *Stomphia*-species in contracted state, is this that the central part of the pedal disc is extended tap-like. Sometimes the pedal disc of *Actinostola spetsbergensis* has the same peculiar appearance.

To the genus *Stomphia* the following species certainly belong: the type-species, *St. coccinea* (O. F. Müll.), *St. polaris* (Dan.) and *St. vinosa* (Mc. Murr.) Verr. Concerning the last species, which Mc. Murrich has described as *Paractis vinosa*, Verrill (1899 p. 295) has put forth that it is a *Stomphia*, which opinion I fully share. It is true, that Mc. Murrich does not mention more than 32 mesenteries (32 pairs compare Verrill l. c.), but the broad pedal disc indicates that in this part there have been more mesenteries, which Mc. Murrich has not observed. Verrill supposes that also *Cymbactis faeculenta* Mc. Murr. is a *Stomphia*. To judge from Mc. Murrich's description, this is certainly not the case. Mc. Murrich namely says that this species is provided with about 96 tentacles but not more than 24 pairs of mesenteries. Evidently there has been one more cycle of mesenteries developed in the distal part, — as in the Actiniaria the number of tentacles is not greater than that of the mesenteries — which Mc. Murrich has not observed. The mesenteries is therefore here probably more numerous in the distal than in the proximal part, while it is just the other way in *Stomphia*. On the other hand, it is very probable that *Cymbactis selaginella*, described by Stephenson 1918, is a *Stomphia*, though the body-wall is considerably thickened here. The whole organisation and the exterior of this species as well as Stephenson's[1] information that "a curious little imperforate mound arises from the concave centre of the basal disc" speak for this opinion. Such a "mound" is, as I have stated above, characteristic of *Stomphia*. Further the presence of "small single mesenteries" in the proximal part recalls *Stomphia*. Thus I think that *Cymbactis selaginella* is a *Stomphia*-species.

Verrill (1899 p. 217) declares that large specimens of *Stomphia carneola* = *St. churchiae* *St.*

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[1] Compare p. 211.

coccinea, have 24 pairs or more perfect and that all the perfect mesenteries are fertile. Neither Mc. Murrich (1911 p. 79) nor I myself have found this to be the case. Verrill either hinges his statement on erroneous observations, or — which is more probable — Verrill has confounded another Paractid with *Stomphia* (compare further *St. coccinea*!). For this reason I have not encluded Verrill's statement in the diagnosis.

Stomphia coccinea (O. F. Müll.) Carlgr.

Pl. 2. Figs. 1, 8.

Actinia coccinea n. sp. O. F. Müller 1776 p. 231, 1778 2. p. 30 figs. 1—3.

— — Müll. Gmelin 1788—93 p. 3133. Bruguière 1789 n. 5 Pl. 72 figs. 1, 2. Blainville 1830 p. 290, 1834 p. 324. Lamarck 1837 3. p. 540. Ørsted 1844 p. 72, 74. Johnston 1847 p. 215. Sars 1851 p. 144. Danielssen 1859 p. 45 (p. p.). Milne-Edwards 1857—60 p. 243. v. Beneden 1866 p. 189 Pl. 19 figs. 1—4.

Stomphia coccinea (O. F. Müller) Carlgren 1893 p. 138, 1902 p. 47, 1913 p. 4. Lönnberg 1898 p. 55. Mc. Murrich 1911 p. 47.

Stomphia churchiae n. sp. Gosse 1859 p. 48, 1860 p. 222 Pl. 8 fig. 5. Norman 1868 p. 440, 1869 p. 318, Schulze 1875 p. 140, Andres 1883 p. 369. Mc. Intosh 1884 p. 53. Pennington 1885 p. 173. Carlgren 1893 p. 80 Pl. 1 figs. 11, 12, Pl. 8 figs. 4—6, Pl. 9 figs. 2, 3, Pl. 10 fig. 4 textfig. 22—25. Stephenson 1918 b p. 126.

Actinia virginea sp. n. Müller 1778 Pl. 6 fig. 53.

— *carneola* sp. n. Stimpson 1852 p. 7.

Stomphia carneola (Stimps.) (p. p.) Verrill 1899 p. 206. Parker 1900 p. 753.

Actinia nitida sp. n. Dawson 1858 p. 404 figs. 3—5.

Rhodactinia davisii var. 4 Verrill 1864 p. 19, 20.

Kylindrosactis elegans sp. n. Danielssen 1890 p. 4, Pl. 2 fig. 8, Pl. 8 figs. 4, 5, Pl. 9 figs. 5—7.

Sagartia repens sp. n. Danielssen 1890 p. 45, Pl. 1 figs. 7, 8, Pl. 8 figs. 2, 3.

Diagnosis: Pedal disc very wide. Column smooth or in contracted state wrinkled. Margin rather distinct. Sphincter strong, long, reticular, sometimes with a tendency to stratification. Tentacles to about 80 in number. Actinopharynx well developed with longitudinal furrows, in number almost corresponding with those of the perfect mesenteries. Mesenteries much more numerous than tentacles. 16 to 18 pairs perfect, sometimes a few of these mesenteries consisting of a perfect and of an imperfect mesentery. Imperfect pairs in variable numbers, in larger specimens in 4 cycles, sometimes a tendency to development of a fifth cycle in some exocoels. The last cycle often represented by a single mesentery instead of a pair. Longitudinal muscles most developed in the outer part of the mesenteries. Parietobasilar muscles strong, reaching to the sphincter. No marginal stomata (always?). Typical nematocysts in the ectoderm of the tentacles 17—26 × 1,5—2,5 μ, in the actinopharynx 19—27 × 2—2,5 μ, spirocysts of the tentacles from 19 × 1,5 μ to 60 × 4,5—5 μ. Besides large specific nematocysts, 34—55 × 5—7 μ in size, in the tentacles, nematocysts with discernible basal part to the spiral thread, 22—26 × 3,5—5 μ in size, in the actinopharynx.

Colour variable. Column cream-white, pale pink or flesh-coloured, irregularly marked with carmine, rose-red or scarlet, of a darker shade on the margin (sometimes the whole surface flesh-coloured or pale greenish-white, Verrill). Tentacles translucent pale pink or flesh-coloured with two circular bands of orange-red, rose-red or carmine and the tips of the same colour. Oral disc white, yellowish-white, cream-coloured, greenish-white or pale orange-red with opaque white spots at the base of the inner tentacles. Mouth surrounded by a narrow circle of rose-red, scarlet or orange-red (*coccinea*, *Churchiae*, *carneola*, Gosse, Carlgren, Verrill, Mc. Murrich).

Column milky white, strongly opalescent. Oral disc pale brownish-yellow with darker coloured, radial rows, the narrow circle of the actinostome brownish-red. Inner tentacles brownish-yellow with darker bases, outer tentacles paler with reddish tips (*Kylindrosactis* Danielssen).

Column milky white with a lustre of an exceedingly faint violet tinge. Oral disc pale buff colour. Tentacles a little darker than the disc (*Sagartia repens* Danielssen).

Dimensions. Diameter of the pedal disc unto 6,5 cm, height of the column unto 5,5 cm in preserved state.

Occurrence: Arctic coast of N. America to Cape Cod (teste Parker). Labrador (teste Packard). New Foundland Banks 45°59′ N. 51°49′ W.; 46°5′ N. 51°41′ W.; 46°6′ N. 52°3′ W. 46 fms. (Ingegerd & Gladan-Exp.). New Foundland (Verkrüzen). Jones Sound (Fram-Exp. 1900—1901).

West Greenland. Upernivik 130 fms. (Öberg 1870) (Ryder). Umanak 30—40 fms. (Torell). 70°29′ N. 55°40′ W., 70°27′ N. 55°40′ W. 50—60 fms. (Sofia-Exp. 1863). Disco bay (Rink-Exp.). Ritenbenk 15—20 fms. (Öberg 1870). Jacobshavn 35 fms. (Öberg 1870). Claushavn 40 fms. (Öberg 1870). Ikamiut (Lohmann 1905). Egedesminde 30—80 fms. (Öberg 1870) (Traustedt). Davis Strait (Holm), Nordre Strømfiord 325—330 m. Temp. at the bottom — 0,01°. Salinity 3,7° at + 3 temp. (Nordmann 1911). Holstensborg (Traustedt 1882), 20 fms. (Holm 1882). 66°45′ N. 59°30′ W. 35 fms. (Sofia-Exp. 1883). Godthaab 64°19′ N. 100—200 fms. (Ammondsen 1863). Skinderhvalen 63°3′ N. 40 fms. (Ammondsen 1863). 63°35′ N. 52°57′ W. (Ingegerd & Gladan-Exp. 1871). Bredefiord 170—180 m (Rink-Exp. 1912). Julianehaab 60°40′ N. 60 fms. (Ammondsen 1863). Pectenbanke (Traustedt 1892). Skovfiord 70—140 m (St. 156) 80—120 m (St. 152) (Rink-Exp. 1912).

Greenland without distinct locality (Traustedt 1892, Öberg and others).

Iceland. Berufiord (Torell), Dyrefiord 50 fms. (Lundbeck 1892). N. W. of Talkni 64°05′4 N. 22°55′ W. 20 fms. (Beskytteren-Exp. 1906). Öfiord (Diana-Exp. 1884)

West Spitzbergen. Bell Sound 30—40 fms. (Torell 1858). Icefiord Advent Bay 30—35 m. Bottom temp. 2—2,7° (Sw. Spitzberg-Exp. 1906 St. 73).

Green Harbour 140 m. Bottom temp. 1,1° (Michael Sars-Exp. 1901). 77°41′ N. 12°50′ E. 95 m (Olga-Exp. St. 18).

East Spitzbergen. Edge Land Devee bay 77°23′ N. 21°2′ E. 28 m (Römer & Schaudinn 1898).

Bear Island—Hope Island 75°49′ N. 24°25′ E. (Sw. Spitsberg-Exp. 1898).

Barents Sea. 74°18′ N. 31°12′ E. 269 m. Bottom temp. —0,4° (Norw. N. Atlantic-Exp. 1878 St. 275 *Sagartia repens*).

Murman coast. Eveton Eretik Isl. (Walter & Kükenthal 1889). Kola E. of Waide Guba (Sandeberg-Exp. 1877; 9—75 fms. (Alexander Kowalewsky-Exp. 22—30 fms. St. 37 1908; 23—35 fms. St. 183; 9—15 fms. St. 205; 75 fms. St. 218 1909—teste Pax). Kola peninsula (Derjugin).

Arctic coast of Siberia. 69°32′ N. 177°41′ E. (Vega-Exp. 1878). 2 miles north of the winter station of the Vega (Vega-Exp. 1879).

Behring Sea. 64 30′ N. 171°45′ W. (Vega-Exp. 1879).

Norway Finmark. Vadso 20—40 fms. (teste Danielssen). Porsanger fiord 70°55′ N. 26°11′ E. Bottom temp. 3,5° 232 m (Norw. N. Atlant.-Exp. *Kylindrosactis*). Outer part of Kvaenang-fiord, Budder bugt and Gurbluluokta 20—50 fms (Aurivillius). Ulfsfiord 250 fms. Karlsö 30—40 fms. (Malmgren 1864). Tromsö 30—50 fms. Dons), Bjarkö 70 m (Dons). Bredvig bugt 14—20 fms. (Bjerkan)

Norway. Drontheimfiord Rödberg 25—30 fms. (Arvidsson and others), Galgeneset, Gjeiteneset 100 m (»Gunnerus«), Storfossen 200 m; N.W. of Bergen (Uddström). Bergen Hafvösund (teste Sars). Manger; Manger Vegholmen; Laurkollen 20—30 fms. (Sars). N.W. of Egersund 100 fms. (Swedish fishermens). Jäderen 100 fms. (Olsson).

Denmark. Jydske Rev 50—150 fms. (Uddström).

Skagerrak $26^1/_4$ miles N. to W. $^1/_2$ W. of Hanstholm 120 m (Thor-Exp. 1907 St. 1080).

Sweden. Väderöarne *Lophohelia* reef, Gullmarfiord: S. of Löken 15 fms. (Carlgren). Smedjebrotten, Grötö; S. of Spättasbådar 20—35 m (Zool. St.). N. of Vinga light 42—16 m (Lagerberg). Varberg (Cleve).

The Sound. Ellekilde 15 fms. (Kramp). Aalsgaarde 10—15 fms. (Kramp). Hellebæk 24 fms. (Mortensen, Jungersen). S. S. W. of the light of Hallands Väderö 15 fms. (Lönnberg). Between Arild and Torekow 14 fms. (Lönnberg). Helsingborg 13—22 fms. (Gunhild-Exp.). Between Helsingborg and Landskrona (Rhamn). Landskrona (Örsted, Gunhild-Exp.). S. V. of Knäkaken 29 m (Lönnberg). N. of Hven 14 fms. (Kramp).

Great Belt. S. E. of Knuds Hoved (Mortensen).

Further distribution. The North Sea, British Islets, Shetland Isl.

Exterior aspect. The exterior of this species has been described before by various authors, wherefore further discussion of it is unnecessary. In some specimens the column is rather thick in preserved state. Concerning the pedal disc (compare p. 233).

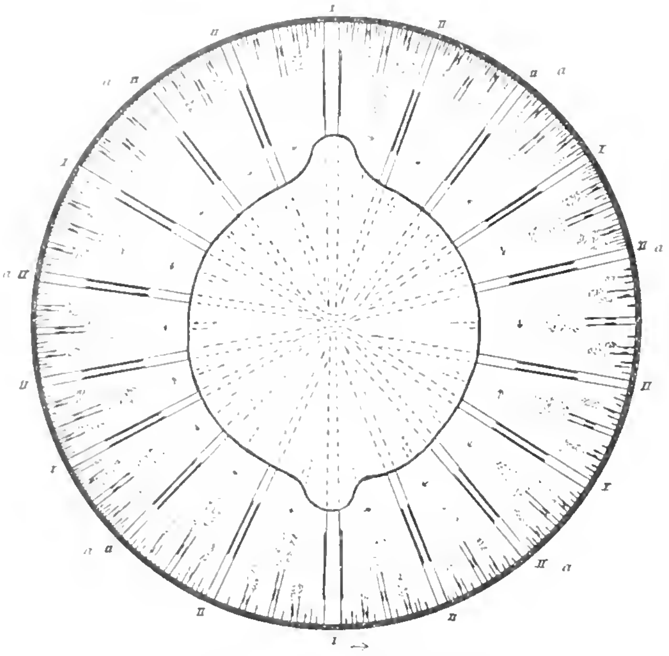
Anatomical description: The anatomy of this species has also been described by myself (1893), by **Verrill** (1899) and by **Mc. Murrich** (1911). **Mc. Murrich's** account of the organisation agrees with mine, except in some small details; on the other hand, **Verrill's** account differs from mine in some important characters, as I have mentioned above. On some points I will, however, complete my earlier observations. Concerning the stinging capsules, there are in the tentacles two kinds of nematocysts, partly typical rib-like, smaller ones (*a*), partly larger, broader in the basal end, and sometimes provided with discernible basal part to the spiral thread (*b*). In the actinopharynx we also find two kinds of nematocysts, partly typical (*a*), partly with discernible basal part to the spiral thread (*c*). In the distal part of the tentacles the largest nematocysts are found. Eight more closely examined specimens show a good agreement in the size of the stinging capsules, as shown by the following list.

Habitat	Distal part of the tentacles			Proximal part of the tentacles		Actinopharynx	
	a	*b*	*spi.*	*a*	*b*	*a*	*c*
Disco fiord......	23-25 × 2 μ	48-55 × 5(6) μ	19 × 1,5—60 × 4-4,5 μ	—	—	—	24 × 3,5 μ
Skov fiord	19 × 2—26 × 2,5	41-50 × 5-7	22 × 1,5—60 × 4-4,5	19-23 × 2 μ	36-46 × 5-6 μ	23-26 × 2,5 μ	24 × 4,5-5
Egedesminde	—	—	—	17-22 × 2	34-46 × 5-6	22-25 × 2,5	24 × 5
Locality?	19-26 × 2-2,5	41-50 × 5-6	—55 × 3,5-4	—	—	19-24 × 2-2,5	24 × 5
Ikarniut	20 × 2—26 × 2,5	41-50 × 5-6	22 × 2—55 × 4,5-5	—	—	24-27? × 2,5	24-26 × 4-5
Labrador	*19 × 1,5—24 × 2	*36-53 × 5(6)	* —55 × 3,5	—	—	—	22-24 × 4,5
Dyre fiord	*19-22 × 1,5	*36-50 × 5	*22 × 1,5—50 × 4,5	—	—	22 × 2	24 × 5
Bohuslän	19-22 × 1,5-2	38-53 × 5	22 × 1,5—48 × 3,5	—	—	19-22 × 2	22-25 × 4-5

The with * designated stinging capsules also contained capsules from the proximal part. The nematocysts of the column are small, in an examined specimen their size was 14—17 × 1,5 μ.

Concerning the mesenteries, I have before (1893) put forth that the youngest mesenteries are developed according to the *Actinostola*-rule. This rule also seems to be valid as far as the older mesenteries are concerned, it is especially distinct in the first cycle of imperfect mesenteries. It is true that these latter seem to be equally developed in transverse sections, but their insertion on the pedal disc shows that both mesenteries of one and the same pair are of different size (textfigure 210). The *Actinostola*-rule is, however, not so distinct here, because the development of the mesenteries, after the appearance of the 6 first pairs of mesenteries, is not the typical one. Instead of a development of 6 pairs of mesenteries of the second order, common in the Actiniaria, 10 or 12 pairs have arisen which are all or for the greater part perfect, like the mesenteries of the first order. On textfigure 210 we see that two pairs of the second order and 3 pairs of the third order correspond to each primary exocoel. Of these latter, which form the first cycle of imperfect mesenteries, the weakest mesenteries in two adjacent pairs are facing each other — to judge from the extension of the mesenteries on the pedal disc — and stand nearest to the interjacent pairs of the second order (designated with II).

In the third pairs of the third cycle the weakest mesentery is facing the second pair of the second cycle (designated with II a, a II). The mesenteries of the third order thus seems to be developed according to the *Actinostola*-rule. Regarding the insertions of the mesenteries of the second cycle on the pedal disc, we find that also here the *Actinostola*-rule is valid. The weakest mesentery in each pair namely stands next to the mesenteries of the first order. Thus the *Actinostola*-rule appears earlier here than in the genus *Actinostola*, where it is only to be distinctly observed from the third cycle. The cause of this difference is that in *Stomphia*, provided with 18 pairs of perfect mesenteries, the number of pairs of mesenteries of the second cycle probably is doubled (12 instead 6), while in *Actinostola* the number is the typical 6. It is easy to understand that the mesenteries of the second order in a species with only six pairs of second mesenteries cannot be arranged according to the *Actinostola*-rule. For that arrangement a reduplication of these mesenteries is first of all required.



Textfig. 210. *Stomphia coccinea*.
Diagram of the arrangement of the mesenteries. The spaced-out lines indicate the extension of the stronger mesenteries on the pedal disc. The fertile mesenteries are provided with groups of points on the inner side. The arrows in the interior of the diagram indicate the place of the weaker mesentery in the pairs of the third cycle.

The specimen of which I have above described and reproduced the arrangement of the mesenteries, was of rather considerable size (the height was about 2,5 cm and the breadth of the pedal disc 6 cm in preserved state). The number of the tentacles was 74 and the mesenteries consisting of no less than 140 paired and 72 unpaired mesenteries. Also the mesenteries of the fourth cycle and those of the following are arranged according to the *Actinostola*-rule, sometimes a mesentery of a subsequent cycle is established, before the mesentery of the preceding cycle has got its partner. As this mesentery is developed on the side away from the longitudinal muscles of the hitherto unpaired mesentery of the preceding cycles, the arrangement of the mesenteries seems apparently to be contrary to the *Actinostola*-rule. Two unpaired mesenteries of two different cycles (6 and 7) in such a case are placed beside each other. The greater part of the mesenteries are developed only in the most proximal part of the body at the limbus and mostly appear as small folds without filaments (in the textfigure these mesenteries are marked with stippled lines).

Issuing from the one directive pair (I → fig. 210) the arrangement of the mesenteries in the more closely examined specimens was as follows. The fertile mesenteries are marked with *k*; (*k*) indicates that only the strongest mesentery of the pair is fertile; *o* signifies unpaired mesentery not having got its partner. The perfect mesenteries are designated with Roman numerals, the imperfect with common numerals.

$$\mathrm{I}\;\underset{o}{6}\;5\;\overset{k}{4}\;\underset{o}{5}\;\overset{k}{3}\;\underset{o}{5}\;\overset{k}{4}\;5\;\underset{o}{6}\quad\mathrm{II}\;\underset{o}{6}\;5\;\overset{(k)}{4}\;\underset{o}{5}\;\overset{k}{3}\;\underset{o}{5}\;\overset{(k)}{4}\;5\;\underset{o}{6}\quad\mathrm{II}\;\underset{o}{6}\;5\;\overset{(k)}{4}\;\underset{o}{5}\;\overset{k}{3}\;\underset{o}{5}\;\overset{k}{4}\;5\;\underset{o}{6}\quad\mathrm{I}\;\underset{o}{6}\;5\;\overset{k}{4}\;\underset{o}{5}\;\overset{k}{3}\;\underset{o}{5}\;\overset{(k)}{4}\;5\;\underset{o}{6}\quad\mathrm{II}\;\underset{o}{6}\;5\;\overset{k}{4}$$

$$\underset{0}{5}\;\overset{k}{3}\;\underset{0}{5}\;\overset{k}{4}\;5\;\underset{0}{6}\quad \mathrm{II}\quad \underset{0}{7}\;\underset{0}{6}\;\overset{(k)}{5}\;\underset{0}{6}\;\overset{k}{4}\;5\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\underset{0}{6}\;5\;6\;\underset{0}{7}\quad \mathrm{I}\quad \underset{0}{7}\;\underset{0}{6}\;\overset{(k)}{5}\;\overset{k}{4}\;5\;\underset{0}{6}\;\overset{k}{3}\;5\;\overset{k}{4}\;\overset{(k)}{5}\;6\quad \mathrm{II}\quad \underset{0}{6}\;5\;\underset{0}{6}\;\overset{k}{4}\;5\;\underset{0}{6}\;\overset{k}{3}\;\underset{0}{6}\;5\;\underset{0}{6}\;\overset{k}{4}$$

$$\underset{0}{6}\;5\;6\quad \mathrm{II}\quad 6\;\overset{(k)}{5}\;\overset{k}{4}\;5\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\underset{0}{6}\;\overset{(k)}{5}\;6\;\underset{0}{7}\quad \mathrm{I}\quad \underset{0}{7}\;6\;\overset{(k)}{5}\;\overset{k}{4}\;5\;\overset{k}{3}\;\underset{0}{5}\;\overset{k}{4}\;5\;\underset{0}{6}\quad \mathrm{II}\quad \underset{0}{6}\;5\;\overset{k}{4}\;5\;\underset{0}{6}\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;5\;\underset{0}{6}\quad \mathrm{II}\quad \underset{0}{6}\;5\;\overset{k}{4}\;5$$

$$\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\overset{(k)}{5}\;6\quad \mathrm{I}\quad 6\;\overset{(k)}{5}\;\underset{0}{6}\;\overset{k}{4}\;5\;\underset{0}{6}\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;5\;6\;\underset{0}{7}\quad \mathrm{II}\quad \underset{0}{6}\;5\;\overset{k}{4}\;5\;\underset{0}{6}\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\underset{0}{6}\;5\;6\quad \mathrm{II}\quad 5\;\overset{k}{4}\;\underset{0}{5}\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\underset{0}{6}\;5\;6\;\underset{0}{7}$$

$$\mathrm{I}\quad \underset{0}{6}\;\overset{(k)}{5}\;\underset{0}{6}\;\overset{k}{4}\;\overset{(k)}{5}\;\underset{0}{6}\;\overset{k}{3}\;\underset{0}{6}\;5\;\overset{k}{4}\;\underset{0}{6}\;5\;6\;\underset{0}{7}\quad \mathrm{II}\quad \underset{0}{6}\;5\;\overset{(k)}{4}\;5\;\overset{k}{3}\;\underset{0}{5}\;\overset{(k)}{4}\;5\;\underset{0}{6}\quad \mathrm{II}\quad \underset{0}{5}\;\overset{k}{4}\;\underset{0}{5}\;\overset{k}{3}\;\underset{0}{5}\;\overset{k}{4}\;5\;\underset{0}{6}.$$

As we see, the development of the mesenteries is a little different in the secondary compartments. In certain compartments a seventh cycle of mesenteries is present. The mesenteries of the third order and at least the strongest mesentery of the pairs of the fourth order were always fertile, the reproductive organs more rarely appear in the mesenteries of the fifth order.

When the number of perfect pairs of mesenteries exceeds 16, the exceeding mesenteries may be provided with reproductive organs. It also may happen that when certain pairs consist of a perfect and an imperfect mesentery, the former then is sterile, the latter fertile. I have never observed more than 18½ perfect pairs of mesenteries in this species (Carlgren 1902 p. 49). Verrill's statement that 24 pairs or more sometimes are perfect, I cannot confirm (compare p. 234).

Stomphia polaris (Dan.) Carlgr.

Pl. 2. Fig. 5.

Tealiopsis polaris n. sp. Danielssen 1890 p. 45 Pl. 1 figs. 7, 8 Pl. 8 figs. 2—3.
Stomphia polaris (Dan). Carlgren 1902 p. 49.

Diagnosis: Pedal disc wide. Column and margin as in *St. coccinea*. Sphincter reticular, wide. Tentacles more than 80, unto 115. Actinopharynx with about 28 longitudinal ridges, siphonoglyphes with aboral prolongations. Mesenteries more numerous than the tentacles, 16 pairs perfect, of which 4 pairs weaker and often consisting of one perfect and one imperfect mesentery. Imperfect pairs of mesenteries in the region of the actinopharynx in 2 cycles, at the basal disc in 3. Muscles of the mesenteries about as in *St. coccinea*. Nematocysts in the ectoderm of the tentacles (19) 24—31 × 2—2,5 μ, in the actinopharynx 22—30 × 2—2,5 μ. Spirocysts of the tentacles from 19 × 1,5 μ to 53 × 3,5—4,5 μ. Large specific stinging capsules in the tentacles not present (or very seldom?).

Colour. Encrusted portion of the column whitish-gray, naked portion and also tentacles sometimes pale dirty whitish-yellow with a darker oral disc, sometimes brick-red. The red-coloured tentacles with a darker annulus in the middle, while the extremities are lighter, the whitish-yellow tentacles with a white crescent in the middle of their adoral surface (Danielssen); reddish-yellow (Römer & Schaudinn).

Dimensions of the reproduced specimen: Heigth of the column 2 cm. Diameter of the pedal disc 2,5 cm, that of the column at the base of the tentacles 3 cm.

Occurrence: East Spitzbergen. Great Isl. 80°15′ N. 30°0′ E. 95 m (Römer & Schaudinn-Exp. St. 37).
Hinlopen Strait. 79°20′ N. 20°55′ E. 80 m (Römer & Schaudinn-Exp. St. 15).

Bismarck Strait. 78°58′,5 N. 20°35′ E. 35 m (Römer & Schaudinn-Exp. St. 45).
Unicorn Bay. 78°40′ N. 21°31′ E. 60 m (Römer & Schaudinn-Exp. St. 46).
Great fiord, Changing point. 78°15′ N. 20°0′ E. 105—110 m. (Römer & Schaudinn-Exp. St. 6).
W. Thymen Strait. 78°14′ N. 21°45′ E. 38 m (Römer & Schaudinn-Exp. St. 47).
Ryk-ys-Islets. 77°49′ N. 25°12′ E. 60—80 m (Römer & Schaudinn-Exp. St. 49).
West Spitzbergen. Bell Sound. 30—35 fms. (Torell).
Norway—Bear Island. 72°53′ N. 21°51′ E. 408 m. Bottom temp. 1,5° (Norw. N. Atlantic-Exp. St. 323).

Exterior aspect: The pedal disc is wide and irregularly folded, there are sometimes traces of radial furrows. The middle part is often, as in the anterior species, extended in a tap-like formation. The limbus is well marked. The form of the column varies with the different state of contraction and is now cylindrical, now narrower in the middle part with proximal and distal end broader (Pl. 2 fig. 5). The column is in contracted state wrinkled and the margin rather well marked. The tentacles are short, cylindrical, pointed at the apex, in contracted state irregularly wrinkled or longitudinally sulcated. The inner are considerably thicker and longer than the outer. Already in small specimens the number of tentacles exceeds the maximum of tentacles in *St. coccinea*. The number of tentacles f. inst. was 87 in a specimen, the pedal disc of which was 0,7 cm broad and the column 0,9 cm high. The number of tentacles was commonly between 95 and 115, the latter number in a specimen of which the pedal disc was 0,6 cm and the height of the column 1,4 cm. The tentacles were arranged in 5 cycles, 6 + 10 + 16 + 32 + 64, of which the last was imperfect. The oral disc is wide and provided with radial furrows, corresponding to the insertions of the mesenteries; the furrows appear most distinctly in the outer part of the disc. There are besides indistinct transversal furrows, arisen by contraction. Two distinct gonidial tubercles are present. The siphonoglyphes are broad and aborally prolongated. The actinopharynx is distinctly longitudinally sulcated, on each side of the direction plane about 14 furrows appear.

Anatomical description. The ectoderm of the column is rather high and contains few nematocysts, about 17 × 1,5 μ large. It forms a cuticle which may be incrusted with foreign bodies, probably kept together by the secretion of the mucus cells. This cuticle, which does not reach any greater thickness, however seems to be easily thrown off, as it is wanting in the specimen reproduced in the figure Pl. 1). The sphincter is reticular as in *St. coccinea*, now shorter now longer, according to the state of contraction. The distribution of the sphincter, the muscles of the tentacles, and those of the oral disc agree with those of the anterior species. The nematocysts in the apex of the tentacles are 24—31 × 2—2,5 μ in size, in the proximal part a little smaller. The spirocysts vary in size from about 19 × 1,5 μ to 53 × 3,5—4,5 μ. I have not observed any large specific nematocysts in the maceration preparations of the numerous, examined specimens. In a single, small specimen from Changing point I have, however, found such capsules in rather great numbers. Such capsules either very seldom occur, or this specimen is a hybrid *coccinea* & *polaris* with the same number of tentacles as in polaris and with large nematocysts as in *St. coccinea*. The supposition that we here have to do with a hybrid is not unlikely, as both species are very nearly related to each other. In the ectoderm of the actinopharynx I have found only typical nematocysts, 22—30 × 2—2,5 μ in size.

The arrangement of the mesenteries agrees very well with that of *St. coccinea*, I have, however, not found any more than 16 perfect pairs in the five specimens which I have examined more closely. Of these 16 pairs four are weaker than the other pairs and most frequently consist of one perfect and one imperfect mesentery, the former sterile as the other perfect mesenteries, the latter most often fertile. These weaker mesenteries were placed symmetrically on both sides of the directive plane. If we indicate the mesenteries of the first cycle with I, the stronger perfect mesenteries of the second cycle with 2 and the weaker of the same cycle with 2_1, the stronger and always perfect 2_1 mesenteries with *a*, the weaker with *b*, the arrangement of these mesenteries on both sides of the directive plane was the following $\overset{\mathrm{dm}}{\mathrm{I}}\ 2\ \underset{a\,b}{2_1}\ \mathrm{I}\ 2\ \underset{a\,b}{2_1}\ \mathrm{I}\ 2\ (\mathrm{I})$. In a primary dorso lateral (?) exocoel thus no 2_1-mesenteries are developed. The mesenteries besides follow the *Actinostola*-rule in their development. A specimen, the pedal disc of which was 1,8 cm broad, the height of the column 1,9 cm, and the number of tentacles 95 in the region of the actinopharynx, shows the following arrangement of the mesenteries. *o*: unpaired mesentery in this region.

$$\overset{\mathrm{dm}}{\mathrm{I}}\,4\,3\,4\,2\,\underset{0}{4}\,3\,4\,2_1\,3\quad \mathrm{I}\,4\,3\,4\,2\,4\,3\,4\,2_1\,3\quad \mathrm{I}\,4\,3\,4\,2\,4\,3\,4\quad \overset{\mathrm{dm}}{\mathrm{I}}\,4\,3\,4\,2\,4\,3\,4\quad \mathrm{I}\,3\,2_1\,4\,3\,\underset{0}{4}\,2\,4\,3\,4\quad \mathrm{I}\,\underset{0}{4}\,3\,\underset{0}{4}\,2_1\,\underset{0}{4}\,3\,\underset{0}{4}\,2\,4\,3\,4.$$

The weakest mesenteries are in the vicinity of 2_1. In the most proximal part of this specimen the number of mesenteries was 171. Thus the number of mesenteries, in comparison with that of the tentacles, is much smaller in this species than in *St. coccinea*. If we take the number of tentacles to be 1 in both species, the number of mesenteries in the named *polaris*-specimen is 1,8, in the more explicitly described specimen of *St. coccinea* 4,76. As for the rest of the organisation it agrees with that of *St. coccinea*; I have, however, sometimes found a small marginal stoma. The longitudinal muscles of the mesenteries vary in appearance, probably according to their different state of contraction, they now recall those of *St. coccinea* (Carlgren 1893), now those of *St. (Cymbactis) selaginella* (Stephenson 1918a), now they are more expanded over the whole surface of the mesenteries; the longitudinal pennons, commonly provided with higher folds than in *St. coccinea*, are however limited to the outer part of the mesenteries.

Plate I.

Plate I.

Fig. 1. *Eloactis mazelii* juv. $^2/_1$ *a*: tentacle, *b*: part of column.

— 2. *Halcampa? vegae* Carlgr. Nat. size.

— 3. *Halcampa arctica* Carlgr. not incrusted specimen from Treurenberg bay. $^2/_1$.

— 4. — — — small specimen from Besimannaja bay. $^2/_1$.

— 5. *Edwardsia (Edwardsioides) vitrea* (Dan). Proximal part of the type-specimen. $^4/_1$.

— 6. *Aethelmis intestinalis* (Fabr.) Nat. size.

— 7. — — — $^2/_1$.

— 8, 9. *Paraedwardsia sarsii* (Düb. & Kor.) = *Edwardsia carnea* of Appellöf from Herlöfiord. $^2/_1$.

— 10. *Edwardsia finmarchica* Carlgr. from Tromsö (Kier) type-specimen a little magnified.

— 11. — *vitrea* (Dan). from Wijde bay showing heteromorphosis. $^3/_1$.

— 12. — *finmarchica* Carlgr. (Goës & Malmgren leg.). $^2/_1$.

— 13, 14. *Limnactinia laevis* Carlgr. from Bohuslän. $^2/_1$.

— 15. *Paraedwardsia arenaria* Carlgr. from Skagerrak. $^2/_1$.

— 16. — — — proximal part seen from the proximal end. $^3/_1$.

— 17, 18. *Sideractis glacialis* Dan. from Sunde much magnified.

— 19. — — tentacle from the type-specimen magnified.

— 20. *Edwardsia tuberculata* Düb. & Kor. from Bergen. $^2/_1$.

— 21—27. *Peachia hastata* Gosse. Series of larvae in different developmental stages. *a*: from the oral end *b*: from the side $^6/_1$, in fig. 24 the distal end begins to get the form of an octaeder, in fig. 25 the tentacles in beginning development (compare the text).

— 28. *Peachia hastata* Gosse from Bohuslän dredged from the clay. $^3/_1$.

— 29. — — — from Bohuslän, oral disc and tentacles of the specimen reproduced in fig. 28. $^6/_1$.

— 30. *Peachia bockii* Dan. & Koren. part of the type-specimen with two tentacles, the conchula and part of the siphonoglyphe. $^3/_1$.

— 31. *Haliactis arctica* Carlgr. from Greenland. $^2/_1$.

— 32, 33. *Milne-Edwardsia loveni* Carlgr. from Väderöarne $^2/_1$, in the specimen reproduced in fig. 32 part of the cuticle removed.

— 34, 35. *Halcampoides purpurea* (Stud.) (*abyssorum* Dan.) small specimen, fig. 34 from the oral side, fig. 35 from the side. $^2/_1$.

— 36, 37. *Isoedwardsia ingolfi* Carlgr. Fig. 36 proximal end $^4/_1$, fig. 37. $^2/_1$.

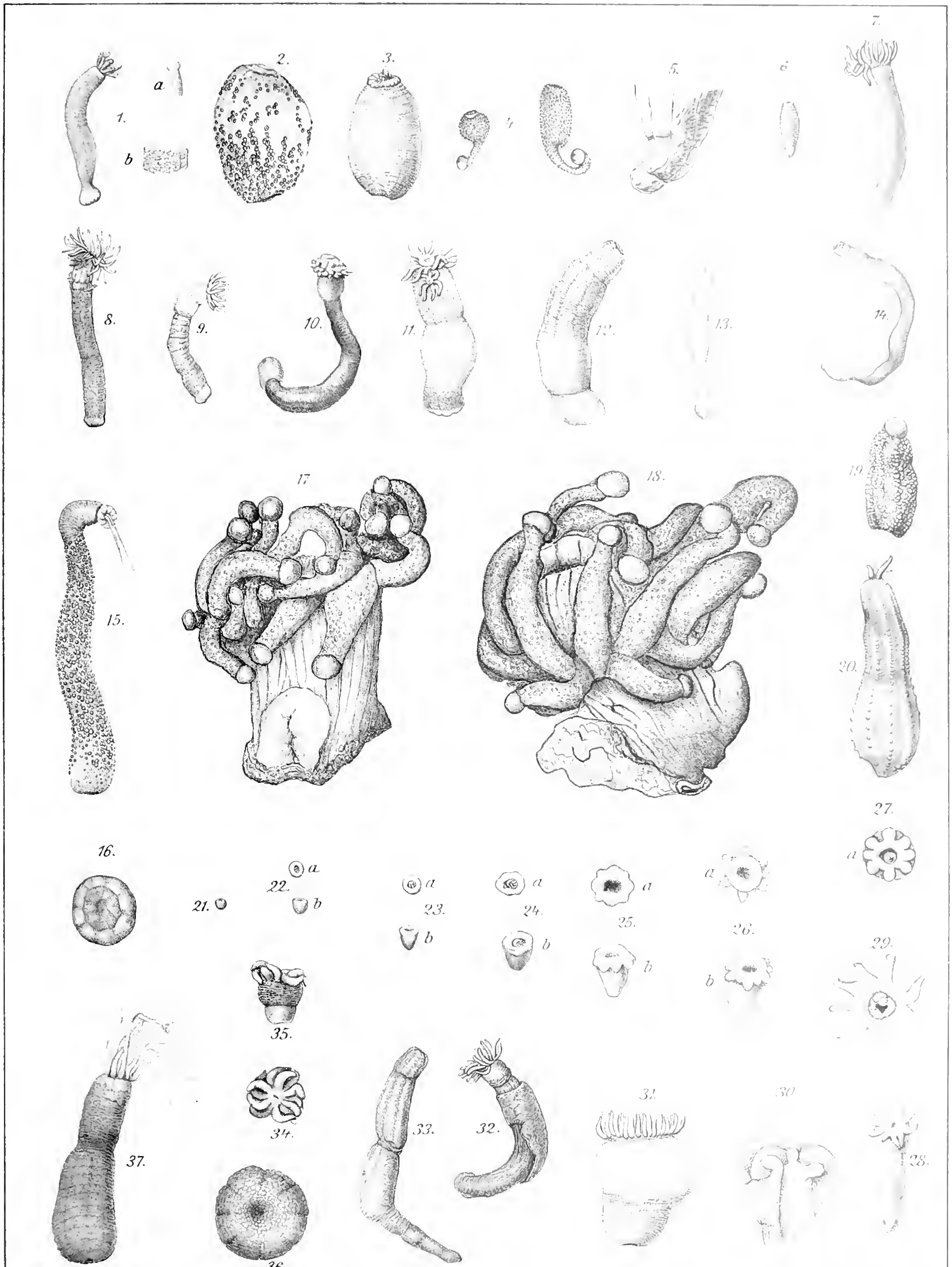

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Plate II.

Plate II.

Fig. 1. *Stomphia coccinea* (O. F. Müll.). Nat. size.

— 2. *Cribrina spetsbergensis* Carlgr. from Behring Sound. Nat. size.

— 3. *Actinostola spetsbergensis* Carlgr. (= *sibirica* Carlgr.). Nat. size.

— 4. — — — juv.

— 5. *Stomphia polaris* (Dan.). Nat. size.

— 6. *Anthosactis jan mayeni* Dan. from Baffin bay. Longitudinal section of the animal. Nat. size.

— 7. — — — — Mouth and actinopharynx of the type-specimen.

— 8. *Stomphia coccinea* (O. F. Müll.) pedal disc with conical off-shoot.

— 9. *Siphonactinopsis laevis* Carlgr. Nat. size.

— 10. *Actinostola groenlandica* Carlgr. Nat. size.

— 11, 12. *Halcampoides purpurea* Stud. (= *H. abyssorum* Dan.). Fig. 11. Mesentery seen from the side of the transverse muscles, fig. 12. Mesentery seen from the side of the longitudinal muscles.

— 13. *Peachia hastata* Gosse. Transverse section through part of the aboral prolongation of the siphonoglyphe showing the strongly ciliated boundary tract between the peculiar prolongation of the siphonoglyphe and the recurvated part (compare textfig. 132).

— 14, 15. *Halcampa arctica* Carlgr. Longitudinal section of the ciliated and of the intermediate streaks (compare the text p. 122).


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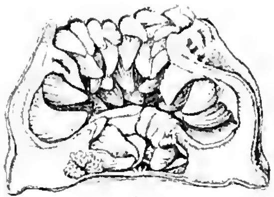
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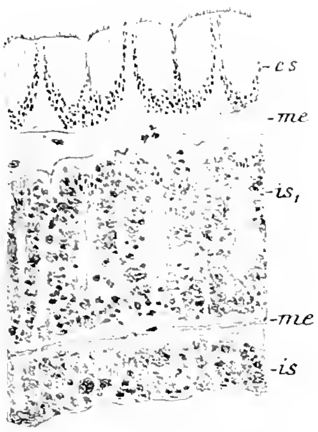

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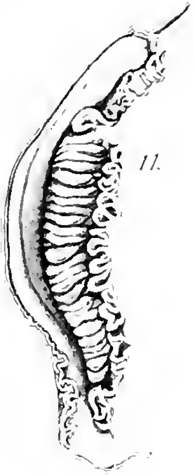
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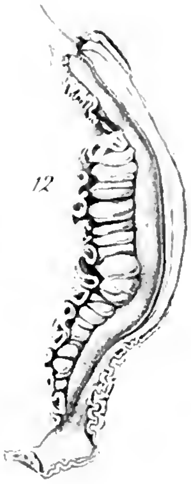
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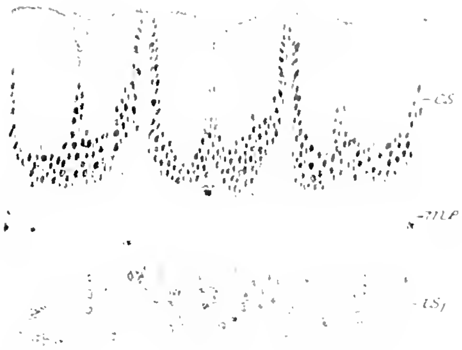

Bundsen [illegible]

Plate III.

Plate III.

Fig. 1. *Sicyonis ingolfi* Carlgr. about $^{5}/_{8}$.
— 2, 3. *Sicyonis tuberculata* Carlgr. $^{5}/_{8}$.
4, 5. *Pycnanthus laevis* Carlgr. $^{5}/_{8}$.
6. *Phychodactis patula* Appel.
7. *Cribrinopsis similis* Carlgr. torn-off tentacles (labelled *Zoanthus* sp. Kolafiord Derjugin).
8–10. *Epiactis* (*Pseudophellia*) *arctica* (Ver.). Nat. size.
11. *Sicyonis variabilis* Carlgr. Nat size.
12. *Parasicyonis sarsii* Carlgr. (from Michael Sars-Exp. 1902 St. 101). Nat. size.
13–15. *Actinostola spetsbergensis* Carlgr. (Nordmann St. 3b). Nat. size.


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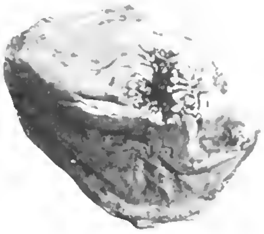
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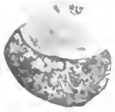
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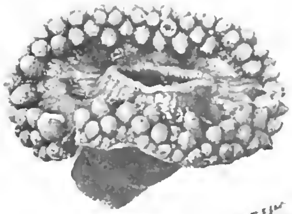
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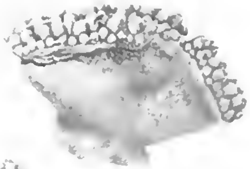
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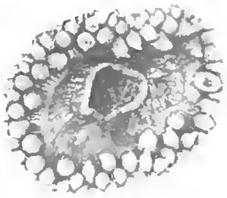
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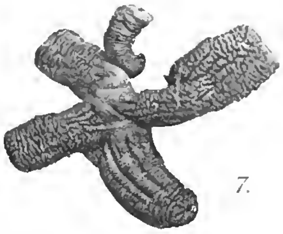
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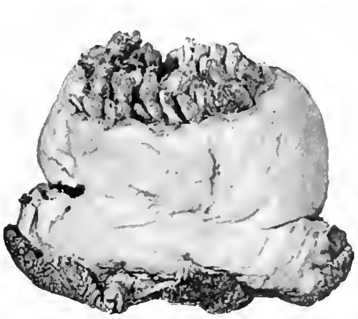
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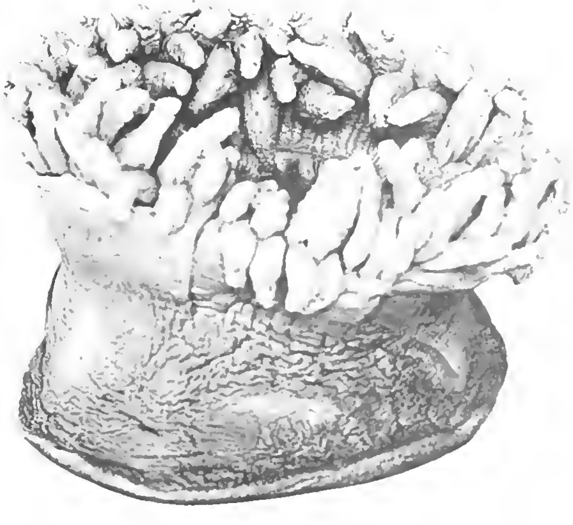
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Plate IV.

Plate IV.

ec: ectoderm, *me*: mesogloea, *c*: cuticle, *in*: incrustation.

Figs. 1—4. *Urticina felina* (L.) *coriacea*.

— 1. Part of verruca, maceration preparation. Beale's carmine *s*: supporting cells, *gl.*: granulous gland cells.

— 2. *a*: supporting cells, *b*: granulous gland-cells from a verruca, maceration preparation.

— 3. Gland cells from the pedal disc, maceration preparation.

— 4. a) mucus cells, b) yellowish gland cells from the column outside the verruca.

— 5. *Halcampa arctica* Carlgr. Not incrusted specimen. Transverse section through part of the scapus with a papilla. *ch*: chitinized ectoderm cells?

— 6. *Scytophorus antarcticus* (Pfeff.). Transverse section of part of the scapus. *gl*: gland cells, *ch*: chitinized ectoderm cells.

— 7. *Paraedwardsia sarsii* (Düb. & Kor.). Transverse section of part of the scapus with a papilla. *ch*: chitinized ectoderm cells.

— 8. *Halcampa duodecimcirrata* (M. Sars). Transverse section of part of the scapus with a papilla. *ch*: chitinized ectoderm cells, *gl*: gland cells.

— 9. *Epiactis arctica* (Verr.) Transverse section of part of the column with a spot. *n*: nematocysts, *gl*: gland cells.

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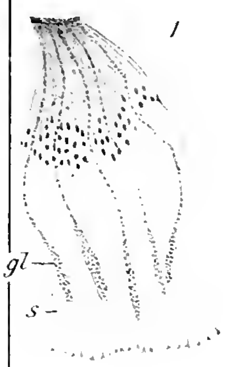

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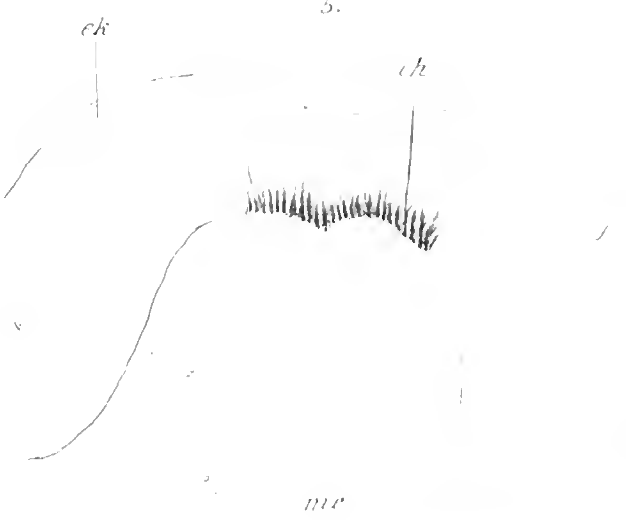

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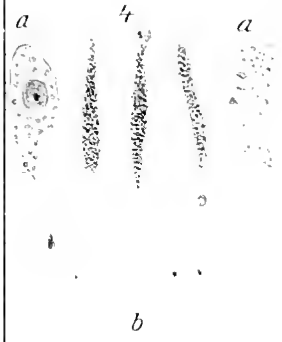

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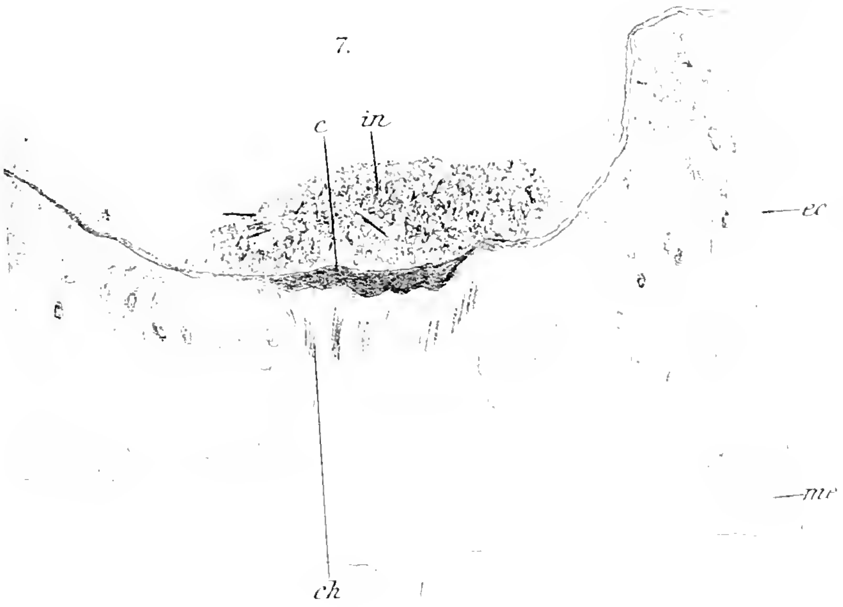

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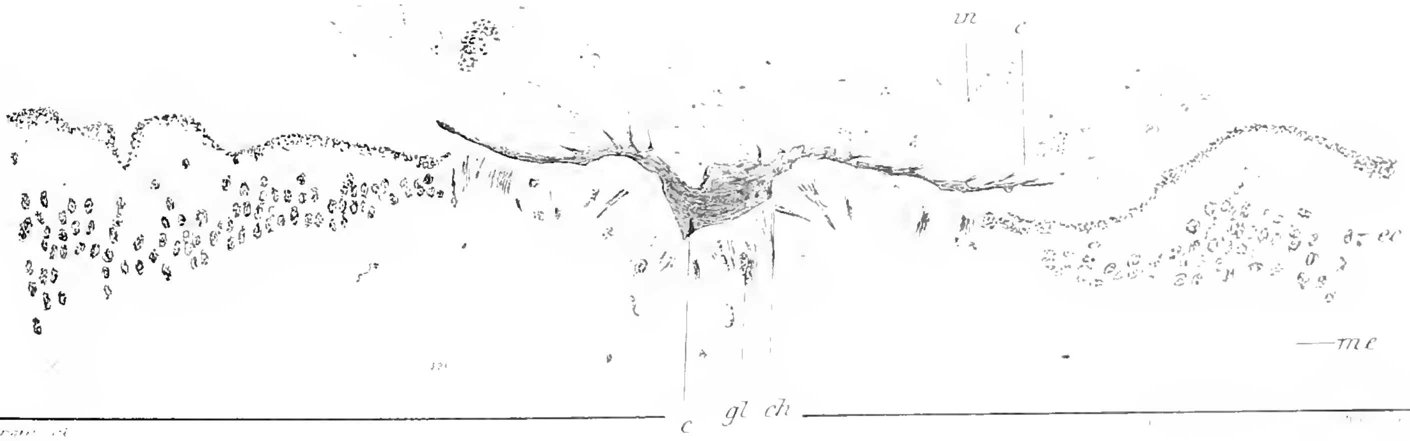


THE INGOLF-EXPEDITION

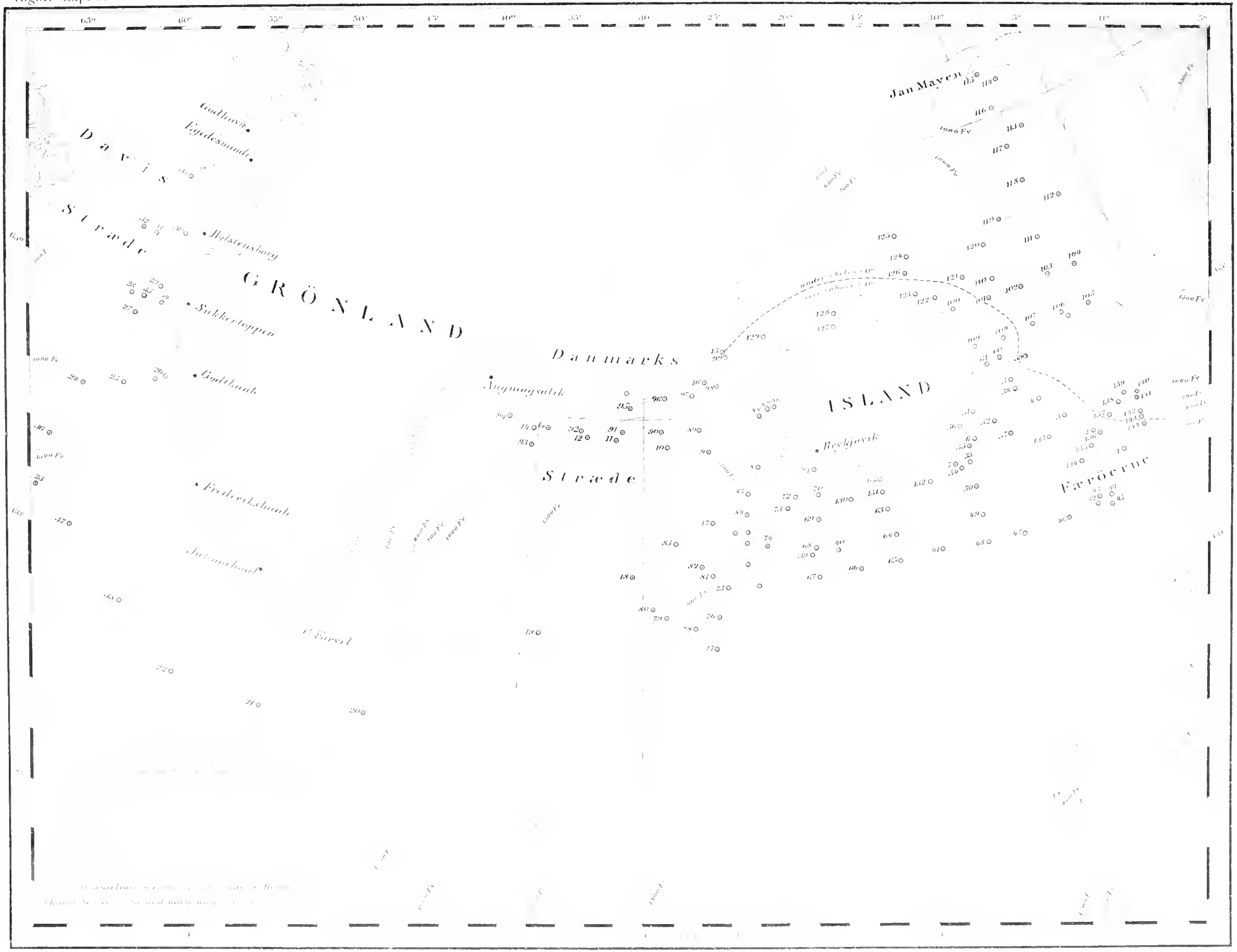
1895–1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr	Lat N	Long W.	Depth in Danish fathoms	Bottom-temp	Station Nr	Lat N	Long W	Depth in Danish fathoms	Bottom-temp	Station Nr	Lat N	Long W	Depth in Danish fathoms	Bottom-temp
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°6	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	−0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr	Lat N	Long W	Depth in Danish fathoms	Bottom-temp	Station Nr	Lat N	Long W	Depth in Danish fathoms	Bottom-temp	Station Nr	Lat. N.	Long W	Depth in Danish fathoms	Bottom-temp.
68	62° 06'	22° 30'	843	3°4	92	64° 44'	32° 52'	976	1°4	118	68° 27'	8° 20'	1060	—1°0
69	62° 40'	22° 17'	589	3°9	93	64° 24'	35° 14'	707	1°46	119	67° 53'	10° 19'	1010	—1°0
70	63° 09'	22° 05'	134	7°0	94	64° 56'	30° 19'	204	4°1	120	67° 29'	11° 32'	885	—1°0
71	63° 46'	22° 03'	46			65° 31'	30° 45'	213		121	66° 59'	13° 11'	529	—0°7
72	63° 12'	23° 04'	197	6°7	95	65° 14'	30° 39'	752	2°1	122	66° 42'	14° 44'	115	1°8
73	62° 58'	23° 28'	486	5°5	96	65° 24'	29° 00'	735	1°2	123	66° 52'	15° 40'	145	2°0
74	62° 17'	24° 36'	695	4°2	97	65° 28'	27° 39'	450	5°5	124	67° 40'	15° 40'	495	—0°6
	61° 57'	25° 35'	761		98	65° 38'	26° 27'	138	5°9	125	68° 08'	16° 02'	729	—0°8
	61° 28'	25° 06'	829		99	66° 13'	25° 53'	187	6°1	126	67° 19'	15° 52'	293	—0°5
75	61° 28'	26° 25'	780	4°3	100	66° 23'	14° 02'	59	0°4	127	66° 33'	20° 05'	44	5°6
76	60° 50'	26° 50'	806	4°1	101	66° 23'	12° 05'	537	-0°7	128	66° 50'	20° 02'	194	0°6
77	60° 10'	26° 50'	951	3°6	102	66° 23'	10° 26'	750	-0°9	129	66° 35'	23° 47'	117	6°5
78	60° 37'	27° 52'	799	4°5	103	66° 23'	8° 52'	579	-0°6	130	63° 00'	20° 40'	338	6°55
79	60° 52'	28° 58'	653	4°4	104	66° 23'	7° 25'	957	1°1	131	63° 00'	19° 09'	698	4°7
80	61° 02'	29° 32'	935	4°0	105	65° 34'	7° 31'	762	-0°8	132	63° 00'	17° 04'	747	4°6
81	61° 44'	27° 00'	485	6°1	106	65° 34'	8° 54'	447	0°6	133	63° 14'	11° 24'	230	2°2
82	61° 55'	27° 28'	824	4°1		65° 29'	8° 40'	466		134	62° 34'	10° 26'	209	4°1
83	62° 25'	28° 30'	912	3°5	107	65° 33'	10° 28'	402	-0°3	135	62° 48'	9° 48'	270	0°4
	62° 36'	26° 01'	472		108	65° 30'	12° 00'	97	1°1	136	63° 01'	9° 11'	256	4°8
	62° 36'	25° 30'	401		109	65° 29'	13° 25'	38	1°5	137	63° 14'	8° 31'	297	—0°6
84	62° 58'	25° 24'	633	4°8	110	66° 44'	11° 33'	781	-0°8	138	63° 26'	7° 56'	471	—0°6
85	63° 21'	25° 21'	170		111	67° 14'	8° 48'	866	0°0	139	63° 36'	7° 30'	702	0°6
86	63° 03'6	23° 47'6	76		112	67° 57'	6° 44'	1267	1°1	140	63° 29'	6° 57'	780	0°9
87	63° 02'8	23° 56'2	110		113	69° 31'	7° 06'	1309	1°0	141	63° 22'	6° 58'	679	0°6
88	64° 58'	24° 25'	76	6°9	114	70° 36'	7° 29'	773	1°0	142	63° 07'	7° 05'	587	—0°6
89	64° 45'	27° 26'	316	8°4	115	70° 50'	8° 29'	86	0°1	143	62° 58'	7° 00'	388	-0°4
90	64° 45'	29° 06'	568	4°4	116	70° 05'	8° 26'	371	0°4	144	62° 49'	7° 12'	276	1°6
91	64° 44'	31° 00'	1236	5°1	117	69° 13'	8° 23'	1003	1°0					

Ingolf Expeditionen 1895 & 1896



THE DANISH INGOLF-EXPEDITION

VOLUME V.

10.

MEDUSÆ.

PART II.

ANTHOMEDUSÆ.

BY

P. L. KRAMP.

WITH 2 PLATES, 40 FIGURES AND 18 MAPS IN THE TEXT
AND A LIST OF STATIONS.

* * *

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1926.

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CONTENTS

Introduction.

The programme for the working up of the "Ingolf" Medusæ was given in the introduction to my paper on the Leptomedusæ (Kramp 1919), and as, in the present work on the Anthomedusæ, I have followed the same plan, I need not repeat it here. The Anthomedusæ of the North Atlantic and adjacent areas have been the subject of a thorough examination by Cl. Hartlaub (Nordisches Plankton, 1907—1917). Therefore, when I commenced the present work, I did not expect my studies to carry any considerable amount of important additions to our knowledge as far as the morphology of the animals was concerned. But I soon found out that, even though the general morphology of most species is fairly well known, there are a lot of minor structures, which are very deficiently examined and which, I am sure, are of very great importance for the classification of the species as well as for the general understanding of the conformation of the animals. Comparative morphological investigations are highly needed in the studies of Medusæ. The present work does not pretend to be a treatise on comparative morphology; it presents a series of empirical results, and only occasionally enters into a discussion of their significance. Some of the items which have been the subject of my special attention, are: the inner structure of the manubrium of the Codonidæ; the morphology of the tentacles and their basal bulbs, with special regard to the so-called abaxial spurs, not only to the mere presence or absence of a spur, but rather to its structure, the manner in which the different cell-layers partake in its construction; the mode of development of the tentacles, which, I think, comprises a series of interesting problems.

The biology of the species (horizontal and vertical distribution, seasonal occurrence, dependance on sea-currents and other hydrographical conditions) constitutes the other main-task of my studies of these animals. In several cases the results of these biological studies are necessarily somewhat unsatisfactory, owing to insufficiency of material, or to lack of precise accompanying data.

On one point the present paper differs from that on the Leptomedusæ: in the latter I have included short diagnoses and summary remarks on geographical distribution of a number of species not represented in the material examined by me but known to occur in the North Atlantic region. This I have not thought necessary in the present case, because every desirable reference to such species may be found in Hartlaub's memoir. As a supplement to the latter I may call attention to the paper on the medusæ of Norway, recently published by Kramp & Damas (1925).

The material at my disposal comprises 28 species of Anthomedusæ, belonging to the families *Codonidæ*, *Margelidæ* and *Tiaridæ*, the family of the *Cladonemidæ* not being represented in the collections.

The 28 species dealt with in the present paper are as follows:

Sarsia princeps (Haeckel)
tubulosa (M. Sars)
Euphysa flammea (Hartlaub, Linko)
tentaculata Linko
aurata Forbes
Steenstrupia nutans (M. Sars)
Hybocodon prolifer A. Agassiz
Bougainvillia ramosa van Beneden
nordgaardii (Browne)
britannica Forbes
— superciliaris L. Agassiz
— principis (Steenstrup)
Lizzia blondina Forbes
Rathkea octopunctata (M. Sars)
Paratiara digitalis Kramp & Damas
Tiaranna rotunda (Quoy & Gaimard)
— affinis Hartlaub
Amphinema dinema (Péron & Lesueur)
Halitholus pauper Hartlaub
— cirratus Hartlaub
Leuckartiara octona (Fleming)
— breviconis (Murbach & Shearer)
— nobilis Hartlaub
Calablema vesicarium (A. Agassiz)
— multicirrata Kishinouye
Neoturris pileata (Forskål)
Pandea rubra Bigelow
Bythotiara murrayi Günther

When nothing else is expressly stated the material belongs to the collections of the Zoological Museum of the University of Copenhagen.

Family **Codonidæ.**

Genus **Sarsia** Lesson.

Sarsia princeps (Haeckel)

Plate I, figs 1—4. Textfigs. 1—5. Chart I

Codonium princeps Haeckel 1879. System der Medusen, p. 13. Taf. I, figs. 1—2.
Grönberg 1898. Die Hydroid-Medusen des arktischen Gebiets. — Zool. Jahrb. Abt. Syst. Bd. XI, p. 458. Taf. 27, figs. 1—2.
Sarsia Browne 1903. Rep. some Medusae from Norway. Bergens Museums Aarbog 1903, p. 8. Pl. I, fig. 1; Pl. III, fig. 4.
Hartlaub 1907. Nordisches Plankton, p. 47, textfig. 44.
Kramp 1914. Conspectus Faunæ Groenlandicæ. — Meddel. om Grønland. Bd. 23, p. 400.
Kramp 1920a. Rep. sci. results of the "Michael Sars" N. Atlantic exped. 1910, p. 5.
Bigelow 1920. Rep. Canadian Arctic Exped. 1913—18, p. 4. Pl. I, fig. 1.

Since this species was first described by Haeckel (1879) it has been the subject of several new descriptions (by Grönberg, Browne, Hartlaub, and Bigelow, see above). Its general appearance is, therefore, well known, and, as far as the morphology is concerned, I shall restrict myself to make a few additional remarks, particularly concerning the inner structure.

Manubrium. The structure of the supporting lamella exhibits a sexual dimorphism; the outer surface of the lamella is almost smooth in the female, whereas in the male it is provided with strongly protruding longitudinal ribs; on account of these ribs the surface is very much enlarged, making room for a considerably larger number of muscular fibrils than is the case in the female. The difference is shown in the transversal sections in the textfigs. 1a and 1b. Plate I, fig. 2 presents the outer surface of the supporting lamella of a male manubrium, stained with carmine; after transference into xylol the ectoderm has been carefully removed, and thus the ribs of the supporting lamella are uncovered; the ribs are running throughout the entire length of the manubrium; their mutual distance is somewhat variable, about 25—30 μ in the example, figured in plate I.

The endoderm of the manubrium is a fairly low epithelium consisting of cylindrical cells; in contracted condition the epithelium is densely and finely transversally folded (textfig. 2). Four well-defined, strongly protruding longitudinal ridges are running in a wavy manner alongside the four interradii of the manubrium (textfig. 3, transversal section of a female manubrium). At the proximal end of the manubrium there is a very short part free of gonads (textfig. 4). Where the manubrium joins the endoderm-lamella of the umbrella the endoderm is quite thin, but in the middle of the circular dorsal area of attachment of the manubrium, the endodermal epithelium is very high and folded; accordingly, at the uppermost end of the gastral cavity there is a ring-shaped groove (see the textfig. 4).

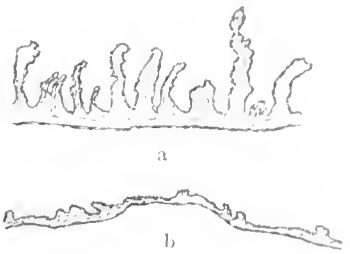

Fig. 1. *Sarsia princeps*. Transversal section of supporting lamella of manubrium. a) male individual, with protruding ribs on the external (ectodermal) side; b) female individual, with almost smooth external surface. — In both figures the ecto- and endodermal cell-layers are omitted, with the exception of the muscular elements; the ectodermal, longitudinal muscle-fibrils are seen in transverse section, partly embedded in the surface of the supporting lamella. Specimens from Greenland, "Tjalfe" stat. 173.

The apical canal, which is one of the most prominent characteristics of this species, is, in reality, no true canal; the distal dilatation is hollow, and there may be lacunæ in the stalk, but the greater part of the "canal" is closed, filled up with a solid endoderm (see textfig. 4). The shape of the distal dilatation is subject to great variation; as a rule it is spherical or knob-shaped, but frequently compressed, bifurcated, palmate etc.

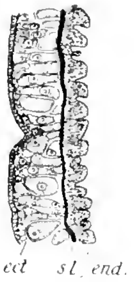

Fig. 2.

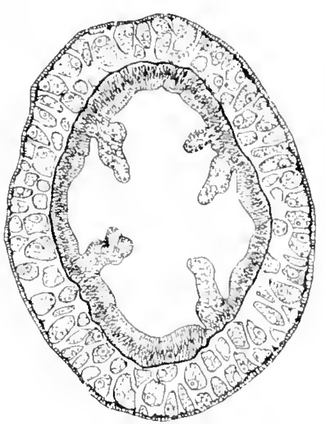

Fig. 3

Figs. 2—3. *Sarsia princeps*. — Fig. 2. Longitudinal section through perradial part of female manubrium. *ect.* ectoderm; *end.* endoderm; *s. l.* supporting lamella. — Fig. 3. Transversal section of female manubrium, showing the four interradial ridges in the endodermal epithelium. — Specimens from Greenland, "Tjalfe" stat. 173.

Umbrella. There is a complete endoderm lamella, consisting of one cell-layer. The jagged margin of the radial canals seems to be a constant feature, though the degree of development is somewhat variable. The irregularity of the outlines is due to short lateral diverticula from the radial canal (see Plate I, figs. 3—4). These diverticula are placed in the plan of the endoderm lamella; they are flattened and consist of two cell-layers, fusing except very near the base of the diverticula, where a small hollow space communicates with the cavity of the radial canal. The endodermal cells of the diverticula are not remarkably vacuolated.

Tentacular bulbs (textfig. 5; Plate I, fig. 1). The nettle-ring is well developed, particularly on the

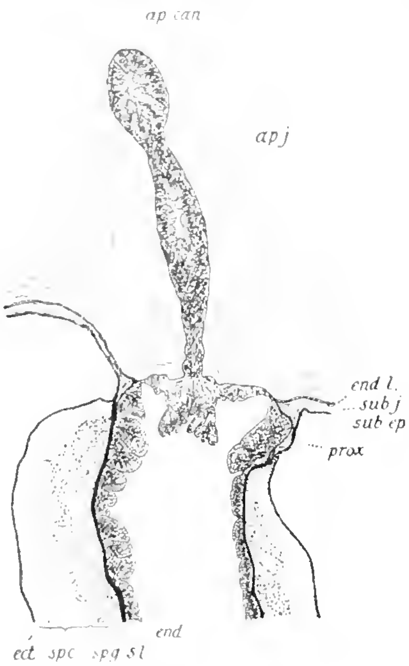

Fig. 4. *Sarsia princeps.* Longitudinal section of upper part of manubrium of a male individual. *ap. can.* apical canal; *ap. j.* apical jelly; *ect.* ectodermal epithelium; *end.* endodermal epithelium; *end. l.* endodermal lamella; *prox.* proximal part of manubrium free of gonads; *s. l.* supporting lamella of manubrium; *sp. c.* spermatocytes; *sp. g.* spermatogonies; *sub. ep.* subumbrella epithelium; *sub. j.* subumbrella jelly. — Specimen from Greenland, "Tjalfe" stat. 124.

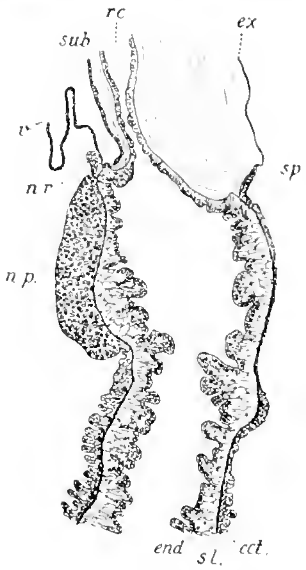

Fig. 5. *Sarsia princeps.* Longitudinal section of the tentacular bulb. — *ect.* ectoderm; *end.* endoderm; *ex.* exumbrella; *n. p.* nematocyst pad; *n. r.* nerve-ring; *r. c.* radial canal; *s. l.* supporting lamella of tentacle; *sp.* apical spur; *sub.* subumbrella; *v.* velum.

adaxial side, narrowing towards the abaxial side, in the middle of which it is interrupted. A well-developed, purely ectodermal spur grasps round the margin of the exumbrella; the ocellus is placed immediately below the spur. In contradistinction to *Sarsia tubulosa*, the radial canal issues from the adaxial side of the bulb, close to the subumbrella, and the endoderm of the bulb is not vaulting into the umbrella, neither behind nor in front of the radial canal (comp. *Sarsia tubulosa*). The shape and the inner structure of the bulb may be seen in the figures.

Colour. In a specimen, found during a cruise of the "Dana" to the west coast of Greenland in 1925, the manubrium, the radial canals, the circular vessel, and the ectoderm of the tentacular bulbs are rosy-red, the apical chamber and the endoderm of the tentacular bulbs intensely carmine, ocelli dark brown. The specimen was examined $2^1/_2$ months after being found and preserved in formalin.

Material (see Chart I).

Greenland:

1) Greenland, without further details. Royal Museum and H. P. C. Moller 1844; Olrik 1865.

2) Davis Strait and Baffin Bay. Borch 1859.

3) Umanak. Fleischer 1865.

4) Godhavn, Disco. Olrik 1860.

The 25 specimens from these localities are identified by Haeckel and include the type specimens, on which Haeckel based his description of the species.

5) Greenland, without further details. — 43 young specimens, height of the bell 2—6 mm.

6) Davis Strait. Olrik 1866. — 40 specimens.

7) Umanak Fjord, Lat. 70° 44′ N., Long. 52° 20′ W. August 6th 1908. Ringtrawl, 150 m wire. "Tjalfe" stat. 173. — 50 specimens, 11—29 mm high.

8) Waigat. Hartz 1890. — 1 specimen.

9) Off Nungarut, Disco. July 21st 1898. M. Pedersen. — 1 specimen, 26 mm high.

10) Godhavn, Disco. Olrik. — 12 specimens.

11) — Lat. 69° 17′ N., Long. 52° 14′ W., 25 miles west of Jakobshavn, Disco Bay. July 16th 1908. Depth 430—440 m. Ringtrawl, 150 m wire. "Tjalfe" stat. 124. — 17 specimens, 15—24 mm high.

12) — Jakobshavn. Traustedt 1892. — 1 specimen.

13) — Claushavn, near Jakobshavn, Lat. 69° 08′ N., Long. 51° 09′ W. July 17th 1908. Ringtrawl, 75 m wire. "Tjalfe" stat. 133. — 4 specimens, 14—26 mm high.

14) — Disco Bay, near Egedesminde, Lat. 68° 49′ N., Long. 52° 48′ W. July 11th 1908. Surface. "Tjalfe" stat. 112. — 1 specimen, 19 mm high.

15) — Egedesminde. Bergendal 1890 (2 specimens) and Traustedt 1892 (11 specimens).

16) — Manermiut, Lat. 68° 35′ N. Bergendal. — 1 specimen.

17) — Lat. 65° 35′ N., Long. 54° 25′ W. Moberg. — 1 specimen.

18) — Godthaab Fjord, Lat. 64° 10′ N. June 15th 1908. Ringtrawl, 70 m wire. "Tjalfe" stat. 54. — 22 specimens, 4—15 mm high.

19) — North of Frederikshaab, Lat. 62° 11′ N., Long. 49° 45′ W. July 2nd 1909. Depth 265 m. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 50 specimens.

20) — Lat. 61° 23′ N., Long. 49° 11′ W. July 17th 1909. Depth 75 m. Ringtrawl, 80—100 m wire. "Tjalfe" stat. 539. — 8 specimens, 5—6 mm high.

21) — North of Julianehaab, about Lat. 60° 43′ N., Long. 46° 10′ W. August 4th 1909. Ringtrawl, 350 m wire. "Tjalfe" stat. 583. — 1 specimen, 12 mm high.

22) — Mouth of Bredefjord, about Lat. 60° 40′ N., Long. 46° 10′ W. July 21st 1909. Ringtrawl, 100 and 125 m wire. "Tjalfe" stat. 544. — 4 specimens, 5—9 mm high.

Spitzbergen and Barents Sea:

23) — Green Harbour, Spitzbergen. July 26th 1901. Damas. — 6 specimens, 11—15 mm high.

24) — Same locality. August 29th 1901. Damas. — 2 specimens, 16—17 mm high.

25) — Near Bear Island, Lat. 74° 07′ N., Long. 19° 04′ E. Sept. 4th 1900. Damas. — 12 specimens, 14—24 mm high.

The specimens from loc. 23—25 are in Bergens Museum; I have examined these specimens during a stay at Liége, Belgium, with Professor Damas.

Further Distribution:

West coast of Greenland: Baffin Bay, from Egedesminde to Smith Sound (Ellesmere Island), Lat. 68° 43′—78° N., Long. 54°—77° 10′ W., May, August and September (Aurivillius 1896, p. 193). Umanak Fjord and the Karajak Fjords, from the end of February to September (Vanhöffen 1897, p. 273). The specimens mentioned by Haeckel (1879, p. 13) and Levinsen (1893, p. 143) are in the collections of the Zoological Museum of Copenhagen and are included in the above list of localities. All the material collected by the "Tjalfe" expeditions 1908—1909 was not preserved; some of the records in Kramp (1913, p. 264), therefore, are given on the authority of the journals of the expeditions. A complete list of Greenland localities is published in the Conspectus Faunæ Groenlandicæ (Kramp 1914, p. 400).

Newfoundland: St. Pierre off the south coast of Newfoundland, in October (Bigelow 1909,

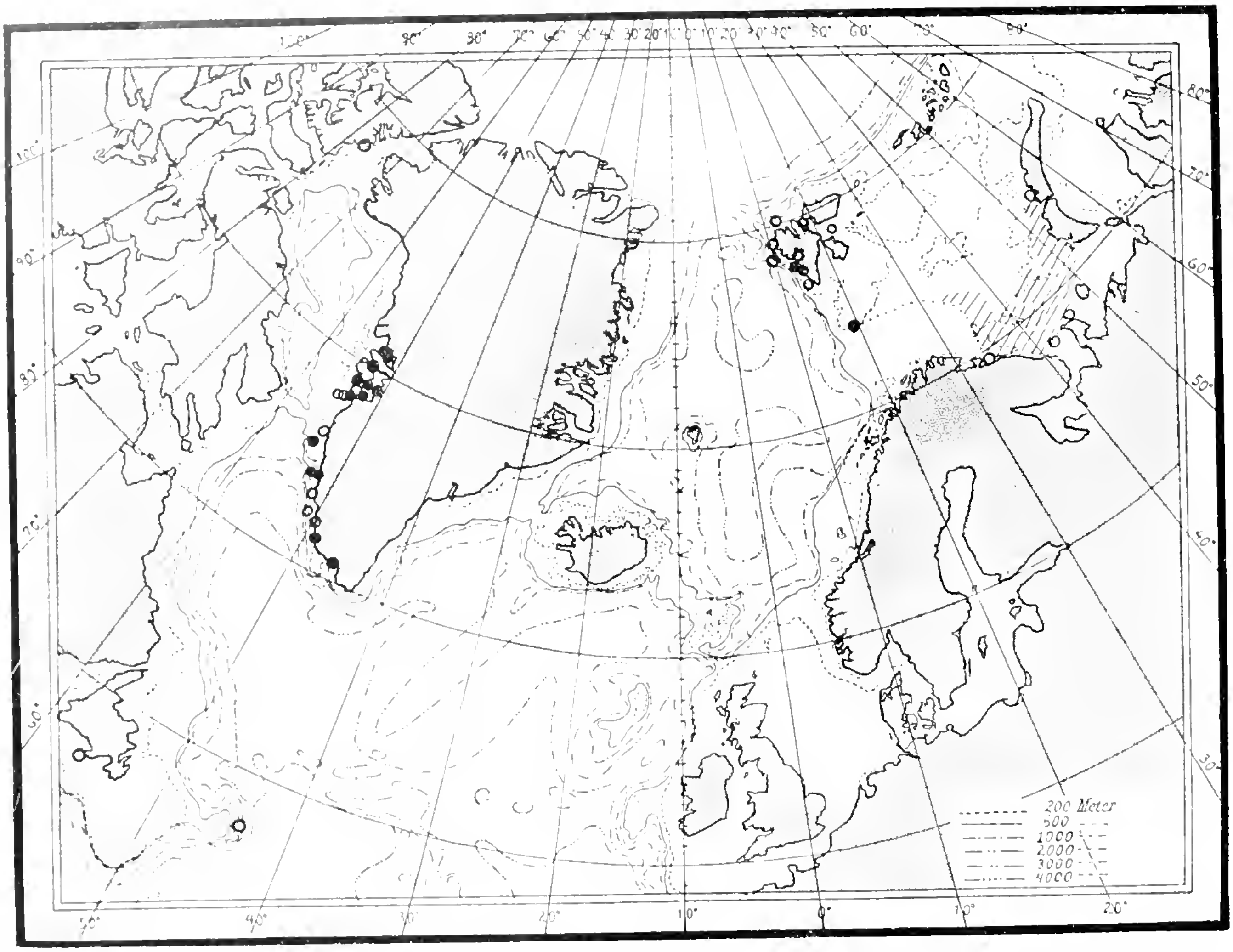

Chart I. ● Finds of *Sarsia princeps* (Haeckel). ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched region the species is commonly occurring.

p. 303). On the eastern slope of the Newfoundland Bank, Lat. 47°34′ N., Long. 43°11′ W. July 11th 1910 (Kramp 1920a, p. 5).

Spitzbergen and Bear Island: in several localities in the coastal area(Grönberg 1898, p.458; Browne 1903, p. 8; Walter 1890, p. 94; Aurivillius 1899, pp. 10, 44, 60; Römer & Schaudinn, 1900, pp. 23, 56; Hartlaub 1907, p. 47).

Barents Sea: Widely distributed, between Long. 33°30′ E. and the west coast of Novaya Zemlya (Linko 1904a, p. 16 and 1904b, p. 212).

Pacific: Arctic Alaska: Collinson Point and Point Barrow, August—October (Bigelow 1920, p. 4). Bering Sea, surface, in August (Bigelow 1913, p. 5).

Sarsia princeps is mainly found in the upper strata, often immediately below the surface of the water. It is a well-marked high-arctic form, abundant at the coasts of Greenland and Spitzbergen and in the Barents Sea; as, moreover, it is found at the north coast of Alaska, it has undoubtedly a circumpolar distribution.

From the Polar Sea it is occasionally carried through the Bering Strait into the Bering Sea; likewise, from the Davis Strait it may drift southwards with the Labrador Current to the coasts of Newfoundland (Bigelow 1909). It is very abundant all along the investigated part of the west coast of Greenland from Julianehaab in the south to Umanakfjord in the north, but its occurrence within this extent is confined to the cold water alongside the coast; it is completely absent in the inflowing, comparatively warm water of Atlantic origin in the Davis Strait. Unfortunately, the distribution in the Baffin Bay, where the Atlantic water plays a far less important part, is very deficiently known; it extends at least into the Smith Sound. There can be no doubt but that the medusa occurs also in the western part of the Davis Strait, off Baffin Land and Labrador, but no material from these areas is available. The cold, southward-moving Labrador Current is mainly running just alongside these coasts, pushing branches towards the shores of Newfoundland and New England. By this current several cold-water species are carried far southwards along the east-coast of North America, but as to *Sarsia princeps* it has not yet been found further south than at the south-coast of Newfoundland. During the "Michael Sars" North-Atlantic expedition 1910 it was demonstrated that a part of the Labrador Current dives below the Gulf Stream water and spreads into the deeper strata of the western basin of the Atlantic Ocean, whither it conveys, among other animals, various arctic species of copepods (Nordgaard). *Sarsia princeps* may likewise follow these water-masses, and this may account for the occurrence of this arctic medusa on the eastern slope of the Newfoundland Bank at the limit of the Labrador Current and the Gulf Stream.

We do not know *Sarsia princeps* from the east coast of Greenland. Very little is however done in the way of pelagical investigations off this inhospitable shore.

Around Spitzbergen and the Bear Island *Sarsia princeps* is very abundant within the coastal areas. There can be no doubt that it is indigenous here; it seems rather strange, therefore, when Römer & Schaudinn (1900, p. 23) relate about a three days' stay in the Horn Sound: "Der Golfstrom hatte eine Fülle pelagischer Organismen in diese Sackgasse hineingetrieben, die . . . gut erhalten blieben", and mention as characteristic examples the medusæ "*Catablema campanula, Codonium princeps, Hippocrene superciliaris*". It can hardly be the opinion of the authors that the said medusæ are Gulf-Stream forms, but rather that in pressing hard towards the coast, the Gulf Stream has pushed parts of the coastal water, together with the associate organisms, into the gulfs and inlets, where, accordingly, these organisms accumulate in particularly great numbers.

The distribution in the Barents Sea likewise proves the arctic habit of the medusa; it is the most abundant in the eastern parts of the area, but rare at the Murman Coast; on that coast it has not been found further west than the Kola Bay; further distribution towards the west is evidently retained by the Gulf Stream.

Seasonal Occurrence:

Concerning the occurrence of *Sarsia princeps* in the Umanakfjord (with adjacent inlets) in northern Greenland, Vanhöffen states (1897, p. 273) that young individuals first appear in February; still as late as in July young specimens may be observed, but full-grown specimens are abundant at the surface in July and August; about the middle of September the species altogether disappears from the plankton. — The part of our Greenland material, which is provided with information of the date of capture, originates from the months of June, July and August. The height of bell in the smallest and in the largest specimens in each month is as follows (in alcohol):

June	4—15 mm
July	5—26 mm
Aug.	11—29 mm

Though the material is not representative, consisting of specimens picked out more or less at random, still the figures clearly demonstrate that medusæ are liberated from the unknown hydroid polyp during a fairly long period; this is evident, because full-grown specimens may occur at least as early as in July, whereas, on the other side, young individuals may be found as late as in August.

The material at my disposal from Spitzbergen and the Bear Island is too small to give reliable results concerning the matter; I shall, however, present the measures:

Green Harbour,	July 26th	11—15 mm
— —	Aug. 29th	16—17 mm
Bear Island,	Sept. 4th	14—24 mm

According to the literature the species has been observed at Spitzbergen from May to August. — As to the occurrence in the Barents Sea, Linko (1904a, p. 16) states the remarkable fact that *Sarsia princeps* and a number of other arctic medusæ occur near the shore off the western parts of the Murman Coast during the winter, from November to February or somewhat later, and, further, that they seem to breed here, numerous young specimens being found together with less numbers of adult individuals. This is not very peculiar as far as the holoplanktonic species are concerned (*Aglantha digitale* and *Aeginopsis laurentii*), but Anthomedusæ and Leptomedusæ might not be expected to occur in arctic regions all through the winter; one would rather suppose these species to pass the winter in the hydroid polyp stage.

Sarsia tubulosa (M. Sars).

Plate I, figs. 5—7. Textfigs. 6—10. Chart II.

Oceania tubulosa M. Sars 1835. Beskrivelser og Iagttagelser etc. p. 25. Pl. 5, figs. 11 a—g.

Within the "*tubulosa*-group" (*sensu* Hartlaub) an extensive series of species, closely related to *Sarsia tubulosa* (Sars), have been described. In the "Nordisches Plankton" Hartlaub (1907) has made an attempt to unravel the northern species, without, however, to attain a final result. I have never willingly believed in these many species, because my examination of material from Denmark, Norway, the Faeroe Islands, Iceland, and West-Greenland demonstrated that each of the features which, according to Hartlaub, constitute the characteristics of the various species (*tubulosa, mirabilis, pulchella, decipiens, densa, litorea,* "*blue Sarsia*") might occur in material from very different localities and in every possible combination. In 1923, in the spring, I took part in a cruise with the S. S. "Dana" in the Danish waters; this cruise afforded me an opportunity of observing an extensive material of *Sarsia* alive. I then discovered that the Danish waters are inhabited by three forms differing very much from one another, as far as the colours are concerned.

Widely distributed in the Kattegat and the Belt Sea I found the "blue *Sarsia*", *i. e.* a form in which the manubrium and the tentacles bear an intense and pure sky-blue colour without intermixture of any other colours, especially without a tinge of green. This sky-blue colour was remarkably constant in all individuals found inside the Skaw.

This form was wanting in the North Sea, where, on the other hand, I found a great number of *Sarsia*, in which the colour of the manubrium and the tentacular bulbs was, as a rule, brown or yellowish-brown, though emerald-green in some individuals; between these two extremes every shade might be found, passing through olive-green and olive-brown.

Also in the North Sea, but mainly in areas not inhabited by the brown or green *Sarsia*, I found a third form, the manubrium of which was colourless or with a faint yellowish or greenish hue; but the apical chamber and the tentacular bulbs were brilliant scarlet.

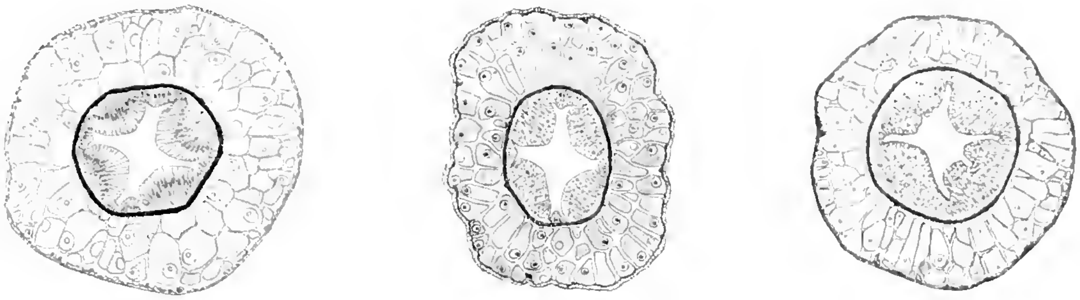
Fig. 6. Fig. 7. Fig. 8.

Figs. 6–8. *Sarsia tubulosa*. Transversal sections of manubrium — Fig. 6. Specimen of "brown Sarsia" from the North Sea Fig. 7. Specimen from Greenland ("Tjalfe" stat 510) — Fig. 8. Specimen of "blue Sarsia" from the Kattegat

I preserved a large number of individuals of these differently coloured forms of *Sarsia*, keeping each particular colour apart in order, later on, to look for morphological characteristics possibly corresponding to the differences of colour.

In observing the living individuals one will realise a certain difference of appearance between the three forms in regard to the shape of the bell, thickness of the bell-wall, length and thickness of the manubrium, size of the tentacular bulbs, etc. But these relative features are difficult to define precisely in words, and they become so entirely altered by preservation, that they cannot possibly be used as a means to separate the three forms with any degree of certainty however slight. A careful examination of the exterior of the various organs and a minute comparison of the three forms yield no more reliable holds for separation. I can state nothing beyond the somewhat vague sentiment: that the general shape is somewhat more solid and plump in the "brown" *Sarsia* than in the two others; that the "blue" *Sarsia* is in every regard the more delicate and slender; finally, that in the "scarlet" form the proximal part of the manubrium free of gonads seems to be comparatively long.

As regards the size of the individuals, most of the "brown" *Sarsia* were 12–13 mm high, a few reaching a height of 14 mm; the "blue" and the "scarlet" specimens were, as a rule, somewhat smaller, but a good number of individuals of these two forms attained 13 mm bell-size.

Afterwards I tried, whether microtome sections might possibly disclose any characteristic differences of the inner structures. As a matter of fact, I was confident, at first, that I had found certain characteristic features in this regard, *viz.* considering the endodermal epithelium of the manubrium (textfigs. 6–13).

I must admit, however, that having examined a considerable material from other geographical regions, I cannot apply a decisive importance to these differences; in any case, they do not suffice as a means of a specific separation of the forms in question. — I shall commence with a description of the endoderm of the "brown" *Sarsia* (see the textfigs. 6 and 9). The endodermal epithelium of the manubrium is a columnar epithelium, consisting of long, narrow cells, visibly reaching from the supporting lamella to the gastric cavity; the cells are particularly narrowed at their base, where they are partly separated by interstitial cells. The epithelium is divided into 4 or 8 longitudinal ridges (4 broad interradial and 4 very narrow perradial) traversing very regularly the entire gonadial part of the manubrium, the cavity of which is, thereby, emphatically cross-shaped. The longitudinal ridges are interrupted by a number of sharp but usually not very deep transversal folds; this transversal folding is, however, highly dependent on the state of contraction of the manubrium (see textfig. 11). — In the "blue" *Sarsia* (textfigs. 8, 10, and 12) as well as in the "scarlet" form (textfig. 13) the gastral cavity is likewise cross-shaped in section, divided by 4 interradial ridges, but the latter are very irregularly shaped and very deeply and densely transversally folded; special perradial ridges cannot be distinguished. The epithelial cells are apparently very small, nearly cubical; they possess, however, a very narrow, nearly filiform basal part connected with the supporting lamella; within each of the transversal folds the filiform parts of the cells are collected in the middle, forming something like a connective tissue.

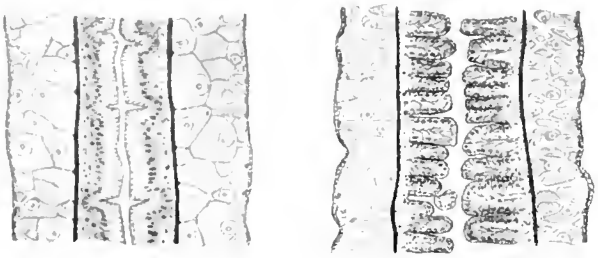

Fig. 9. Fig. 10.

Figs. 9–10. *Sarsia tubulosa.* Longitudinal sections of manubrium. Fig. 9. Specimen of "brown Sarsia" from the North Sea. Fig. 10. Specimen of "blue Sarsia" from the Kattegat.

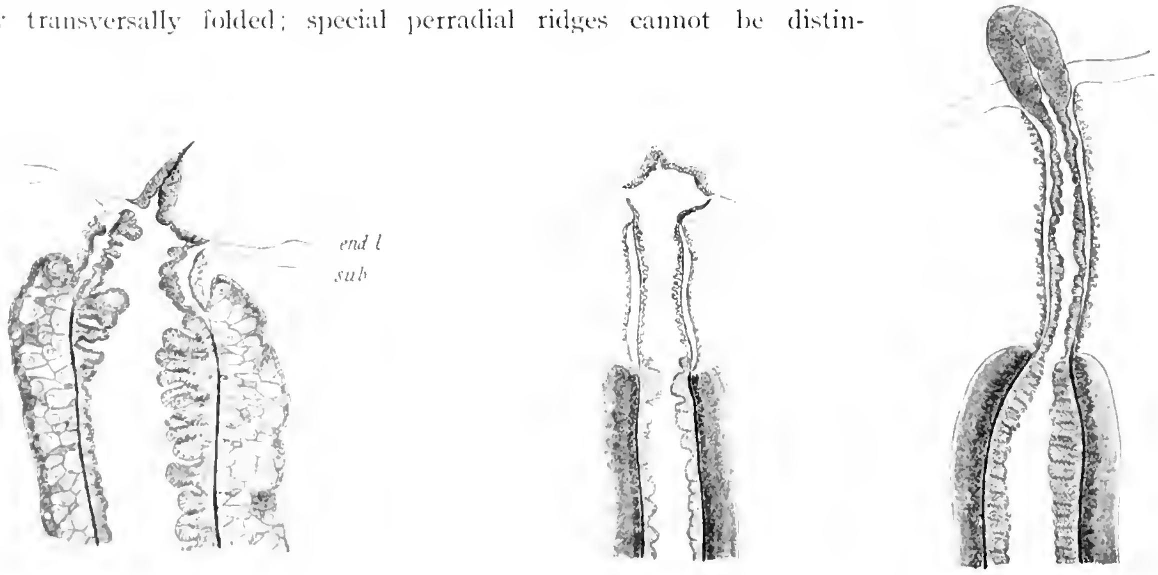

Fig. 11. Fig. 12. Fig. 13.

Figs. 11–13. *Sarsia tubulosa.* Longitudinal sections of apical chamber and proximal part of manubrium. Fig. 11. Specimen of "brown Sarsia" (a green specimen) from the North Sea; on the left hand side the section has passed near the point of issue of a radial canal; *end. l* endoderm lamella; *sub* subumbrella. Fig. 12. Specimen of "blue Sarsia" from the Kattegat; observe the spacious cavity of the apical chamber. Fig. 13. Specimen of "scarlet Sarsia" from the North Sea; observe the long proximal part free of gonads, and the solid mass of endoderm in the apical chamber.

Though, accordingly, the ground-plane of the structure of the epithelium is about the same as that in the "brown" *Sarsia*, nevertheless the shape of the cells brings about another general picture of the epithelium. Probably this difference of structure stands in correlation to the greater power of extension of the manubrium in the "scarlet" and (especially) in the "blue" *Sarsia* in contradistinction to the "brown" form.

This characteristic is not, however, a good means of practical distinction between the forms in question, because it is somewhat circumstantial to cut sections in order to identify the animals, and the state of preservation of the specimens is also to be taken into consideration. In a sample, in which the well preserved specimens may be referred to the type of the "brown" *Sarsia*, the badly preserved specimens may show a structure highly resembling that which I have described as characteristic for the two other forms. This distorted picture is probably due to shrinkage and a commencing dissolution of the cells. On the other hand, shrinkage and dissolution cannot be responsible for the picture found in the Danish specimens of the "blue" and the "scarlet" *Sarsia*, because the specimens examined were very carefully preserved.

The "scarlet" *Sarsia* exhibits still another structure, to which we may probably apply some significance: sections demonstrate that the densely pigmented apical chamber (textfig. 13) is nearly filled up with a solid mass of endoderm, whereas the apical chamber in the "brown" and the "blue" *Sarsia* contains a well-marked, frequently very spacious cavity lined with a well-defined onelayered epithelium.

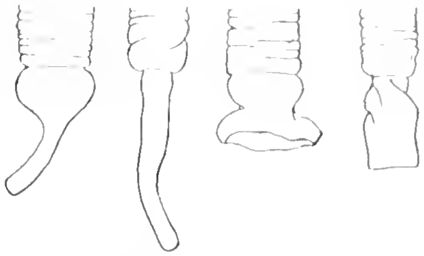

Fig. 14. *Sarsia tubulosa*. Four different states of contraction of the stomach. Specimens from one single locality at the west coast of Greenland, "Tjalfe" stat. 519.

According to the above, I am of opinion that three different forms of "*Sarsia tubulosa*" may be distinguished in the Danish waters. On the other hand, the various inner structures, just described, do not seem to me to justify a specifical separation of the three forms, and, as stated above, the external features are all of a relative character and are highly variable.

The next question relates to the identity of the three forms with the various forms described by Hartlaub, and to the mutual relation and geographical distribution of the latter.

It is probable that the "scarlet" *Sarsia* is identical with "*Sarsia densa*" Hartlaub. The colour and the comparatively long proximal part of the manubrium free of gonads imply this suggestion. *Sarsia densa* was described from Heligoland; the other localities, mentioned by Hartlaub, are very uncertain.

I have not the slightest doubt but that the "brown" *Sarsia* is identical with the large brown or green *Sarsia*, which abounds at the west coast of Norway in spring and summer, and it is most probably the form, described by M. Sars from Florö, *i. e.* the typical *Sarsia tubulosa sensu strictu*. In order to study the problem of the different species of *Sarsia*, Hartlaub paid a visit to Florö and the Shetland Islands, whence he mentions the "blue" *Sarsia*. He describes, however, the colour as greenish-grey, yellow-green, green, or green-blue, thus quite other colours than the purely sky-blue found in the *Sarsia* from the Baltic and the Kattegat, which Hartlaub has never seen alive himself.

As to the colour of the Baltic *Sarsia*, Hartlaub quotes a series of most peculiar and incompatible statements from various German authors, the correctness of which statements I do not, of course, venture to deny. I myself have never seen a *Sarsia* from inside the Skaw having any other colour than sky-blue.

We shall now proceed to an examination of every single organ of the medusa and their variations, searching eventually existing differences in material from different geographical regions.

The shape of the bell and the thickness of the bell wall vary according to the state of contraction, and the mode and degree of variation seems to be identical in the several forms of the group.

Textfig. 14 presents a selection of different states of contraction of the stomach, drawn from individuals derived from one single Greenland locality. As a matter of course, when in possession of such power of transformation, the stomach cannot be supposed to express specifical differences.

The length of the manubrium and the relative length of the proximal part free of gonads, are so highly dependent on the state of contraction, that exact comparative measuring is a hopeless undertaking, at least when a very large material in uniform state of contraction is not at hand. We must satisfy ourselves with the indefinite statement that as a rule the manubrium is longer in the "blue" and the "scarlet" *Sarsia* from the Danish waters than in specimens of *Sarsia* from Norway, the Faeroe Islands, or Greenland. Among the latter, however, preserved specimens may be found, the manubrium of which attains a length of as much as 7 times the height of the bell cavity. In a somewhat similar state of contraction the part of the manubrium free of gonads is not any longer in the "blue" *Sarsia* than in the Atlantic forms, whereas in the "scarlet" *Sarsia* it is usually comparatively long.

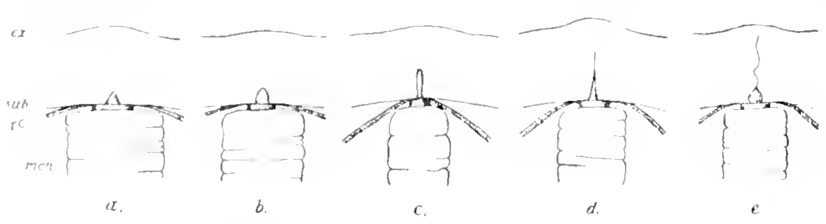

Fig. 15. *Sarsia tubulosa.* Variation of apical chamber. Specimens from one single Greenland locality, "Tjalfe" stat. 510. — *a.* low-conical; *b.* dome-shaped; *c.* tenon-like; *d.* high-conical with apical canal; *e.* spherical with apical canal. — All these forms may be found with or without apical canal. — *ex.* exumbrella; *man.* manubrium; *r. c.* radial canal; *sub.* subumbrella.

Apical canal may be present or absent in individuals from any geographical area and without any correlation to the size of the specimens. The presence of an apical canal is by no means more frequent in Greenland specimens than in others, though the *Sarsia*, occurring off the west coast of Greenland, may certainly be considered identical with the North-American "*Sarsia mirabilis*", in which the presence of an apical canal is said to be particularly frequent.

The shape of the apical chamber is subject to a high degree of variability. It is sometimes very much flattened or almost quite wanting. When a well-marked apical chamber is present, the following typical forms may be distinguished (textfig. 15): conical (low or high), dome-shaped (short, with parallel sides, rounded at the top), tenon-like (long, narrow, with parallel sides, rounded or square-cut at the top), spherical, and egg-shaped. All of these forms may occur with or without an apical canal. I have carried out an enumeration of the frequency per cent. of these forms of apical chamber in preserved material from West-Greenland, Iceland (6 specimens only), the Faeroe Islands, and Norway, as well as in "brown", "blue", and "scarlet" *Sarsia* from Denmark (table I). It will be observed that all of the 6 typical forms may be found in material from any locality, but in highly varying proportions. There can be no doubt, however, but that these different types of apical chambers are merely the outcome of as many different states of contraction. Proceeding from the cone-shape as the fundamental shape, table II gives an idea, how the other types may be supposed to arise from the latter by circular constriction or longitudinal contraction. This is not merely an imaginary suggestion, as will appear from a comparison between the figures in table I representing the percentage of the different types in well preserved and somewhat badly preserved (*i. e.* more contracted) material of "brown" and "blue" *Sarsia* from Denmark. In both forms it will be observed that the contraction diminishes the frequency of the conical form, whereas the frequency of the spherical and egg-shaped apical chambers is greatly increased. The dome-shaped and tenon-like types are transitional forms; in the material of "brown" *Sarsia* examined the frequency of these two types is not essentially changed; in the "blue" *Sarsia* from the Kattegat the higher contraction in the badly preserved specimens has resulted in an increase of the number of dome-shaped apical chambers, whereas the tenon-like type is very much reduced in number, proportionally to the increase of the egg-shaped type. The fundamental shape of the apical chamber is apparently somewhat higher in the "blue" than in the "brown" *Sarsia*; accordingly, in the "blue" the contraction will preferably first produce the tenon-like type (remember that the "well" preserved material is also somewhat contracted), thereafter the egg-shape. The accidentality of the figures will, besides, be seen from the Norwegian material also containing a large number of specimens with tenon-like apical chamber, which is undoubtedly a result of the accidental state of preservation of the individuals.

Table I. *Sarsia tubulosa.*

Percentage of the different forms of apical chamber in material from different localities

locality		Greenland	Iceland	Faeroe Islands	Norway	Denmark				
						brown		blue		scarlet
preservation						good	bad	good	bad	
shape of apical chamber	flattened	14	67	20	20	7	5	7	5	4
	conical	34	17	8	6	37	22	26	19	17
	dome-shaped	8.5	..	..	2	20	16	16	24	30
	spherical	10	..	40	26	6	19	2	14	30
	tenon-like	25	17	20	37	20	22	45	9	9
	egg-shaped	8.5	..	12	9	10	16	4	20	9
number of specimens examined		117	6	25	87	86	37	55	21	23

Table II. *Sarsia tubulosa.*

Form of apical chamber in relation to state of contraction

fundamental shape	even constriction	special basal constriction	dorso-ventral contraction
low conical	dome-shaped	spherical	flattened
high conical	tenon-like	egg-shaped	low conical

As thus every possible type of apical chamber may occur in any one of the examined forms of *Sarsia*, and as the relative frequency of the various types is dependent on the accidental state of contraction, we may conclude that the shape of the apical chamber has no specific value.

The **radial canals** (textfig. 16) are a little narrower and more thinwalled in the "blue" *Sarsia* than in the other forms (including the "scarlet" *Sarsia*).

The tentacular bulbs (Plate I, figs. 5—7) are somewhat varying in regard to the development of the nettle-ring, the protrusion of the ocellus etc. In spite of a thorough and careful comparative examination I have been unable to detect any characteristic difference of shape in the tentacles and tentacular bulbs in *Sarsia* from various localities or belonging to different varieties of colour, with the only exception that the bulbs are usually somewhat smaller (narrower and shorter) in the "blue" *Sarsia* than in the others.

Size of the individuals: Hartlaub states as maximal height of the bell in the forms mentioned by him: *tubulosa* Sars 13 mm; blue *Sarsia* from the Baltic 10 mm; *densa* 10 mm; *litorea* 15 mm; *pulchella* Forbes 8 mm; *mirabilis* 14 mm. — In the material examined by me the maximal sizes are as follows: individuals from West-Greenland 14 mm, Iceland 14 mm, the Faeroe Islands 17 mm, Norway 18 mm, Denmark: "brown" *Sarsia* 14 mm, "scarlet" *Sarsia* 13 mm, "blue" *Sarsia* 13 mm. The "blue" *Sarsia* is, however, usually somewhat smaller, individuals more than 10 mm high being rarely met with. Probably the "scarlet" *Sarsia* is also generally somewhat smaller than the maximal size stated above, 13 mm. On the other hand, 13—14 mm bell-height is quite commonly found in *Sarsia* from Norway, the Faeroe Islands, and Greenland.

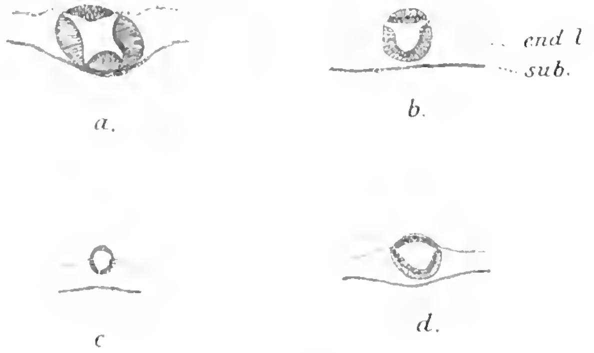

Fig. 16. *Sarsia tubulosa.* Transversal sections of radial canals. — *a.* Specimen from the Faeroe Islands ("Ingolf" stat. 1), section of middle part of the canal, × 50. *b.* Specimen from Greenland ("Tjalfe" stat. 510), distal part of the canal, × 65. — *c.* "blue Sarsia" from the Kattegat, distal part of the canal, × 65. — *d.* "brown Sarsia" from the North Sea, proximal part of the canal × 65. — *end. l.* endoderm lamella of umbrella; *sub.* subumbrella.

The investigations, mentioned above, lead to the following conclusions: The typical *Sarsia tubulosa* is the form occurring at the west coast of Norway, a large form with a greenish or brownish coloured manubrium. The material, examined by me, from the Faeroe Islands, Iceland, and West-Greenland does not in any regard deviate from the Norwegian type. The "blue" *Sarsia* in the Kattegat and the Baltic is a somewhat smaller and more delicate variety of *Sarsia tubulosa*, characterized by the greater power of extension of the manubrium, the somewhat smaller tentacular bulbs, and, above all, by the purely sky-blue colour of the manubrium and the tentacular bulbs; its deviation from the typical form is, however, so slight, that it does not by far justify a specifical separation. — The "scarlet" *Sarsia* in the North Sea is probably identical with *Sarsia densa* Hartlaub, and it is possible that the comparatively long proximal part of the manubrium, free of gonads, may characterize it as a separate species which is, however, closely related to *Sarsia tubulosa*.

Finally, I shall make a short inspection of the various Hartlaubian "species" of *Sarsia*, belonging to the *tubulosa*-group in the more restricted sense.

"*Blaue Sarsia*" is mentioned by Hartlaub from several localities, among others from the west coast of Norway and from the Shetland Islands. As mentioned above, the blue colour in the specimens observed by Hartlaub seems to be another than the pure sky-blue in the Baltic *Sarsia*. I have examined an extensive material of *Sarsia tubulosa* from various parts of the west coast of Norway (mentioned in Kramp & Damas 1925), and I did not find a single specimen which was not a typical *tubulosa*; in any case, none might recall the Baltic *Sarsia*. The material, which was collected by Damas, was frequently provided with notes referring to the colour of the living specimens; as colours, most frequently occurring, were mentioned: green, greenish-brown, and yellowish-brown, whereas blue colours were never recorded. On the other hand, Hartlaub quotes a series of records from various German authors concerning the colours of *Sarsia* from the Baltic, colours which, though more or less bluish, seem to differ from the only colour which I have observed myself in living specimens.

Sarsia densa Hartlaub. As mentioned above, I find it very likely that this form may be maintained as a distinct species, so far as the material from Heligoland, described by Hartlaub, is concerned, on the other hand, I consider the many other records as very doubtful.

Sarsia pattersoni Haddon from Ireland appears, from the description, to correspond very exactly with the "scarlet" *Sarsia* found by me in the North Sea, so much so, that they must be considered identical. As, on the other hand, my "scarlet" *Sarsia* is, probably, also identical with *Sarsia densa* Hartlaub, it seems probable that the latter must likewise be referred to *S. pattersoni*.

Sarsia decipiens (Dujardin) is only known from aquaria (Bretagne and Heligoland); apparently the medusa does not differ in any regard from the typical *Sarsia tubulosa*, whereas the hydroid polyp seems to be a little different from *Coryne sarsii* (and *mirabilis*); as, however, the hydroid polyp has not been found under natural conditions, we had perhaps better not lay too much stress on this slight difference.

Sarsia litorea Hartlaub (south-eastern part of the North Sea) is in no respect, neither in shape nor in size, different from the Norwegian *Sarsia tubulosa*.

Sarsia pulchella Forbes is a doubtful species; according to Forbes's description it may in certain regards, especially in colour, remind one of *Sarsia densa* Hartlaub as well as of my "scarlet" *Sarsia* from the North Sea; the relative length of the proximal part of the manubrium, free of gonads, does not appear from the description.

Sarsia mirabilis L. Agassiz. There can hardly be any doubt but that the common *Sarsia* at the west coast of Greenland is identical with *Sarsia mirabilis* L. Ag. Having accomplished the examinations of Greenland *Sarsia* mentioned above, I consider myself justified in stating that *Sarsia mirabilis* is in every respect similar to *Sarsia tubulosa*. Neither do the corresponding hydroid polyps yield any certain support for a specific distinction.

I do not venture to say that the problem of the limitation of the species of *Sarsia* has been solved through the investigations mentioned above. There is still a good deal to be elucidated, and an examination of living material from all parts of the area of distribution of the *tubulosa*-group seems to be needed, before a final result can be gained. I mean to be able to state, however, that the species *Sarsia tubulosa* is distributed all over the North-Atlantic coastal regions, that there exists a number of local varieties of the species, and that, possibly, within limited areas we may recognise a few other distinct species, as *densa* (*pattersoni?*) and perhaps *decipiens*, though also these forms are so closely related to *S. tubulosa*, that they may possibly be regarded merely as local varieties.

Material (see Chart II).

Greenland:

1) — Lat. 67° 22′ N., Long. 56° 14′ W., "Store Hellefiskebanke". July 7th 1908. Ringtrawl, 0—100 m wire. "Tjalfe" stat. 105 b. — 2 specimens, 6—7 mm high.

2) — Lat. 63° 30′ N., Long. 54° 25′ W. About 100 miles W. S. W. of Godthaab. June 26th 1895. "Ingolf" Exped. stat. 25. — 2 specimens.

3) North of Frederikshaab. July 2nd 1909. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 23 specimens, 3—13 mm high.

4) Frederikshaab. July 8th 1909. Ringtrawl, surface. "Tjalfe" stat. 519. — Numerous specimens, 8—14 mm high.

Iceland:

5) Bordeyri. Steineke. — 2 specimens.

6) Isafjord. Mariboe 1865. — 2 specimens.

7) Isafjord. June 6th 1895. "Ingolf" Exped. — 1 specimen, 5 mm high.

8) — Patreksfjord. June 22nd—23rd 1904. "Thor" stat. 159 (04). — 1 specimen, 11 mm high.

9) — Stykkisholm. June 18th 1897. H. Jonsson. — 1 specimen, 10 mm high.

10) — Lat. 64° 06′ N., Long. 23° 14′ W. Faxebugt, West-Iceland. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 2 specimens, 12—14 mm high.

11) — Reykjavik. August 6th 1895. "Ingolf" Exped. — 1 specimen, 2½ mm high.

Faeroe Islands:

12) Faeroe Islands, without further details. Steenstrup 1844. — 2 specimens, 8 mm high.

13) Lat. 62° 30′ N., Long. 8° 21′ W. North-west of the Faeroe Islands. May 11th 1895. "Ingolf" Exped. stat. 1. — 49 specimens, 6—13 mm high.

14) Fuglefjeld. May 10th 1902. "Diana", A. Ditlevsen. — 1 specimen, 8 mm high.

15) Sörvaag. May 13th 1902. Surface. "Diana", A. Ditlevsen. — 3 specimens, 2—8 mm high.

16) Vestman Sound. May 5th 1899. Th. Mortensen. — 4 specimens, 3½—10 mm high.

17) Thorshavn. May 26th 1901. Surface. R. Horring. — 5 specimens, 10—17 mm high.

18) Thorshavn. August 31st 1903. Otterström. — 2 specimens, 2—4 mm high.

19) Between Suderö and Great Dimon. June 7th 1899. Th. Mortensen. — 2 specimens, 4—7 mm high.

20) Trangisvaag. August 17th 1895. "Ingolf" Exped. — 1 specimen, 4 mm high.

21) Trangisvaag. August 15th 1896. "Ingolf" Exped. — 17 specimens, 3½—7 mm high.

West of Scotland:

22) Lat. 57° 36′ N., Long. 7° 05′ W. Little Minch. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 1 specimen, 4½ mm high.

Norway:

23) Bergen. July 6th 1911. Th. Mortensen. — 1 specimen, 4½ mm high.

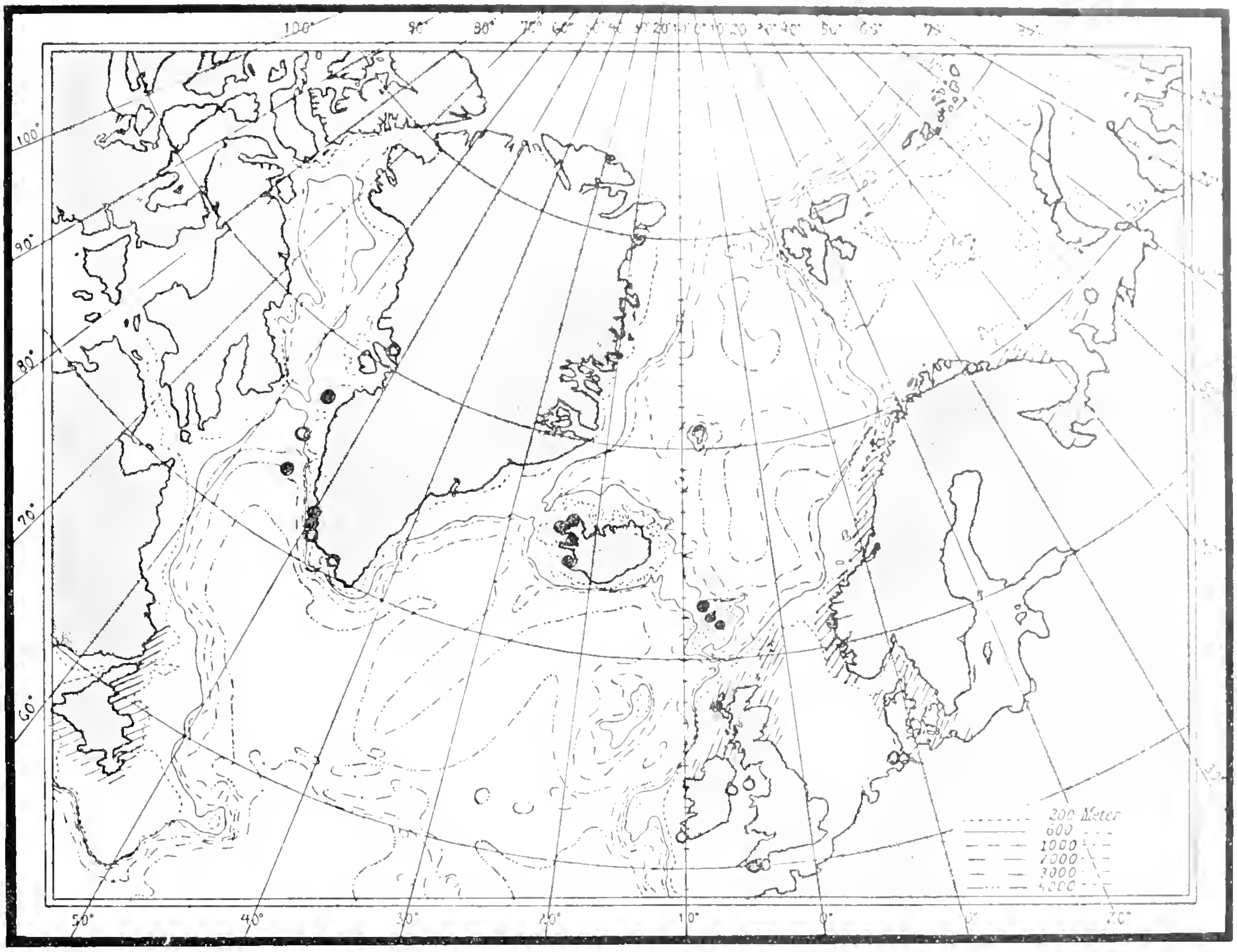

Chart II. ● Finds of *Sarsia tubulosa* (M. Sars). ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched regions the species is commonly occurring.

Geographical distribution and seasonal occurrence:

In the "Nordisches Plankton", Hartlaub (1907 and 1917) has given some detailed and, I think, very complete lists of the localities where the various forms of *Sarsia tubulosa* and related species have been found. Though I do not agree with Hartlaub as far as the limitation of the species and varieties is concerned, still I may refer to his lists for details of occurrence, and restrict myself to give the following summary record of the distribution of *Sarsia tubulosa* in a wider sense.

At the west coast of Greenland the medusa occurs from June to August, sometimes in great abundance. Off the southern part of the coast it is found in the neighbourhood of the shore and in the fjords; on the other hand, all the localities North of Lat. 63° N., hitherto known, are situated far from land, where the temperature of the water is comparatively high. The medusa is not found with certainty north of Lat. 67°22′ N. (on "Store Hellefiskebanke", off Holstensborg), but Vanhöffen (1897) has found the hydroid in Little Karajak Fjord and reared the medusa.

At the east coast of North America the species is common in the coastal area from Labrador to the southern part of the New England coast. It is mainly found in the early spring (March—May), but it may be met with later in the summer.

At the coasts of Iceland the medusa has only been found at the comparatively mild west coast, never at the north coast and the still colder east coast. The time of occurrence is the summer, June—August.

Sarsia tubulosa is very common at the Faeroe Islands (May—August), at the Shetland Islands, and at the coasts of the northern parts of Great Britain (east and west coast of Scotland, north coast of Ireland, from March or April to June or July, sometimes also in August). In more southerly localities it becomes rarer. It has been found at the south-western coast of Ireland from February to August, though the time of occurrence has been much varying in different years (Browne 1900, p. 712). In the Channel it is observed now and then in April—June, rarely also in August.

From the west coast of France we only know "*Sarsia decipiens*", found in an aquarium in Lorient, south coast of Brittany.

In the eastern part of the North Sea *Sarsia tubulosa* is somewhat rare. The forms *Sarsia densa*, *decipiens*, and *litorea* are known from Heligoland (Hartlaub 1907). In the spring of 1923 I found the typical *Sarsia tubulosa* in great abundance off the west coast of Jutland, where this form is usually rare.

In the eastern part of the Skagerrak, in the Kattegat, and in the western part of the Baltic the "blue" *Sarsia* is very abundant. It appears in February or March, is particularly numerous in April and May, and disappears mostly in June; single specimens may, however, sometimes be found as late as in July or even in August.

Sarsia tubulosa is very numerous at the west coast of Norway as far northwards as Lofoten. It appears in March, is the most frequent in May, and usually disappears in July. Single specimens may occasionally be found in August and September. The medusa occurs mainly in the fjords, being rare in the open sea (Kramp & Damas 1925).

At the Murman Coast and in the White Sea *Sarsia tubulosa* occurs in summer, generally fairly scarce, but in certain years it may appear in great quantities.

Finally, the medusa is very common at the northern part of the west coast of North America.

Summary.

These records present a picture of *Sarsia tubulosa* as a well-marked neritic medusa, mainly occurring in the coastal areas of the boreal regions. In Europe it has its maximal occurrence around Scotland and the Faeroe Islands and at the west coast of Norway, whence it decreases in number towards the north as well as towards the south. In several places it penetrates into arctic regions, but in these regions it mainly occurs in such parts where the water has a comparatively high temperature, and then only in the warmest summer months. In the boreal and temperate regions it is a well-marked vernal form, which appears in February or March, is the most frequent in April or May, and afterwards gradually disappears from the plankton. The records at hand clearly demonstrate that the farther we pass towards the north, the more the time of occurrence of this medusa is delayed.

Genus Euphysa Forbes.

Euphysa flammea ((Hartlaub, in litteris) Linko)

Plate I, figs. 12—14; Chart III.

partim *Codonium princeps* Levinsen 1893. Meduser etc., Grönlands Vestkyst. — Vid. Medd. naturh. Foren. Kbhvn. 1893, p. 143.

partim *Sarsia brachygaster* Grönberg 1898. Die Hydroid-Medusen des arktischen Gebiets. — Zool. Jahrb. Abt. Syst. Bd. XI, p. 454 and 459—460.

Tiara sp. Maas 1904. Méduses etc. — Rés. des camp. scient., Prince de Monaco. Fasc. XXVIII, p. 13; pl. II, fig. 11.

Sarsia flammea Linko 1904b. Zoolog. Studien im Barents-Meere. — Zool. Anzeiger, Bd. 28, p. 212.

— — Hartlaub 1907. Nordisches Plankton, p. 12, textfigs. 4—6.

Cytæis sp. Kramp 1913. Medusæ, "Tjalfe" Exped. — Vid. Medd. Dansk naturh. Foren. Bd. 65, p. 267.

Sarsia brachygaster Kramp 1914. Conspectus Faunæ Groenlandicæ. — Meddel. om Grønland, Bd. 23, p. 405.

— *flammea* Bigelow 1920. Rep. Canadian Arctic Exped. 1913—18, p. 4; Pl. II, fig. 5.

— — Kramp & Damas 1925. Les Méduses de la Norvège. — Vid. Medd. Dansk naturh. Foren. Bd. 80, p. 244, textfigs. 1—3.

History[1].

In 1902 (Zool. Anzeiger, Bd. 25, p. 162) Linko presented a preliminary description of this arctic medusa, without, however, providing it with a specific name; he considered it belonging to the family of the *Tiaridæ*, being related to the genus *Protiara*, on account of the gonads being, as he believed, divided into four interradial parts by four narrow perradial lines.

Informed by Hartlaub, in a letter, that the same species was going to be described in the "Nordisches Plankton" under the name of *Sarsia flammea*, Linko adopted that name in his subsequent paper on zoological studies in the Barents Sea (Linko 1904b, p. 212). Contrary to Hartlaub's statement that the gonads form a complete ring encircling the manubrium, Linko maintains, however, that they are divided in the perradii. How this difference of opinion might arise, is discussed in Kramp & Damas (1925). The four translucent perradial lines, clearly visible in the manubrium, are due to the structure of the endoderm, whereas the gonad is continuous and ring-shaped as in other *Codonidæ*.

Hartlaub's new description of "*Sarsia flammea*" was published in the "Nordisches Plankton" in 1907. I have no objections to that description, but a number af important additions will be found in the following pages. — Hartlaub's list of synonyms requires some critical remarks. Among the synonyms we find "*Sarsia eximia*, Haeckel 1879 in parte", and on the next page (p. 13) Hartlaub makes out, why he has included that name in the list: "... dass auch die grönländischen, von Haeckel als *S. eximia* erwähnten Exemplare des Kopenhagener Museums, zu meiner neuen Art gehören, sowie die von Levinsen und Aurivillius auf Haeckels Autorität hin so benannten grönländischen Exemplare". To this statement I shall remark that no record of *Sarsia eximia* from Greenland or any other arctic locality is mentioned by Haeckel;

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[1] The reasons, why I remove this species from the genus *Sarsia* and refer it to *Euphysa*, will be mentioned below.

accordingly, though *Sarsia eximia* in Haeckel is a heterogeneous compound of species, it does not include *S. flammea*. Moreover, Levinsen (1893) does not record *Sarsia eximia* from Greenland on the authority of Haeckel: two Greenland medusæ, collected in 1890, were identified by Levinsen as *Sarsia eximia*, and on the authority of Levinsen that species was recorded as belonging to the Greenland fauna by Aurivillius (1896, p. 198) and by Grönberg (1898, p. 454). The next question is, whether these two Greenland specimens belong to "*Sarsia flammea*" as supposed by Hartlaub. I am able to state that they neither belong to *S. eximia* nor *flammea* but most probably are young specimens of *S. tubulosa*. — In Hartlaub's list of synonyms "*Sarsia eximia*" is likewise put alongside the name of Linko, which may be due to a misprint.

It is beyond doubt that the medusa, described and figured by Maas (1904) as "*Tiara* sp." is identical with *Euphysa flammea*.

Bigelow (1913, p. 3—4, and 1920, p. 4—5) is inclined to think that *Sarsia japonica* Maas is identical with "*Sarsia flammea*". This seems uncertain, and I prefer, therefore, to leave that question open for the present, as does Bigelow himself.

On the other hand, having examined the collections of the Zoological Museum of Copenhagen, I am able to state that the individual from Jakobshavn, West Greenland, identified by Grönberg (1898) as *Sarsia brachygaster* (though with due reservation), does in reality belong to *Euphysa flammea*. The specimen is mentioned in Levinsen (1893, p. 143) as *Codonium princeps*.

Morphological and systematical remarks.

In Kramp & Damas (1925, pp. 244—246) are mentioned some morphological peculiarities of this species. Among others, the textfigures 2 and 3 present a transversal section of the male manubrium, demonstrating the four interradial longitudinal ridges and the cross-shaped section of the gastral cavity. In this regard a sexual dimorphism seems to exist, inasmuch as a transversal section of a female manubrium exhibits exactly the same picture, as far as the endoderm is concerned, as that figured by Linko (1902): the interradial ridges of the endodermal epithelium are very broad in the male, but in the female they are narrow at their base and separated by very broad interspaces. In contradistinction to Linko, however, I am unable to distinguish any prolongation from the supporting lamella penetrating into the endodermal ridges.

In transversal sections of the male as well as the female manubrium I have observed a structure, which has been overlooked by Linko as also by later authors: four powerful, though narrow, perradial muscular bands, placed, as other longitudinal muscles in the Coelenterata, in the ectoderm close to the supporting lamella. I have not found such particular perradial bands in any species of *Sarsia*. But examining a number of other *Codonidæ* I found exactly the same structure in *Euphysa aurata* Forbes and *Euphysa tentaculata* Linko (as to their presence in modified state of development in *Steenstrupia nutans* and *Hybocodon prolifer*, see below). Now, as a matter of fact, there are several other features separating the "*Sarsia flammea*" of Linko and Hartlaub from the species of *Sarsia*, and, at the same time, recalling the genus *Euphysa*. It is most probable, therefore, that the presence of these muscular bands is a matter of considerable systematical importance. At any rate, I am convinced that "*Sarsia flammea*" is not a *Sarsia* at all.

Among such features shall be mentioned: 1) The lack of ocelli. 2) The nematocyst-ring of the tentacular bulbs is complete, uninterrupted on the abaxial side, without specially developed lateral pads as we find them in *Sarsia*; the bulbs (Plate I, figs. 13—14) are broad at their base, gradually tapering outwards. 3) The very large eggs in the female manubrium; most of the eggs remain in a juvenile stage of development, and a comparatively small number of large mature eggs stand out as rounded prominences on the surface of the gonad, giving to the latter a hunched appearance. 4) The successive development of the tentacles. In full-grown specimens the four tentacles are equally developed, but quite young specimens have only one tentacle (a "*Steenstrupia*" or "*Euphysa*" stage). During the growth of the medusa the three other tentacles develop one by one, so that we may find stages with two, three, or four tentacles of different sizes, until at last, in the final stage, they all attain full size (see Kramp & Damas 1925). — Through *Euphysa tentaculata* (which when fully developed possesses three tentacles, one large and two smaller ones) the present species is so closely connected with the well known *Euphysa aurata* that we shall have to unite them within one and the same genus.

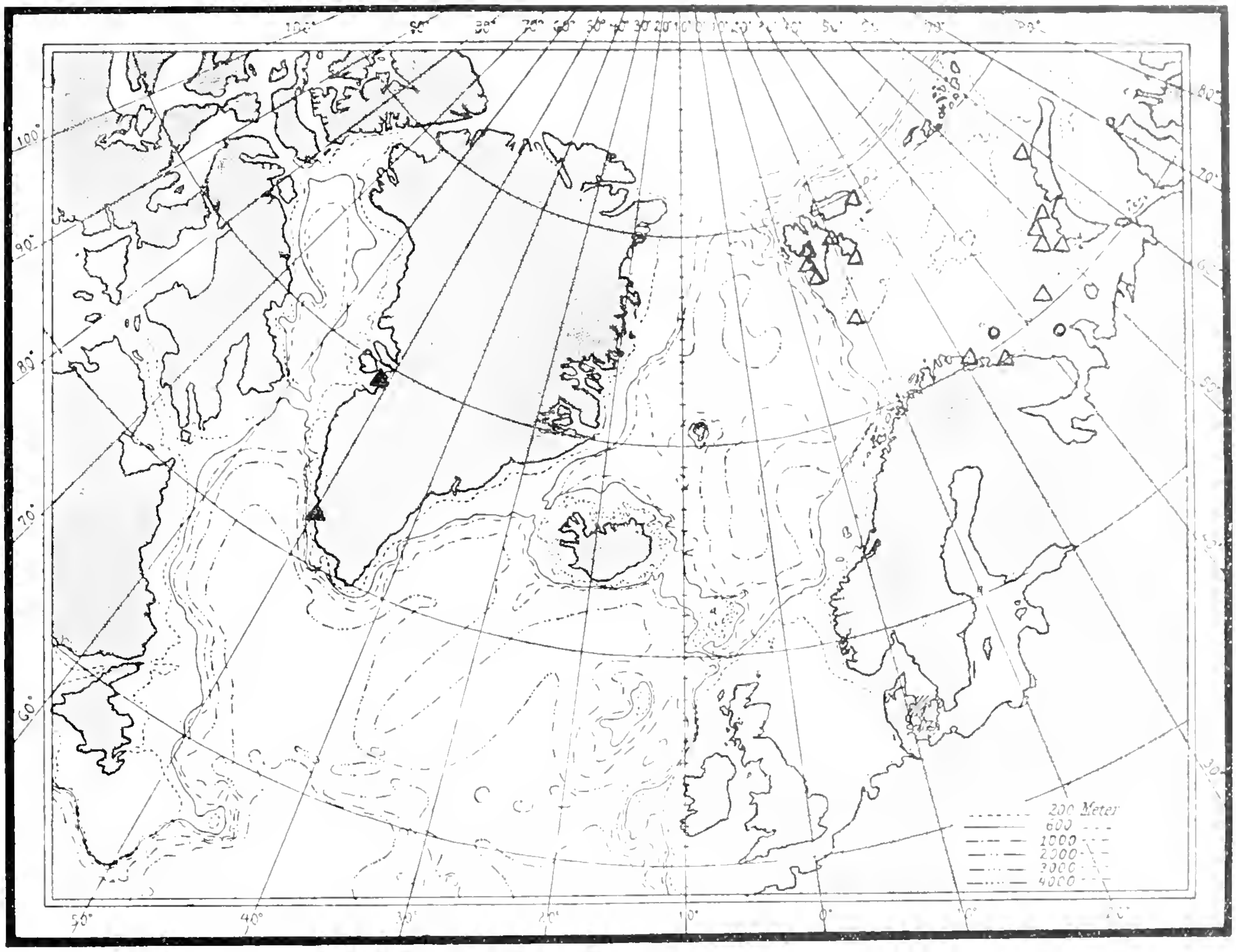

Chart III ▲ Finds of *Euphysa flammea* (Linko). Occurrence according to the literature.
○ and hatching: Occurrence of *Euphysa tentaculata* Linko

Material (see Chart III).

West coast of Greenland:

1) — Jakobshavn. Bergendal 1890. — 1 specimen, $4^1/_2$ mm high.

2) — Frederikshaab. July 2nd 1909. Depth 265 m. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 8 young specimens, 2–4 mm high.

The specimen from Jakobshavn is the one identified by Grönberg as *Sarsia brachygaster*. Grönberg erroneously records the date of capture as October 20th 1890, which is, in fact, the date when the specimens were handed over to the museum of Copenhagen together with several other animals collected by Mr. Bergendal.

Further Distribution.

Spitzbergen, June—August. — Bear Island, in July (for details, see Hartlaub 1907, p. 13). — Barents Sea, May—August (for details, see the International Plankton Lists for August 1903, August 1904, May and August 1906). — Norway, near Vardo, at the northernmost, arctic part of the Norwegian coast, July 31st 1907, at the surface (Kramp & Damas 1925, p. 244) — (Greenland: the locality Egedesminde, Hartlaub 1907, p. 13, must be excluded from the list of localities). — North coast of Alaska in August and October (Bigelow 1920, p. 4).

The geographical distribution of *Euphysa flammea* falls within the arctic regions, where it occurs in the coastal waters during the summer months. As it has been found at the north coast of Alaska, it may be considered a circumpolar species.

Euphysa tentaculata Linko.

Plate I, fig. 8. Textfigs. 17–20. Chart III.

Euphysa tentaculata Linko 1904b. Zoolog. Studien im Barents-Meere. — Zool. Anzeiger, Bd. 28, p. 214.
Corymorpha Hartlaub 1907. Nordisches Plankton, p. 85.

Linko (1904) has described, but not figured, a small medusa from the Barents Sea, closely related to *Euphysa aurata*, but provided with three tentacles, one long and two shorter ones; he named it *Euphysa tentaculata*. Hartlaub (1907) quotes the description of Linko and, at the same time, suggests that the species may be identical with *Corymorpha pendula*, L. Agassiz, the medusa of which was described by A. Agassiz (1865, p. 102, fig. 324). The two species, however, differ from one another in certain regards, so much so, that I would find it rather premature to unite them into one species.

From various localities in the inner parts of the Danish waters I have observed a number of small medusæ, corresponding so closely to the description of *Euphysa tentaculata* Linko, that I do not hesitate to refer them to that species, which I am now going to describe.

Description (see Plate I, fig. 8).

Bell regular, dome-shaped, $^3/_4$–$^2/_3$ as broad as high, greatest breadth about midway between top and bottom. Gelatinous substance fairly thick, particularly at the apical pole, where it is evenly rounded or just a little cone-shaped.

Fig. 17. *Euphysa tentaculata.* Longitudinal section of entire medusa, passing through the largest tentacle and the opposite rudimentary bulb. For description and explanation of this section, see the text. × 10.

Manubrium broad, cylindrical, about as long as the bell cavity (textfig. 17), broadly attached to the middle of the subumbrella. According to the state of contraction there may be a slight indication of a stomachal peduncle (as in Plate I, fig. 8), or the apical wall of the stomach may be a little arched upwards into the apical jelly (as in textfig. 17). The gonad encircles the manubrium, leaving a short part free at both ends. The mouth opening is simple; it is surrounded by a slightly elevated ectodermal ring containing nematocysts of two different sizes (textfig. 18). In the male, the surface of the gonad is smooth, but in the female it is hunched owing to the large, prominent eggs (Plate I, fig. 8; textfig. 17). In a section through a fully developed female gonad are seen: the oocytes (in the inner part, nearest to the supporting lamella), a large number of degenerative eggs in different stages of decomposition, and a smaller number of large, fully developed or developing eggs with more or less irregular outlines, greedily devouring the neighbouring degenerative eggs, remains of the nuclei of which are often seen in the protoplasm of the large eggs.

The ectodermal musculature of the manubrium is confined to four narrow, perradial, longitudinal bands close to the supporting lamella (textfig. 19). I have not been able to detect any other ectodermal muscular elements in the manubrium. In a cross-section we may count about 20 muscular cells in each band; the muscular cells are partly immersed into the supporting lamella. As to the degree of development of these muscular bands, there is no obvious difference between the two sexes.

Fig. 18. *Euphysa tentaculata.* Longitudinal, interradial section of the mouth tube. — *m.* mouth opening; *n.* nematocysts; *n. bl.* nematoblasts; *s. l.* supporting lamella; *g.* gonad; *st.* stomach. — × 150.

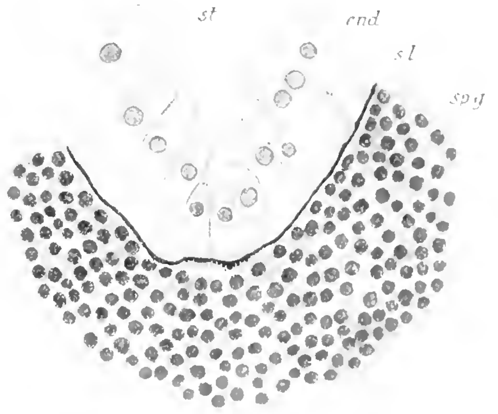

Fig. 19. *Euphysa tentaculata.* Transversal section of perradial part of manubrium of a male individual — *end.* endoderm; *s. l.* supporting lamella; *sp. g.* spermatogonia; *st.* stomach. — Observe the cross-section of the perradial, longitudinal, ectodermal muscular band. — × 100.

The supporting lamella of the manubrium is thin.

The endodermal epithelium of the manubrium is divided into four longitudinal, interradial ridges, transversally folded (texfig. 17) and separated by four deep, perradial grooves. The ridges are best developed in the distal part, the mouth tube. In the endoderm of the mouth tube (textfig. 18) we find a considerable number of nematoblasts with nematocysts in different stages of development, destined for the ectodermal ring of nematocysts. The transversal musculature of the endoderm is weak and seems to be evenly distributed. — The cells in the apical wall of the stomach are fairly large, but not vacuolated in any particular degree.

The four radial canals are straight and very narrow, distally connected by a narrow circular vessel.

The four tentacular bulbs are unequally developed, but all of the same structural type. The largest bulb carries a long tentacle; the opposite bulb is much smaller and has no trace of a tentacle. The two remaining (lateral) bulbs are of intermediate size, each carrying a tentacle about half as long as the large one, and both nearly alike. The bulb consists of an endodermal dilatation included in the jelly above the margin of the umbrella, and a complete ring of somewhat thickened ectoderm containing nematocysts. The endodermal dilatation is dome-shaped or somewhat pear-shaped, placed close to the subumbrella (the jelly on this side being confined to a very thin lamella), but separated from the exumbrella by a wide space of gelatinous substance (shrunk in the figure of the section, textfig. 17, better seen in the total figure, Plate I, fig. 8). The radial canal opens in the adradial side of the bulb, close to the subumbrella; the endodermal epithelium of the bulb is highly developed, particularly so on the abaxial side. — The nematocyst ring is well developed; it lies close to the lower part of the endodermal dilatation on the adaxial and the lateral sides, but on the abaxial side it is prolonged into a hook-like spur, grasping around the margin of the exumbrella; the spur is broad, flattened, tapering outwards. There is a sharp limit between the nematocyst ring and the tentacle. The latter is, in a contracted state, rather stout and rigid (see Plate I, fig. 8); in the proximal part the surface is finely wrinkled, with quite a large number of nematocysts evenly distributed. In the distal part of the tentacle the nematocysts are collected in highly developed rings, completely encircling the tentacle which, moreover, terminates in a spherical knob of nematocysts. — The tentacle is solid (textfig. 20), its interior being filled up with large, vacuolated endodermal cells, irregularly arranged. The tentacle has a strong longitudinal musculature and is capable of extending itself to a very considerable length.

Fig. 20. *Euphysa tentaculata* Transversal section of tentacle, passing through one of the nematocyst rings. Observe the strong longitudinal muscles, seen in cross-section × 225.

Velum well developed. Nerve-ring weak.

Size: In Danish specimens the bell may attain a height of 4—5 mm. The specimens from the Barents Sea, described by Linko, were 5 mm high.

Colour: Specimens, examined about 3 months after being preserved in formalin, have retained a bright, scarlet coloration of the endoderm of the manubrium and the tentacular bulbs.

Development. This species bears a close resemblance to *Euphysa aurata*, and is undoubtedly nearly related to that species. The most characteristic feature of *Euphysa tentaculata* is the possession of three tentacles. When newly liberated from the hydroid, however, the medusa has only one tentacle, like *E. aurata*; it is, however, easily distinguished from corresponding stages of *E. aurata* by the comparatively large size of the lateral tentacular bulbs. I have seen young stages, 0.5 and 0.8 mm high, with only one tentacle. The two lateral tentacles begin their development, when the bell is about 1 mm high. In one specimen, 1.2 mm high, the lateral tentacles are about as long as the corresponding tentacular bulbs, but still smooth and pointed. In another specimen of the same size, the two tentacles are slightly longer, each provided with a well-developed and well-defined terminal knob strongly armoured with nematocysts, and with traces of one ring of nematocysts; in this specimen the large tentacle has 9 definite rings besides the terminal knob. It is worth noticing that the two lateral tentacles in these young individuals are very nearly equally developed.

Geographical distribution and seasonal occurrence. — Outside the Barents Sea (Linko) this species has only been found in the Danish waters, where it is indigenous in the southern Kattegat, the Sound, and the Belt Sea. It occurs from May to July, but has never been observed in any considerable numbers.

Euphysa aurata Forbes.

Plate I, figs. 10—11 Textfigs. 21—22 Chart IV

Euphysa aurata Forbes 1848. Monogr. of British Naked-eyed Medusæ, p. 71; Plate XIII, fig. 3.
Corymorpha aurata Hartlaub 1907. Nordisches Plankton, p. 81; textfigs. 76—78.
Steenstrupia aurata Mayer 1910. Medusae of the World, p. 35.
?*Euphysa virgulata* A. Agassiz 1865. North American Acalephæ, p. 189; figs. 316—319.
?*Euphysa mediterranea* Haeckel (1864 and) 1879. System der Medusen, p. 32.

Bigelow (1914, p. 5) is inclined to identify the North-American species *Steenstrupia virgulata* (A. Agassiz) with the European *Steenstrupia* (*Euphysa*) *aurata*. The latter is, however, a much smaller species, attaining a size of not more than 4.5 mm bell-height, whereas the American species may be as much as 12 mm high. As, moreover, the hydroid of the American form is unknown, it seems to me that we had better keep them apart and, for the present, regard them as distinct species. — It seems probable, on the other hand, that *Euphysa mediterranea* Haeckel may be identical with *Euphysa aurata*.

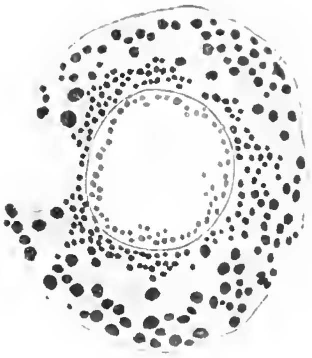

Fig 21 *Euphysa aurata* Transversal section of manubrium of female individual The endoderm is divided into four interradial ridges, separated by deep perradial grooves; outside the latter, in the ectoderm, are seen the four narrow, perradial muscular bands In the inner part of the ectoderm are further seen a great number of oocytes the small black nuclei, in the peripheral part the somewhat larger degenerative eggs and one large, mature egg in the act of devouring one of the degenerative eggs Observe also the very thin ectodermal epithelium of flattened cells Specimen from Hellebæk, Denmark [illegible]

Remarks on the morphology.

The structure of this medusa is well known, as far as the general features of the morphology are concerned. As to the minute anatomical structures, the species is so much like *Euphysa tentaculata* that a detailed description would be nearly accordant with the description of the latter, given above. I shall, therefore, restrict myself to mention a few points in which the two species are differing from one another. — Textfig. 21 presents a cross-section of the manubrium of a female individual. The number of eggs, which attain full development, is usually fairly small; one such large egg is seen in the figure; observe, how the borders of this egg enclose the degenerative eggs, the nuclei of which may, for some time, be seen in the protoplasm of the developing egg, but are gradually absorbed and disappear.

The four perradial, longitudinal muscular bands in the manubrium are still narrower than in *Euphysa tentaculata*; the number of muscle cells seen in a cross-section only amounts to 4 or 6 in each band, alike in both sexes. — In other respects the section, textfig. 21, might as well illustrate the manubrium of *E. tentaculata*. — As in the latter species, also here the mouth is surrounded by a slightly elevated ring containing nematocysts. Accordingly, it is due to a mistake, when Hartlaub (1907), in the diagnoses of the subgenera *Euphysa* and *Steenstrupia* (in contradistinction to *Amalthaea*) points out the lack of oral nematocysts ("ohne orale Nesselarmatur").

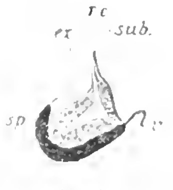

Fig. 22. *Euphysa aurata*. Longitudinal section of rudimentary marginal bulb; observe the purely ectodermal abaxial spur. *ex.* exumbrella; *r. c.* radial canal; *sp.* spur; *sub.* subumbrella; velum. The gelatinous substance is somewhat shrunk. Specimen from the Skaw, Denmark. × 50.

In *Euphysa aurata* more than one tentacle is never developed; the three other bulbs are rudimentary and much smaller than the tentaculiferous bulb; the one opposite the latter is smaller still than the two lateral bulbs. The bulbs have nearly the same shape as in *Euphysa tentaculata* (see textfig. 22), only, as a rule, somewhat broader in the radial direction (Plate I, figs. 10—11).

Material (see Chart IV):

Disco Bay, West-Greenland, Lat. 69° 27′ N., Long. 54° 10′ W. August 16th 1919. Plankton-net, horizontal haul about 100 m below the surface. Temperature of the water 5° C. Porsild. — 1 specimen.

Geographical distribution and seasonal occurrence.

The Hydroid: There is now no reason to doubt, that the *Corymorpha nana* Alder really is the hydroid of *Euphysa aurata* Forbes. The hydroid has been found in the following localities: off the coast of Northumberland, brought on shore by fishermen (Alder 1858, p. 108); Lat. 70° 47′ N., Long. 28° 30′ E., near Tanafjord in the northernmost part of Norway, depth 232 m (Bonnevie 1899, p. 22); Plymouth (Stechow 1912, p. 404).

The Medusa: — "*Steenstrupia mediterranea*" is found at Villefranche and Nice in the Mediterranean (Carus 1884, p. 22); a single time near Trieste in October (Graeffe 1884, p. 354), and at the Dalmatian coast in June and July (*Steenstrupia aurata*, Neppi & Stiasny 1913, p. 30).

The presence of *Euphysa aurata* at the west coast of Greenland is stated for the first time in the present paper.

The southernmost locality in the east-atlantic region, known up to now, is the Scilly Islands (Browne) At Plymouth the species seems to be fairly rare; it has been observed in April—June and in September (*Euphysa aurata*, Plymouth mar. Fauna 1904, p. 191). The International Plankton Catalogues record the medusa several times from the Channel, found in the months of February, May, August, and November, though most frequently in May. — At the south-west coast of Ireland (Valencia Harbour) the species is not common, observed from April to June and, singly, in August, September, and November (Browne 1900, p. 706). — At Port Erin, Isle of Man, Browne has found it from the end of March to the beginning of June (Browne 1895, p. 248). In the International Catalogues it is mentioned from the Irish Sea and the Bristol Channel in May and August, a single year also in February and November. — In the Firth of Clyde the species

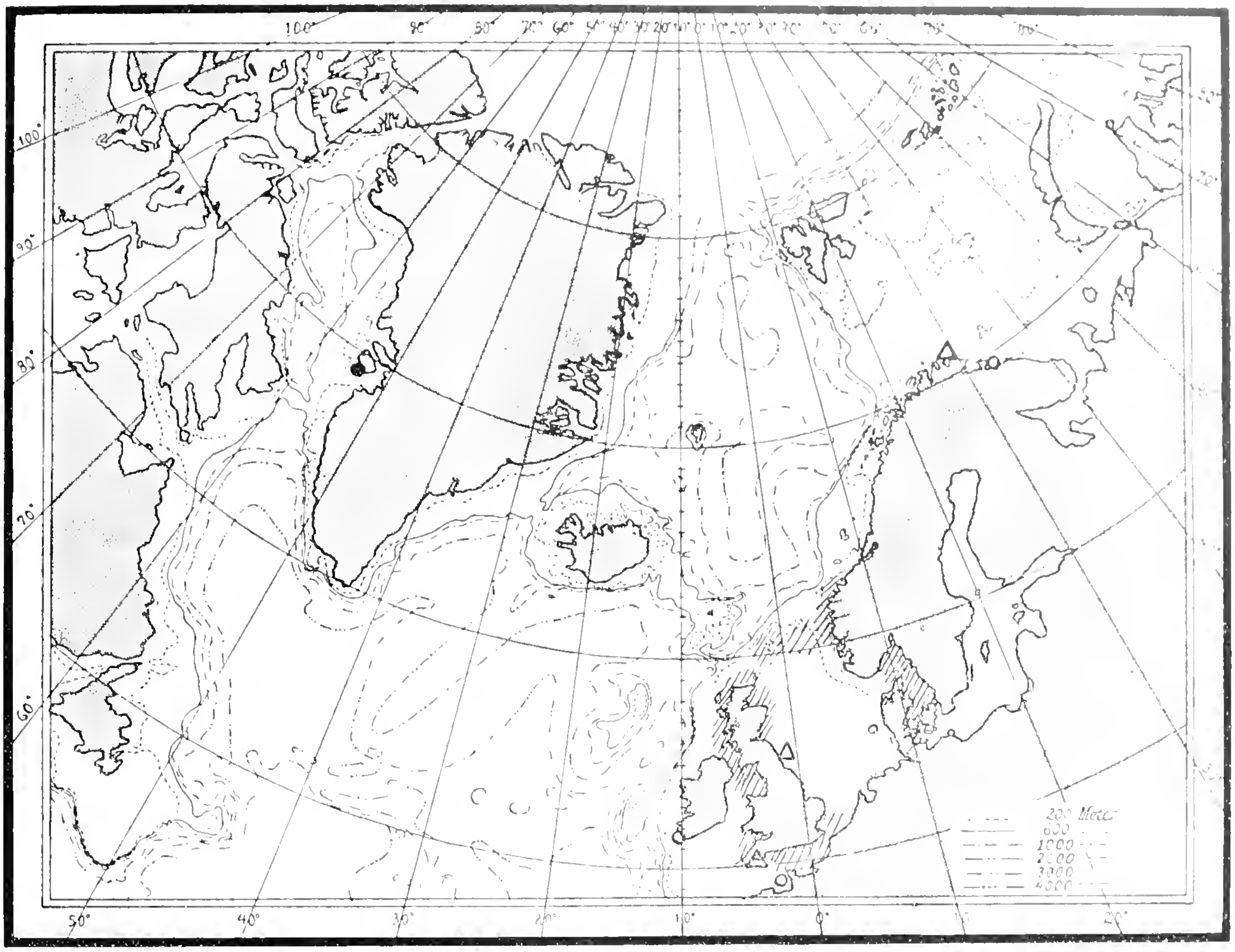

Chart IV. ● Occurrence of *Euphysa aurata* Forbes. ○ Occurrence according to the literature. In the hatched regions the species is commonly occurring. △ Occurrence of the corresponding hydroid polyp, *Corymorpha nana* (Alder).

is more common. It was found in this locality in the autumn of 1864 by Kölliker (1864, p. 233). According to Browne (1905, p. 749) the medusa appears in the Firth of Clyde in May, is fairly abundant in June and July, decreasing in number until October. Young specimens are found until July; later on full-grown specimens prevail; single large specimens may still be met with in November, December, and January. — An individual was found on July 19th 50 miles N.W. of Scotland by the German Plankton Expedition (Maas 1893, p. 67). — At St. Andrews, on the east coast of Scotland, the medusa occurs in great abundance from the end of July to the beginning of September (Crawford 1895, p. 257).

Forbes (1848, p. 71), who was the first to describe this medusa, found it in Brassay Sound in the Shetland Islands. Hartlaub (1907, p. 82) found it at Lerwick in the beginning of July, and Damas noted it from Balta Sound on May 23rd 1906 (Kramp & Damas 1925, p. 247).

West coast of Norway. — From the fjords in the neighbourhood of Bergen the medusa is mentioned by Browne (1903, p. 11) as found in September and November, by Broch (1905, p. 4) as occurring in August. Damas has found it in several localities in the fjords from Bergen to Aalesund in every month between April and November, moreover he found it between the Shetland Islands and the west coast of Norway in June (Kramp & Damas 1925, p. 247). Damas thought that the individuals from the spring and from the autumn belonged to two different species, the bell of the vernal form being somewhat higher and narrower than in the typical *Euphysa aurata*. Subsequent careful examination has demonstrated, however, that no such constant difference is demonstrable.

Euphysa aurata is found at the Murman coast at various seasons of the year (Linko 1904b, p. 214).

The species has not been found with certainty at Heligoland in the North Sea (see Hartlaub 1907, p. 82).

In the Danish waters *Euphysa aurata* is fairly common in summer and autumn. It is indigenous in the Kattegat, whence it is frequently carried into the Belt Sea.

Summary.

The distribution of *Euphysa aurata* at the North-European coasts does not speak in favour of the supposed identity with *Euphysa mediterranea*. Not only are the two areas of distribution completely separated from one another, but within the North-European region the distribution of the species is evidently chiefly northerly; the species is somewhat scarce at the southern parts of the British coasts, but occurs abundantly round Scotland, and the area of distribution extends to the Murman Coast and the west coast of Greenland.

In most regions *Euphysa aurata* may be found at almost every season of the year, in other regions the occurrence is limited to a shorter and more definite period. At the coasts of England and Ireland it has its main occurrence in April—May, decreases in number during June and July, but may be found throughout the autumn until November or even until February. In the Firth of Clyde it seems to have a somewhat later and more definite "season", appearing in May, with maximal occurrence in June—July, but it may still be found in December and January. At the west coast of Norway, again, it occurs from early spring to late autumn. In the Danish waters the occurrence is limited to the summer and autumn; it appears in June or July, culminates in August, and is only occasionally met with as late as in December.

Genus **Steenstrupia** Forbes.

Steenstrupia nutans (M. Sars).

Textfigs 23—28. Chart V.

Corymorpha nutans M. Sars 1835. Beskrivelser og Iagttagelser etc. p. 7; Pl. I, figs. 3 a—g (the hydroid).
Steenstrupia rubra Forbes 1848. Monogr. of British Naked-eyed Medusæ, p. 73; Pl. 13, fig. 1.
flaveola Forbes 1848. ibid., p. 74; Pl. 13, fig. 2.
cranoides + *lineata* + *galanthus* Haeckel 1879. System der Medusen, pp. 30—31.
Corymorpha nutans Hartlaub 1907. Nordisches Plankton, p. 76, figs. 74—75.
Steenstruphia rubra Mayer 1910. Medusæ of the World, p. 31.
gracilis Brooks 1882. Johns Hopkins Univ. Studies from biol. Lab., vol. 2, pp. 136 and 144.

Remarks on the morphology.

An excellent figure of the general appearance of the medusa *Steenstrupia nutans* was given by Hartlaub (1904, p. 105; reproduced in the "Nordisches Plankton", 1907, p. 78, fig. 74). In the paper quoted above (1904) Hartlaub also describes and figures the peculiar structure of the surface of the gelatinous apical projection of the medusa; when contracted, the top of the conical projection becomes covered with "borstenähnlichen Organen". I have found these structures in my sections (textfig. 23); they appear as unicellular ectodermal papillæ, more or less club-shaped, each containing a nucleus and a considerable, only a little vacuolated, amount of protoplasm. This structure is a special development of the ectodermal epithelium, and it is quite probable that sections of better preserved material will reveal nervous elements at the base of these cells. On the whole, the epithelium of the exumbrella is uncommonly strongly developed in this species, the cells being nearly cubical, and traces of unicellular "papillæ" being found in scattered groups anywhere on the surface, though not so conspicuously developed as on the apical projection.


Fig. 23. *Steenstrupia nutans*.[1] Ectodermal unicellular papillæ on the apical projection. × 150.

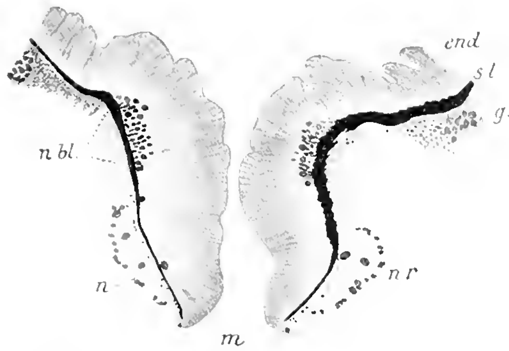

Fig. 24. *Steenstrupia nutans*. Longitudinal section of mouth tube (on the right hand side the section has passed a little awry). — *end.* endoderm; *g.* gonad; *m.* mouth opening; *n.* wandering nematocyst; *n. bl.* nematoblasts; *n. r.* nematocyst ring. × 90.

As in the case of *Euphysa*, Hartlaub states in the diagnosis of the "subgenus" *Steenstrupia* that the mouth lacks an armature of nematocysts. As a matter of fact, the distal part of the mouth tube is encircled by a well-developed, fairly prominent ring of high ectodermal cells, very much vacuolated, and strongly armoured with nematocysts of two different kinds, a large number of small ones and a less number two or three times the size of the first (see textfig. 24). Nematocysts are developing in great numbers in the endoderm of the proximal part of the mouth tube, where they are found in all stages within a well-defined, ring-shaped zone. There is much evidence that the fully developed nematocysts wander from this zone outwards along the inner side of the supporting lamella, turn round the edge of the latter, and thus reach into their final place in the ectoderm.


Fig. 25. *Steenstrupia nutans*. Transversal section of proximal part of female manubrium. Observe the four interradial ridges in the endoderm, the thickened supporting lamella, and the broad perradial muscular bands seen in cross section. The ectoderm contains oocytes, undeveloped eggs and mature eggs. — × 50.

As to the structure of the female gonad (textfigs. 25 and 26), I shall only shortly point out that the undeveloped eggs remain in an amoeboid condition, retaining an angular outline, and do not seem to enter into a state of decomposition until they are included in the large developing eggs; in this regard there is a difference between *Steenstrupia* and *Euphysa*.

As in *Euphysa*, the ectodermal musculature of the manubrium in *Steenstrupia nutans* is divided into four perradial, longitudinal bands, but in the latter species these bands are very broad,

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[1] The sections of *Steenstrupia nutans* are all made from specimens from an unknown locality in the North Atlantic, collected by the "Thor".

about as broad as the intervening, interradial parts (textfigs. 25 and 26). The supporting lamella is fairly thick, particularly so in the broad, perradial parts, where its outer surface is longitudinally cancelled, thus increasing the surface on which the muscular bands are fastened. It would be interesting to know, whether this holds good also for other species of the genus *Steenstrupia* sensu strictu. — The endodermal circular musculature is evenly distributed.

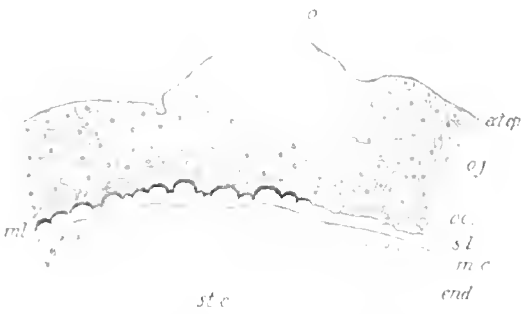

Fig 26. *Steenstrupia nutans.* Transversal section of adradial part of female manubrium, comprising a part of one of the longitudinal muscular bands. *ct. ep.* ectodermal epithelium; *end.* endodermal epithelium; *m. c.* circular muscles in the endoderm; *m. l.* longitudinal muscles in the ectoderm; *o.* mature egg with nucleus; *o. c.* oocytes; *o. j.* undeveloped eggs; *s. l.* supporting lamella; *st. c.* stomachal cavity. — × 150

The structure of the endodermal epithelium of the manubrium is somewhat different in the different parts of the manubrium. In the proximal part (textfig. 25) there are four perradial, highly elevated, narrow, undulating ridges, gradually tapering towards the distal half part, where the ridges are nearly obsolete. In the mouth tube the perradial ridges reappear, but are broad and thick, separated by four narrow grooves. Throughout the manubrium the endodermal epithelium is transversally wrinkled, consisting of cylindrical cells (textfig. 26). — The manubrium is broadly attached to the subumbrella, or rather to the stomachal peduncle; here, in the dorsal (apical) wall the epithelium is formed by low, nearly cubical endodermal cells. — The apical canal is a real canal, altogether open from the beginning to the top, the inner space being lined with an endodermal epithelium of cubical cells.

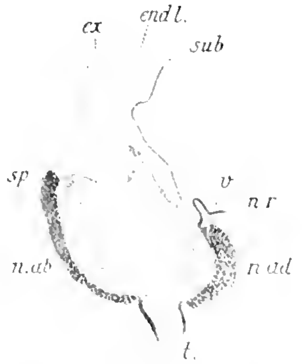

Fig 27. *Steenstrupia nutans.* Longitudinal section of tentaculiferous bulb. Observe the abaxial outgrowth of the endoderm. — *end. l.* endoderm lamella; *ex.* exumbrella; *n. ab.* abaxial part of nematocyst ring; *n. ad.* adaxial part of nematocyst ring; *n. r.* nerve ring; *sp.* abaxial spur; *sub.* subumbrella; *t.* tentacle; *v.* velum — × 38.

Fig. 28. *Steenstrupia nutans.* Longitudinal section of lateral rudimentary bulb. Observe that the endoderm partakes in the formation of the abaxial spur — *end. l.* endoderm lamella; *ex.* exumbrella; *n. r.* nerve ring; *r. c.* radial canal; *sp.* abaxial spur; *sub.* subumbrella; *v.* velum — × 38.

The radial canals are fairly broad (as compared with *Euphysa*), nearly circular in cross-section; the endoderm lamella is fairly strong. Outside each radial canal a strong band of longitudinal muscles is developed in the ectodermal epithelium of the subumbrella (similar bands, but less strong, are found in *Euphysa*).

The tentacular bulbs differ in a characteristic way from those of *Euphysa*, in so far as the hook-like spurs, which clasp the exumbrella side of the bell margin, are formed not merely by the ectoderm of the bulbs, but by the endoderm as well, a hollow abaxial prolongation of the bulb growing outwards and upwards, from the tentaculiferous (textfig. 27) as well as from the three rudimentary bulbs (textfig. 28). This endodermal outgrowth is only separated from the nematocyst-bearing ectoderm of the bulb by a thin supporting lamella, whereas in *Euphysa* the pear-shaped or spherical endodermal part of the bulb is separated from the purely ectodermal spur by a considerable layer of gelatinous substance

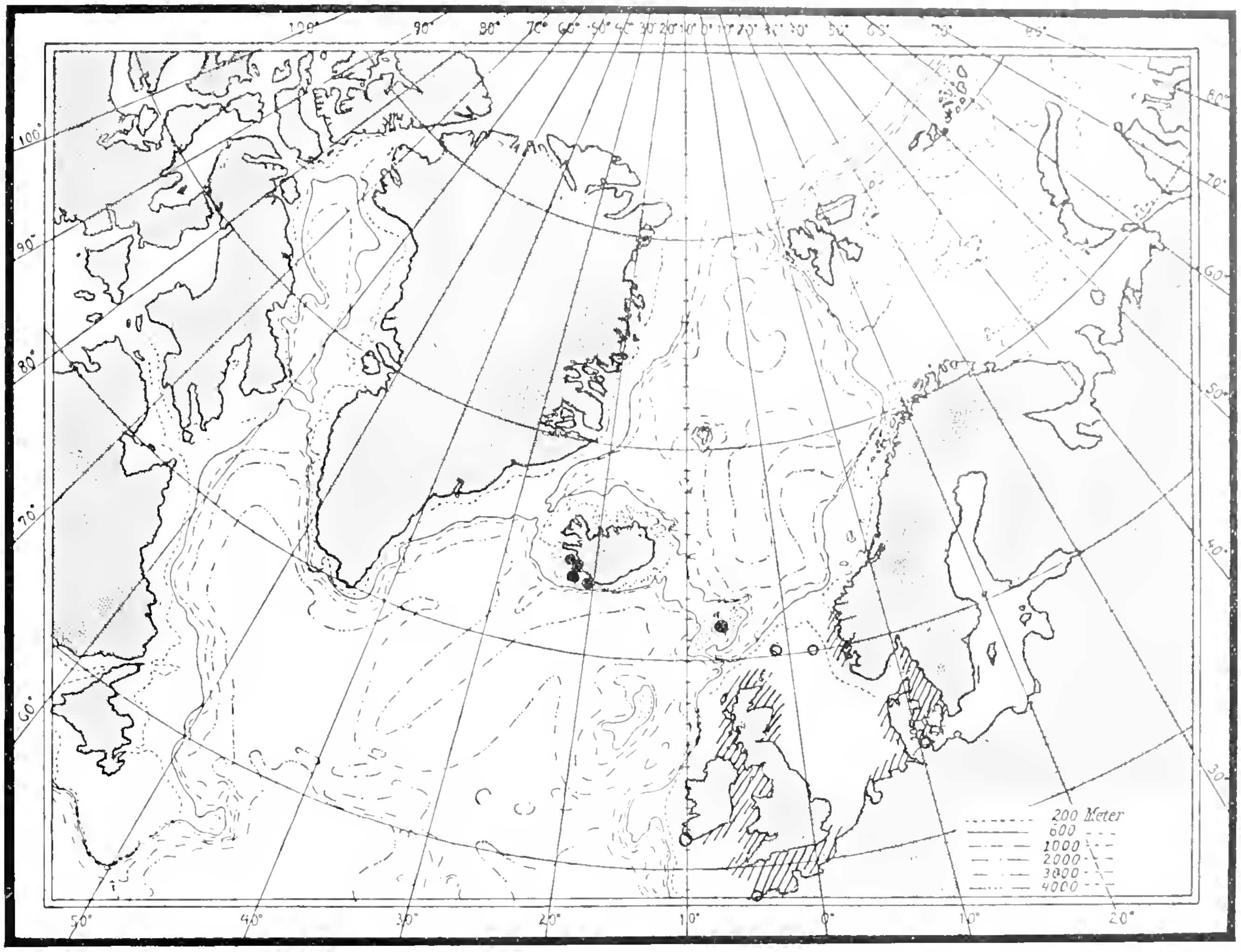

Chart V. ● Finds of *Steenstrupia nutans* (M. Sars) ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched regions the species is commonly occurring.

The nerve-ring below the velum is considerably better developed in *Steenstrupia nutans* than in any of the species of *Euphysa* examined by me.

I have now pointed out a number of features, which seem to me to establish a sound basis for a generic distinction between *Euphysa flammea, tentaculata,* and *aurata* on one side and *Steenstrupia nutans* on the other. Future studies will show, whether this distinction can be maintained, when other species of the group are examined.

Material (see Chart V).

Iceland:

1) — Reykjavik. August 6th 1895. "Ingolf" Exped. — 16 specimens, fairly small.

2) — Lat. 64°06′ N., Long. 23°14′ W. Faxebugt, west coast of Iceland. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 2 specimens.

3) — Lat. 63°45′ N., Long. 22°37′ W. South of Reykjanæs. August 7th 1896. "Ingolf" Exped. 26 specimens.

4) — Lat. 63°30′ N., Long. 21°03′ W. South coast of Iceland. July 15th 1904. "Thor" stat. 189 (04). — 3 specimens, 4—6 mm high.

Faeroe Islands:

5) — Trangisvaag. August 17th 1895. "Ingolf" Exped. — 1 young specimen.

Geographical distribution.

Mayer (1910, p. 31) is of opinion that *Steenstrupia gracilis* Brooks from the Atlantic coast of North America south of Virginia is identical with the European *Steenstrupia nutans*, and Bigelow (1915, p. 316—317) simply records "*Steenstrupia rubra*" among the neritic warm-water species in that area. The supposition may be correct, but further studies are required to confirm it.

"*Steenstrupia cranoides*" Haeckel and "*Steenstrupia lineata*" Leuckart are names for the Mediterranean form, which has been found in several localities at the coasts between Nice and Trieste. A hydroid, which appears to be *Corymorpha nutans*, was found at Naples by Lobianco (1899, p. 458).

Distribution and seasonal occurrence at the North European coasts:

The Hydroid: At the north coast of France Malard (1907, p. 563) found the hydroid in a limited area from April to September, but it was completely absent in the winter half-year. — At the British Islands the hydroid is observed in several localities off nearly all parts of the coasts from the Channel to the Orkney and the Shetland Islands (Forbes & Goodsir 1840, p. 309; Hincks 1868, p. 127; Allman 1871, p. 388, with gonophores in June—September; Duerden 1896, p. 411; Plymouth mar. Fauna 1904, p. 190, with "attached medusæ" in May). — In the south-western part of Iceland (Faxebugt, Bredefjord) the hydroid was found in great abundance by Sæmundsson (1902, p. 52 and 1911, p. 73). — West coast of Norway: Bergen—Lofoten (G. O. Sars 1873, p. 134). — A very peculiar and, I believe, somewhat problematic find of this hydroid near Novaya Zemlya, is mentioned by Jäderholm (1909, p. 42). — Moreover the hydroid has been found in the North Sea, north of Borkum in 20 m' depth (Metzger 1873, p. 176), and small specimens, 10—15 mm high, with only slightly developed gonophores, were found in great abundance 15—16 miles north-west of Heligoland on May 12th by Hartlaub (1894, p. 170). — In the Danish waters inside the Skaw the hydroid is sometimes found in great abundance.

The Medusa:

North coast of France: Roscoff in June (Hartlaub 1907, p. 79); Baie de la Hougue (Billard).

British Isles: Common in the Channel; according to Garstang it is the most common of the Anthomedusæ at Plymouth in May; it appears in April and is common until the middle of June, after which time it disappears (Lebour 1917, p. 161, *St. rubra*). In the International Plankton Catalogues the species is frequently recorded from the Channel in May, sometimes also in August, November, and February. — Ireland: appears at Valencia Harbour at the end of March or the beginning of April, becomes sexually mature in May, decreases rapidly in number during the month of June; single specimens may be met with in July and August (Browne 1900, p. 702, *Corymorpha nutans*). — Irish Sea: Port Erin, observed once in August

(Browne 1895, p. 247, *St. rubra*). — The Plankton Catalogues record the medusa from the Bristol Channel and the waters round Ireland in August, rarely in May and November. — Firth of Clyde: Skelmorlie in autumn (Kölliker 1864, p. 233, *St. rubra*); appears at Millport at the end of May, is the most common in the beginning of June, disappears about the middle of July (Browne 1905, p. 748, *Corymorpha nutans*). — The Shetland Islands: May, July, and August (Forbes 1848, pp. 73 and 74, *St. rubra* and *flaveola*, Hartlaub 1907, p. 78); 2 miles E.S.E. of Balta Sound, May 23rd 1906 (Kramp & Damas 1925, p. 248).

Faeroe Islands: June 1898 (Cleve 1900, p. 97, *St. galanthus*). Trangisvaag in August 1895 (see above, loc. 5).

Iceland: Vestman Islands in July and August (Cleve 1901). South-western coasts, in July and August (see above, loc. 1—4). According to Sæmundsson (1902, p. 52) the medusa occurs in vast swarms near Reykjavik in autumn.

West coast of Norway: Hartlaub (1907, p. 77) has found the medusa in great abundance at Florö (near Bergen) in the middle of July; Damas found it between the Shetland Islands and Norway in June and in the neighbourhood of Aalesund in July (Kramp & Damas 1925, p. 248).

North Sea: At the coast of Holland in August; at Heligoland from the beginning of June to the middle of August, but never abundant (Hartlaub 1894, p. 188; 1897, p. 455; 1907, p. 77; Haeckel 1879).

Danish Seas: Rare off the west coast of Jutland, common in the Kattegat and in the Belt Sea, where also the hydroid may be found in great abundance; the occurrence of the hydroid is, however, rather inconstant: in places, where it is found abundantly one year, it may be sought in vain the next year, and the medusa has a correspondingly irregular occurrence. The medusa generally appears in June and disappears in August or September.

Summary.

The medusa *Steenstrupia nutans* is abundant in the northern as well as in the southern parts of its area of distribution within the North European region. It keeps itself within short distance from the coasts. The seasonal occurrence is evidently earlier in the southern than in the northern regions. At the southern British coasts the medusa appears in March or April and has its main occurrence in May; at the coasts of Scotland it does not appear until May and is the most common in June; at the west coast of Norway it occurs in July, at the south-western coasts of Iceland in July and August.

Genus **Hybocodon** L. Agassiz.

Hybocodon prolifer L. Agassiz.

Plate I, fig. 9. Textfigs. 29—34. Chart VI.

Hybocodon prolifer L. Agassiz 1862. Contrib. Nat. Hist. U. S. — Acalephae. Vol. IV, p. 243. Pl. 25.

— — Haeckel 1879. System der Medusen, p. 33.

Amphicodon fritillaria Haeckel 1879. ibid. p. 36.

— *globosus* Haeckel 1879. ibid. p. 36.

— *amphipleurus* Haeckel 1879. ibid. p. 37. Taf. I, figs. 7—9.

Japetus Steenstrup in his well-known work on the alternation of generations ("Om Forplantning og Udvikling gjennem vexlende Generationsrækker", 1842) stated to have found in the neighbourhood of Reykjavik in Iceland some "coryne-like" animals, which he gave the name of *Coryne fritillaria* (p. 11). The accompanying drawings (Tab. I, figs. 41—42) are small and bad. The description in the text is likewise very deficient; still it serves to prove that the animals have nothing to do with the hydroids nowadays called *Tubularia* and *Hybocodon*. A more detailed description and better figures are given of a medusa, which was found pelagic in the same locality. Steenstrup meant to see a certain likeness between these medusæ and the small bell-shaped organs which he had seen detach themselves from the "*Coryne fritillaria*", and therefore regarded them as further developed stages of these latter. — The correctness of this conception was doubted already by L. Agassiz (1862, p. 244), who gave a thorough description and numerous excellent figures of the hydroid *Hybocodon prolifer* as well as of the corresponding medusa. Agassiz justly found that "The free Medusa of our *Hybocodon*, bears a close resemblance to that of *Coryne fritillaria*, as figured by Steenstrup" (p. 244).

In 1899 (p. 425) Sæmundsson described a hydroid, resembling *Tubularia*, and the medusæ detached from it, which he had found at Reykjavik. On account of the scanty literature concerning these matters in the library of Reykjavik, Sæmundsson regarded this form as a new genus and species, which he called *Auliscus pulcher*. He does not mention the striking likeness between the hydroid and *Hybocodon prolifer* Ag., nor that between the medusa and the one, which Steenstrup considered to be the medusa of "*Coryne fritillaria*". We must agree with Hartlaub that Sæmundsson "ohne es zu wissen, den Ammenpolypen von Steenstrups planktonisch gefangener *Coryne fritillaria*-Meduse entdeckt hat". But when Hartlaub afterwards states (p. 98): "Keinenfalls ist der *Auliscus pulcher*-Hydroid identisch mit dem N. amerikanischen *H. prolifer*-Polypen", I, however, think that this rather categoric statement wants further discussion.

Sæmundsson's description was published in the Danish language, with a short diagnosis in Latin, which may account for Hartlaub not being able to carry out a thorough comparison between the descriptions given by Sæmundsson and Agassiz. In reality, a comparison point by point will show a perfect conformity in every respect except one! Then the question arises, how much importance we must apply to the single point, in which the two forms disagree.

As far as I am aware, no recent description of the American hydroid is at hand; our knowledge of that species is based exclusively on the original description by Agassiz, which is, however, very thorough and satisfactory. On the other hand, the Icelandic "*Auliscus pulcher*" has recently been reexamined by Broch (1916, p. 22), who has made one or two valuable additions to the description as given by Sæmundsson.

In both of the hydroids the polyps issue separately from creeping stolons. The stalk is surrounded by a perisarc-tube, very narrow below, gradually increasing in width towards the top, and terminating in a thin, hyaline "cup" immediately below the hydranth. The tube is smooth, apart from a few growth-rings; these are not mentioned by Agassiz, but are clearly distinguished in his figure (Plate XXV, fig. 1). The height of the polyp is the same in both forms, reaching as much as 5 cm. The hydranths are shaped equally. In *H. pulcher* the number of proximal tentacles is stated to be 24—30; as to the American *H. prolifer* the number is not stated by Agassiz, but according to the figures it must be 25—30. The number of distal tentacles is stated to be 30 in *H. pulcher*, up to 32 in *H. prolifer*. The shape of the medusa-buds and the newly detached medusæ is perfectly alike in both forms. In *H. pulcher*, it is true, the medusa is said to possess 2 tentacles when detached from the hydroid, whereas the newly liberated medusa of *H. prolifer* bears only one; Broch, however, states that the second tentacle in *H. pulcher* belongs, in fact, to a young medusa, budding from the tentacular bulb of the mother-medusa, and not to the latter itself. We find, thus, the most perfect agreement between the two forms, except in regard to the manner, in which the gonophores are attached to the hydranth of the polyp. In this respect there is a difference, to which Hartlaub applies great and decisive importance. In *Hybocodon prolifer* (according to Agassiz) the numerous gonophores issue directly from the body of the hydranth (Plate XXV, fig. 3). Agassiz himself (p. 245) calls attention to this point to distinguish the species from "*Parypha crocea*", in which the gonophores are developed upon long blastostyles. In *Auliscus pulcher*, according to Sæmundsson, they are collected in small clusters; such a cluster is figured in Tab. IV, fig. 7; it contains one well-developed medusa and three small buds. According to Broch, the gonophores are placed upon 8 faintly branched blastostyles. Having reexamined the specimen from Iceland, I can confirm Broch's description in every respect. Provided that the gonophores of the American *Hybocodon prolifer* are really all placed directly on the body of the hydranth as described by Agassiz, there seems, indeed, to exist a characteristic difference between that species and the Icelandic form, found by Sæmundsson, though they agree perfectly in every other respect. If the hydroid of Sæmundsson is a proper species, it must bear the name of *Hybocodon* (or *Tubularia*) *pulcher* Sæmundsson. It is a mistake to apply the specific name of *fritillaria* Steenstrup to this hydroid or to the corresponding medusæ. The name of *fritillaria* was first used by Steenstrup for the hydroid "*Coryne fritillaria*", which was not a Tubulariid, and it cannot be transferred to the medusæ, wrongly considered by Steenstrup to have been derived from that hydroid. — If the common European *Hybocodon*-medusa might prove, in future, to be specifically distinct from the American *H. prolifer* and to be derived from a hydroid identical with *H. pulcher* Sæmundsson, then the European form must likewise bear the specific name of *pulcher*. These questions, however, cannot be solved, until the hydroid has been found at the European coasts. (In his "Addenda" Hartlaub states that Browne has found the hydroid of *Hybocodon* at Plymouth, but no records as to its appearance in this locality are at hand). — The numerous Icelandic specimens of the medusa, examined by me, bear a complete resemblance to the European form, which, likewise, agrees perfectly with the American medusa. — On the other hand, *Hybocodon christinæ* Hartlaub seems to differ from *H. prolifer* in several respects and must, I think, provisionally be regarded as a distinct species (see Hartlaub 1907, p. 102).

Already before the liberation from the hydranth, the medusa of *Hybocodon prolifer* is about to develop medusa buds from the great tentacular bulb, and these buds may be about to develop a new generation of medusæ, before they themselves leave the mother-medusa. Thus, in this species a strong asexual reproduction takes place, so that a small number of hydroids may give origin to a huge stock of medusæ, and the farther this stock is carried away by the currents, the greater becomes the number of individuals. During the first months of the occurrence of the medusæ only this asexual reproduction takes place; later on the gonads begin to develop. In the female medusa only a small number of eggs are developed; these eggs are fertilized while still sitting on the manubrium, and here they develop into actinula larvæ, which are not liberated until two wreaths of tentacles are present. Asexual reproduction may continue some time after sexual reproduction has commenced, but soon ceases. It is unknown, whether the first medusæ, liberated directly from the hydroid, ever reach sexual maturity, or whether this stage is reserved for later generations. Not until 3 or 4 months after the appearance of the first medusæ in the plankton, the first cases of sexual reproduction are observed, but shortly afterwards practically no budding individuals are found. The time at which the sexual reproduction begins, depends on the age of the stock, not on the age of the single individuals.

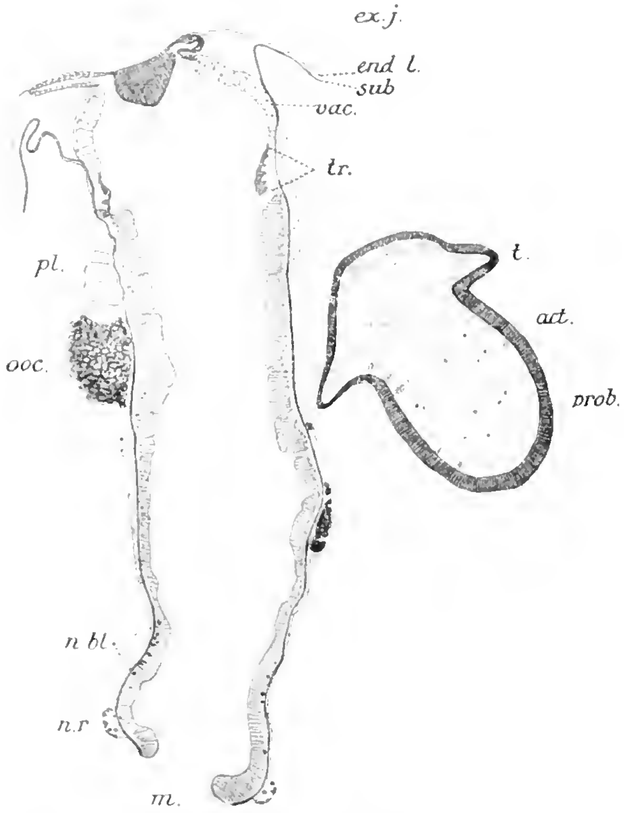

Fig. 29. *Hybocodon prolifer.* Longitudinal section of female manubrium, passing nearly through the perradii. — *end. l.* endoderm lamella of the bell; *ex. j.* exumbrella jelly; *m.* mouth opening; *n. bl.* zone of nematoblasts in the endoderm; *n. r.* nematocyst ring; *ooc.* remains of oocytes not yet devoured by the plasmodial egg; *pl.* lobes of plasmodial egg; *sub.* subumbrella; *tr.* transitional zone of partly vacuolated endodermal cells; *vac.* vacuolated endodermal cells of manubrium ("Chordazellen"). — *act.* young actinula; ectodermal epithelium and supporting lamella fully developed; the latter is very thin in the proximal part; endodermal epithelium developed only in the proximal part and in the developing tentacles (*t.*); small scattered groups of endodermal epithelial cells are besides developing here and there in the proboscis (*prob.*). For the rest the interior of the actinula is filled up by the vacuolated, not yet differentiated endodermal syncytium, several nuclei of which are seen scattered in the vacuolated protoplasm. — In the mother-animal, observe the thickened mesogloea around the basal part of the manubrium, between the endodermal epithelium of the latter and the endoderm lamella of the bell. — Combination of a number of successive serial sections. — Specimen from the Faeroe Islands. × 50.

Remarks on the morphology.

The general shape of this medusa is well-known, and I shall, therefore, be content to put forth some few additional remarks. — The nettle-cell armature of the mouth: At quite a short distance above the mouth opening the lower end of the mouth tube is surrounded by a highly prominent, ring-shaped mound of nematocyst-bearing ectoderm (longitudinal section, textfig. 29); it is compound of several prominent, rounded knobs (see transversal section, textfig. 30), consisting of high, vacuolated cells, hardly containing any protoplasm, but with small, distinct nuclei. These cells are plentifully provided with nematocysts, all of which are of the oval type, but of two different sizes. At a somewhat higher level the endoderm of the mouth tube contains a girdle-shaped accumulation of nematoblasts; from this zone the ectodermal nettle-ring, mentioned above, gets its supply of nematocysts. The endodermal nematoblasts are mainly crowded in the interradial parts of the endodermal epithelium; these parts are greatly developed, forming four broad, prominent ridges, separated by four deep, sharply defined, perradial grooves (see the transversal section, textfig. 31). The longitudinal section (textfig. 29) nearly passes through the perradii, wherefore the endodermal epithelium of the mouth tube has the appearance of being rather low and containing but a small number of nematoblasts. The interradial longitudinal ridges are faintly developed or quite obliterate within the gonadial part of the manubrium (transversal section, textfig. 32), but they are again very distinct in the proximal part, free of gonads, where they are shaped like narrow ribs, separated by broad interspaces. — It is a well-known fact that the endoderm of the proximal part of the manubrium consists of large, vesicular cells nearly destitute of protoplasm ("chorda cells"); but there is no sharp limit between the latter and the ordinary epithelial cells of the middle part of the manubrium; the lowermost "chorda cells" still contain some remains of protoplasm, as seen in the longitudinal section (textfig. 29). The dorsal epithelium of the stomach is shaped like a highly prominent plug composed of very high and narrow cells containing a great amount of protoplasm. The mode in which the manubrium is attached to the subumbrella is peculiar: In the uppermost part of the manubrium the vesicular endoderm is separated from the thin ectodermal epithelium by a considerable layer of gelatinous substance (see the longitudinal section, textfig. 29), accordingly the upper end of the manubrium is surrounded by a gelatinous ring with flaring sides. This structure is not only seen in sections (as in fig. 29), but also very distinctly by direct observation of the uninjured medusa; and it is not only observed in badly preserved material, but in individuals in excellent state of preservation as well.

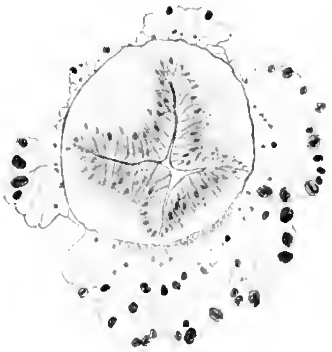

Fig. 30.

Fig. 31.

Figs. 30—31. *Hybocodon prolifer.* Transversal sections of mouth tube. — Fig. 30. Section passing (a little awry) through the ectodermal ring of nematocysts. — Fig. 31. Section through the zone of nematoblasts in the endoderm. *n.* nematocyst in the ectoderm. — Specimen from Nyborg, Denmark. — × 180.

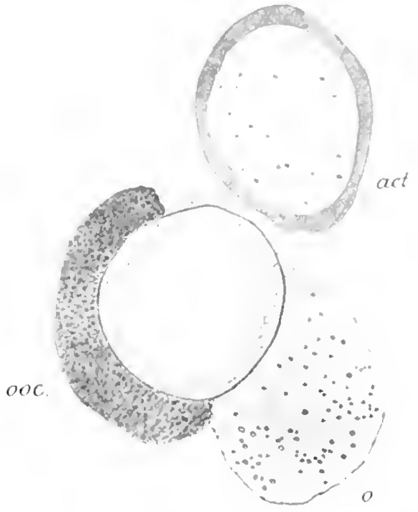

Fig 32 *Hybocodon prolifer.* Transversal section of female manubrium, middle part. The stomach is dilatated by a copepod; this is left out in the figure, but the outlines of its body are clearly reproduced in the contour of the endodermal epithelium of the medusa — *ooc.* oocytes. — *o.* large syncytial egg, which has withdrawn its marginal lappets and become nearly spherical; the egg is still surrounded by the ectodermal epithelium of the manubrium; no trace of cell-formation; very fine blebs are uniformly distributed in the plasma; the egg has apparently ceased devouring its neighbours. — *act.* young actinula, still without traces of tentacles; ectodermal epithelium completely developed; supporting lamella complete, though extremely thin at the proximal end; the endoderm begins to differentiate, but no epithelial cells are yet formed; in the middle of the body is seen a small rest of yolk. Specimen from the Faeroe Islands. — × 50.

Plate I, fig. 9 represents a well preserved specimen seen from below. The figure clearly shows, how the endodermal lamella of the bell (seen in optical section) is widely separated from the subumbrella epithelium in the adradii, whereas the two cell-layers are closely connected in the perradii and the interradii; the planes of contact are, however, considerably broader in the perradii than in the interradii. — The same figure shows the five exumbral nettle ribs and their proximal dilatations. The latter consist of a one-layered epithelium of very large polygonal cells almost as broad as high. They are very much vacuolated, containing only a very insignificant amount of protoplasm, concentrated in the corners of the cells. Each one of the cells contains a small nucleus and 1—4 oval nematocysts of different sizes. In the broad nematocyst pads the cells are irregularly arranged, but upwards on the exumbrella they gradually arrange themselves into 4—3—2 rows, so that the dilatated parts become pointed upwards and, finally, are continued in the nettle ribs. The latter consist of cells quite similar to those found in the dilatated parts, but in the ribs the cells are arranged in one single row. In the nettle ribs there may sometimes be as many as 7 or 8 nematocysts in one single cell. — In its proximal part the dilatated nematocyst-bearing epithelium is broader than the corresponding tentacular bulb (see the tangential section, textfig. 33), and it is, for the most part, separated from the endoderm of the bulb by a gelatinous layer of considerable thickness (radial section, textfig. 34); only in the immediate neighbourhood of the velum, the exumbral jelly is confined to a thin supporting lamella. The nematocyst-bearing epithelium may, accordingly, only very improperly be designated as part of the tentacular bulb. As a matter of fact, the three rudimentary bulbs are completely "internal", exclusively consisting of an endodermal dilatation of the gastrovascular system, only close by the velum, on both sides of the latter, approaching the ectodermal epithelium. As far as the tentaculiferous bulb is concerned, we may well speak about a true tentacular bulb; the latter is broadly bulbiform, but its actual shape depends on the number of medusa-buds and tentacles present. The basal part of the bulb is covered by the inner part of the vacuolated, nematocyst-bearing ectoderm; but the distal part is covered by a fairly thick ectodermal epithelium, densely crowded with nematocysts, very much like the nematocyst ring in *Euphysa* and *Steenstrupia*.

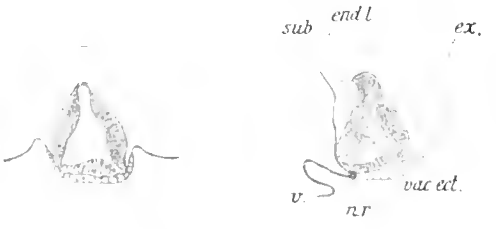

Fig. 33. Fig. 34.

Figs 33—34. *Hybocodon prolifer*. Rudimentary marginal bulb. — Fig. 33. Tangential longitudinal section, showing the greatly vacuolated ectoderm. — Fig. 34. Radial longitudinal section. *end l.* endoderm lamella, passing into the radial canal below; *ex.* exumbrella; *n r.* nerve ring; *sub.* subumbrella; *v.* velum; *vac. ect.* vacuolated, nematocyst-bearing ectoderm. — Specimen from the Faeroe Islands. — × 40.

The peculiar and interesting oogenesis in *Hybocodon* has been studied a. o. by Hargitt (1904, p. 33), who, however, mainly restricts himself to state that it takes place in practically the same manner as in *Pennaria*, *Corymorpha*, and *Tubularia crocea*. A thorough description of the oogenesis is given by H. Müller (1908, pp. 39 ff.). I have cut a number of sections of *Hybocodon* from the Faeroe Islands and the Danish waters, showing several interesting stages of the oogenesis; but the facts, as they appear from my sections, are in certain particulars not in accordance with those described by Müller. I consider it, therefore, inexpedient to enter further upon the matter, until I have examined a more extensive material. I shall merely refer to the accompanying figures and the corresponding explanations (textfigs. 29 and 32).

Material (see Chart VI).

Iceland:

1) — Lat. 66° 17′ N., Long. 14° 27′ W., near Langenes, North-East-Iceland. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 3 specimens.

2) — Axarfjord, on the north coast, August 12th 1903. Depth 38 m, caught about 1 m below the surface. "Beskytteren", C. V. Otterström. — 1 specimen, with actinulæ.

3) — Lat. 66°14′ N., Long. 17°28′ W., Skjalfandi Bay, North-Iceland. July 21st 1904. Depth 200 m. Young-fish trawl, 30 m wire. "Thor" stat. 208 (04). — 1 specimen, with actinulæ.

4) — Hesteyrifjord. June 25th 1902, surface. "Diana", A. Ditlevsen. — 2 specimens, with actinulæ.

5) — Mouth of Hrafnsfjord. June 27th 1902. Vertical haul from 23 m. "Diana", A. Ditlevsen. — 4 specimens, one with actinulæ.

6) — Isafjord. June 6th 1895. "Ingolf" Exped. — 18 specimens, all with medusa buds.

7) — Skutilsfjord. May 25th 1892. W. Lundbeck. — 125 specimens, all with medusa buds.

8) — Skutilsfjord. June 5th 1892. W. Lundbeck. — 81 specimens: 70 with medusa buds alone; 3 with medusa buds and actinulæ as well; 8 mature without medusa buds.

9) — Dyrefjord. May 30th and June 1st 1895. "Ingolf" Exped. — 7 specimens, all with medusa buds.

Faeroe Islands:

10) — Lat. 62°30′ N., Long. 8°21′ W., north-west of the Faeroe Islands. May 11th 1895. "Ingolf" Exped., stat. 1. — About 150 specimens, most of which have medusa buds.

11) — Kvannesund. May 26th 1902. Surface. "Diana", A. Ditlevsen. — 1 large specimen, with medusa buds.

12) — Klaksvig. May 22nd 1902. Surface. "Diana", A. Ditlevsen. — 19 specimens, with medusa buds, one with actinulæ.

13) — Fuglefjord. May 10th 1902. "Diana", A. Ditlevsen. — 16 specimens, all with medusa buds.

14) — Vestmannafjord. May 28th 1902. "Diana", A. Ditlevsen. — 1 specimen, with medusa buds.

15) — Thorshavn. May 26th 1901. Surface. "Diana", R. Hörring. — 21 large specimens, all with medusa buds.

16) — 15 miles south of Vaagö. May 20th 1902. "Diana", A. Ditlevsen. — 1 small specimen.

17) — Sumbö, Syderö. June 12th 1903. Vertical haul, 21-0 m. "Beskytteren", C. V. Otterström. — 264 specimens.

Geographical distribution and seasonal occurrence.

The American *Hybocodon prolifer* is only known from a comparatively small area off the east coast of North America: at Woods Hole, Vineyard Sound, and in Massachusetts Bay. It is very abundant, and is generally found in early spring, March—May, but may occur later in the summer until August (L. Agassiz 1862, p. 243; Hargitt 1904, p. 33; Bigelow 1914, p. 6). It has also been found on the Pacific coast, at Dutch Harbour in May (Bigelow 1913, p. 6) and at Vancouver in February (McLean Fraser 1914, p. 130).

The distribution in the European seas is northern-boreal and reaches from northern France to the north coast of Iceland and northern part of the west coast of Norway.

France: St. Vaast and Roscoff, in May and the beginning of June (Hartlaub 1907, p. 100); Granville, Normandy (Haeckel 1879, p. 37, *Amphicodon amphipleurus*)[1].

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[1] Where nothing else is stated, the name of *Hybocodon prolifer* has been used

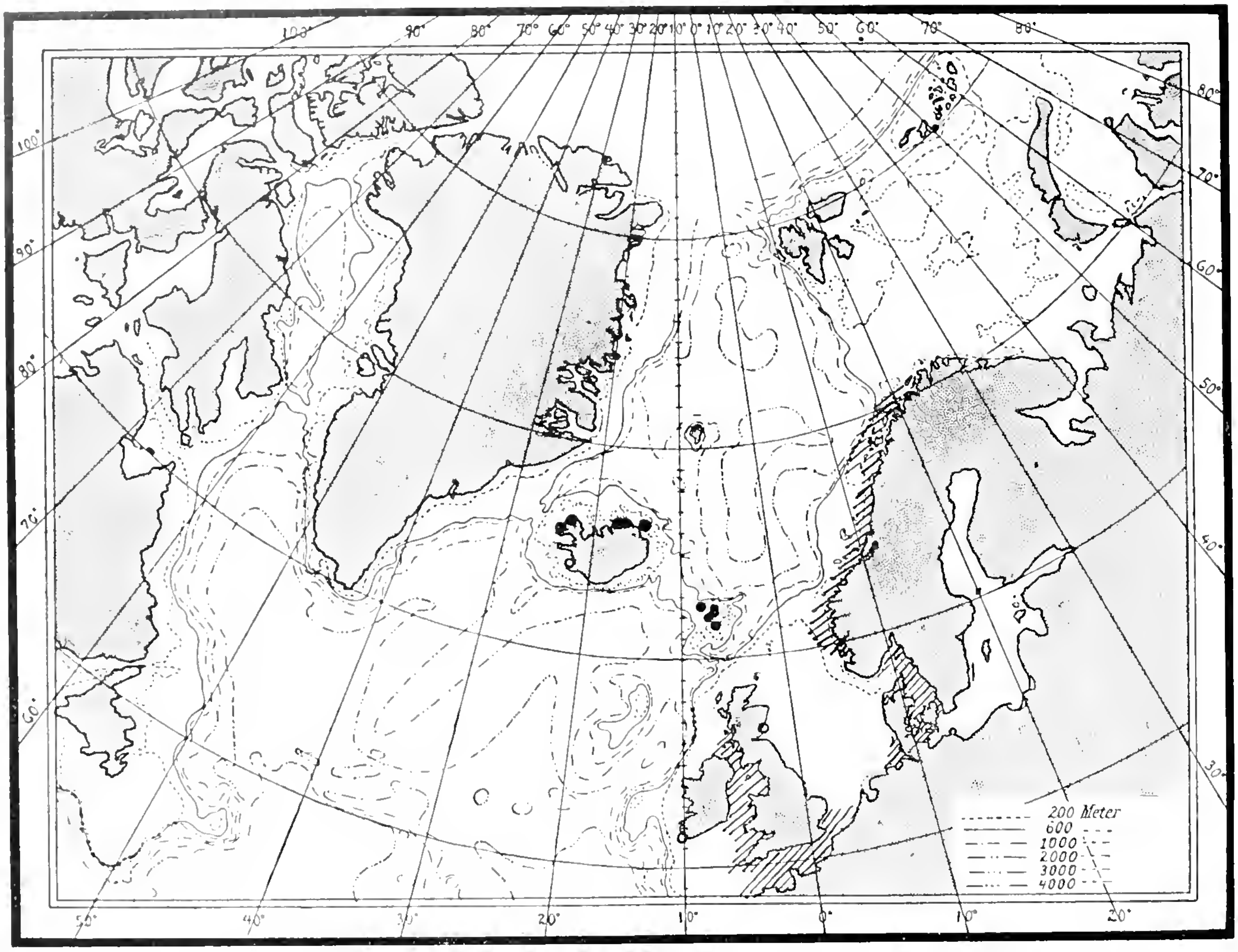

Chart VI ● Finds of *Hybocodon prolifer* A. Agassiz. ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched regions the species is commonly occurring.

British Isles: Plymouth, from the end of March, common in April and May, disappears in June (Browne 1897, p. 187; Plym. mar. Fauna 1904, p. 191; Lebour 1917, p. 161). — Valencia Harbour, Ireland, February to the beginning of June, rare (Browne 1900, p. 706 and Table I and III). — Dublin (Greene 1857, *Diplonema islandica* and *Steenstrupia owenii*, according to Browne 1896). — Port Erin, Isle of Man, may be abundant in April and May, but seems to be rather capricious in its occurrence; it was absent, e. g., in 1896, and in 1900 it was only met with in January (Browne 1895, p. 253, *Amphicodon fritillaria*; Herdman 1897, pp. 33—34, and 1900, p. 117). — Firth of Clyde, April and May to the middle of June, common (Browne 1905, p. 752). — St. Andrews Bay in May (Crawford 1895, p. 257).

North Sea: south-western part and in the Heligoland Bay from the middle of March to the middle of May (Böhm 1878, p. 195; Hartlaub 1907, p. 100).

Danish Seas: Kattegat and Belt Sea into the western part of the Baltic, very common during the spring.

Norway: near Florö in May (Sars; Haeckel 1879, p. 36, *Amphicodon globosus*). — All along the coast as far north as Lofoten and the Malang Bank; very numerous in the fjords, less common on the coastal banks, never found in the true oceanic water. First appearance at the end of March, in full act of budding off medusæ; increasing in number in the fjords during April and May, continually budding; the sexual reproduction commences about the middle of May, whereafter the budding ceases, and the medusa gradually becomes rarer (Kramp & Damas 1925, p. 250).

Faeroe Islands: very common in May and June, mature individuals in June (see above, loc. 10—17).

Iceland: near Reykjavik (Steenstrup 1842 and Sæmundsson 1899, see above). — Western and northern coasts, common in May and June, mature individuals at the end of June; off the north coast single mature specimens are also found in July and August (see above, loc. 1—9).

In the International Plankton Bulletins (Catal. 1906 and 1909) *Hybocodon prolifer* is frequently mentioned as occurring in the Channel and in the Bristol Channel in February and May, also once in August. In Catal. 1916 it is recorded from several Swedish and Danish stations, partly dating from seasons which are in striking disagreement with the seasonal occurrence of the species according to other experiences.

Summary.

According to the above, *Hybocodon prolifer* is a northern-boreal species, occurring all along the boreal coasts of Europe, but not penetrating into true arctic regions; it is, e. g., neither found at the east coast of Iceland nor at the arctic coasts of Norway.

In the southern part of the area of distribution (British coasts, the North Sea area) the medusa appears early in spring, sometimes in the middle of winter, increases in number until April or May, and usually disappears in June, being only occasionally met with as late as in August. In northern localities the time of occurrence is somewhat later, though the difference is not very considerable (about one month or one and a half).

Family **Margelidæ.**

Genus **Bougainvillia** Lesson.

At different times the generic names of *Hippocrene*, *Bougainvillia* (written by some authors *Bougainvillea*), and *Margelis* have been applied to the medusæ belonging to this genus. *Hippocrene* Brandt (1835) has been considered the oldest generic name; but in the first place it was preoccupied by Oken for a genus of Mollusca, secondly Lesson (as demonstrated by Hartlaub 1897, p. 456), as early as in 1830 has proposed the generic name of *Bougainvillia* for the species *B. macloviana*. Lesson, it is true, described the species under the heading "Cyanée de Bougainville", but further below in the text (p. 118) he made it the type species of a new genus, *Bougainvillia*, applying to it the specific name of *macloviana*. Steenstrup (1850, p. 35) introduced the generic name of *Margelis*, "because *Bougainvillea* has been used long ago, by the elder Jussieu, as generic name of a plant" ("da *Bougainvillea* forlængst er af den ældre Jussieu anvendt som Slægtsnavn paa en Plante"). According to modern nomenclature, this does not prevent the use of *Bougainvillia* as a generic name in the animal kingdom; it is, therefore, the proper name for the medusæ in question.

5 species of *Bouganvillia* are known from the northern seas: *ramosa* (van. Beneden), *nordgaardii*

(Browne), *britannica* Forbes, *superciliaris* L. Agassiz, and *principis* (Steenstrup). Material of all five species is found in the Zoological Museum of Copenhagen.

Whereas *Bougainvillia superciliaris* has only rarely been confounded with other species, *britannica* and *ramosa* were for a long time considered to be one species, usually named *B. ramosa* (van Beneden). The credit is due to Hartlaub for having separated the two species, which are as different morphologically as biologically. P. I. van Beneden (1844) described a hydroid, which he erroneously referred to *Eudendrium ramosum* (Linné) Ehrenberg, but which is now generally called *Bougainvillia ramosa*; van Beneden also observed the detachment of the medusa from the hydroid, and described and figured the young medusa (van Beneden 1844, p. 57, Plate IV, figs. 10—13). The same hydroid and medusa were again described by Dalyell in 1847, respectively under the names of "*Tubularia* (*Sertularia*) *ramosa*" and "*Medusa ocilia* (*octocilia*)" (Dalyell 1847, vol. I, pp. 64—71; the medusa described pp. 66—71 and figured on Plate XI, figs. 9—10); in the same work (p. 70) he shortly mentioned another medusa, "*Medusa duodecilia*", figured Plate XI, figs. 11—12. The latter medusa is identical with *Bougainvillia britannica* Forbes 1848. Already in 1841 Forbes described a "*Hippocrene britannica*", and in 1848 he referred some new specimens to the same species, which he now called *Bougainvillia britannica*. Hartlaub (1897, p. 464, and 1911, pp. 160—162) doubts the correctness of this identification and calls attention to certain points in which the two descriptions by Forbes disagree; it is possible, though I do not find it very probable, that Hartlaub is right in denying the identy of the two medusæ, in which case the specific name of *duodecilia* Dalyell has the right of priority in advance of *britannica* Forbes 1848. In the "Nordisches Plankton" Hartlaub, however, uses the latter name, I think with full right, because that name is generally used by several authors, whereas the name *duodecilia* has never been used since it was established by Dalyell.

Thus the species *ramosa* and *britannica* are originally described separately. The confounding is due to Wright (1858, p. 449, footnote). In a "Note on the development of *Bougainvillia Britannica* from *Atractylis ramosa*", Wright states that from the hydroid *Atractylis ramosa* (i. e. *Bougainvillia ramosa*) he reared the "*Medusa ocilia*" Dalyell with 4 unbranched oral tentacles and 4 pairs of marginal tentacles; the medusæ were brought to Edinburgh, and kept in aquarium, where they developed into "*Bougainvillia Britannica* Forbes". As demonstrated by Hartlaub, the figure does, however, not agree with *B. britannica* Forbes, but is in perfect accordance with full-grown individuals of *B. ramosa*. Hence the confounding is introduced into the literature, renewed by L. Agassiz (1862) and by Haeckel (1879), from these prominent medusologists proceeding to later authors, as in Bedot: Histoire des Hydroïdes, and Mayer: Medusae of the World. Mayer, however, does not use the name *ramosa*, but *britannica* in common for both species. — Already when Hartlaub wrote his beautiful and important paper "Die Hydromedusen Helgolands" (1897) he was aware that more than one species were hidden under the name of *Bougainvillia britannica*. But he was not yet fully conscious of the real state of things, and he, therefore, described a series of new species of *Bougainvillia*, all of which were, in 1911, referred by himself to the two old species *ramosa* and *britannica*. The new species were as follows: *B. flavida* and *autumnalis* (both = *B. ramosa*), *B. xantha* and *bella* (both = *britannica*). Since Hartlaub has, in the "Nordisches Plankton" (1911), carried out a thorough revision of the *Bougainvillia*-medusæ, we are now on safe ground, when we want to identify the medusæ of this group.

In the collections of the Zoological Museum only two of the above-named five species of *Bougainvillia* are represented by a somewhat extensive material from new northern localities; as to the three remaining species I shall, therefore, confine myself to present a few summary remarks.

Bougainvillia ramosa van Beneden.

Within the North-European area *Bougainvillia ramosa* has a southern distribution; it occurs at the southern parts of the British coasts, in the southern part of the North Sea, and in the Danish waters. A peculiar pygmy variety is found in the Nordaasvand, near Bergen in Norway, mentioned and described as *B. ramosa* var. *minima* in Kramp & Damas (1925, p. 254); the typical form is not known from the west coast of Norway. It is recorded, it is true, by Broch (1905) as occuring in the Godösund near Bergen in June, and the record is included in Hartlaub's list of localities (Hartlaub 1911, p. 185); in the paper by Kramp & Damas, quoted above, it is stated that the specimens in question belong to *B. britannica*.

In the North-East Atlantic area the medusa occurs in late summer and autumn, from July or August to November or December. Hartlaub's record of this species as being found in the Skagerrak on March 1st 1903 must be designated as uncertain.

Bougainvillia nordgaardii (Browne).

This species is distinguished from all other northern species of the genus by the lack of ocelli. The medusa, full-grown specimens as well as a continuous series of juvenile stages, is thoroughly described by Kramp & Damas (1925, p. 256). In the same paper the geographical distribution is dealt with; as far as hitherto known, the area of distribution is remarkably small, comprising the fjords on the west coast of Norway between Bergen and Molde, together with a single off-shore locality north-east of the Shetland Islands. Moreover Hartlaub (1911, p. 193) records the medusa from the "Valdivia" stat. 11 on the Wyville Thomson Ridge.

The medusa occurs in autumn, from August to November.

Bougainvillia britannica Forbes.

As a rule the species is easily distinguished from *B. principis* by the oral tentacles having a long, unbranched stem, from *B. superciliaris* also by the lack of a stomachal peduncle, by the somewhat broader marginal bulbs, and by the fainter development of the ocelli.

This species occurs along the British coasts and in the North Sea, whence it is occasionally carried into the Kattegat. The only locality outside this area, from which it is recorded in the literature, is Eastport, Maine, at the east coast of North America, where Mayer found a large specimen in September 1898; Mayer has given a figure of the specimen (1910, Plate 17, fig. 8), from which it appears that the correctness of the identification can hardly be doubted.

The northernmost localities up to now are the Shetland Islands, where the species was found by Forbes, and Godösund near Bergen (Broch 1905, *B. ramosa*, see Kramp & Damas 1925, pp. 264 and 265). — It occurs at the coasts of Scotland and Ireland in June, July, and August; in the Channel from April to June. It seems to be rare in the inshore waters near Plymouth, but very abundant farther out at sea, in the Atlantic current. In May 1914 I took a single specimen at the mouth of Plymouth Sound, but during a nightly excursion, May 19—20th, 5—7 miles south of Eddystone lighthouse, a vast number of specimens, exclusively young individuals, were found both at the surface and in the intermediate strata.

Off the coast of Holland, *B. britannica* has been found a single time, at the beginning of August. At Heligoland it frequently occurs in great abundance from May to June, single individuals being found as late as in August, according to Hartlaub, who also records the medusa from the entrance to the Skagerrak (1911, p. 164).

The Zoological Museum of Copenhagen possesses a large number of specimens from the Danish waters and from the Channel.

Bougainvillia superciliaris L. Agassiz.

(Chart VII).

Hippocrene superciliaris L. Agassiz 1849. Contrib. Nat. Hist. Acalephae of N. America, p. 273; Plates 1—3.
Bougainvillia — L. Agassiz 1862. Contrib. Nat. Hist. U. S. — Acalephae. Vol. IV, p. 344.

L. Agassiz (1849) has given a very complete description and numerous excellent figures of this elegant medusa, and in the "Nordisches Plankton" Hartlaub (1911, pp. 171—177) described the very small and simple hydroid polyp; Hartlaub also gives a very good general account of the structure of the medusa and quotations of the literature. In the present paper I only want to say that the characteristic stomachal peduncle is distinctly seen in young specimens not more than 2—3 mm high.

Material (see Chart VII).

Greenland:

1) — Lat. 69°15′ N., Long. 51°55′ W., Disco Bay. July 6th 1916. Surface. 2nd Thule Exped., stat. 2. — 10 specimens.

2) — Lat. 69°12′ N., Long. 54°20′ W., south-west of Disco. July 21st 1916 70—40 m. 2nd Thule Exped., stat. 3. — 1 specimen.

3) — Jakobshavn. Bergendal 1890. — 3 specimens.

4) — Jakobshavn. July 31st 1892. Traustedt. — 4 specimens, 9—11 mm high.

5) — Godhavn, Disco. Olrik 1866. — 1 specimen.

6) — Egedesminde. Bergendal 1890. — 10 specimens.

7) — Egedesminde. Traustedt 1892. — Numerous large specimens.

8) — Davis Strait (without further details). Bergendal 1890. — 3 specimens.

9) — Lat. 67°22′ N., Long. 56°14′ W. "Store Hellefiskebanke". July 7th 1908. Ringtrawl, 0—100 m wire. "Tjalfe" stat. 105b. — Numerous specimens, 3—7 mm high.

10) — Holstensborg. Traustedt 1892. — 28 specimens.

11) — Off Holstensborg. July 10th 1859. Olrik. — 7 specimens, 6—9 mm high.

12) — Lat. 66°53′ N., Long. 53°53′ W. Near Holstensborg. May 28th 1909. Plankton-net. "Tjalfe" stat. 386. — 5 specimens, 4—6 mm high.

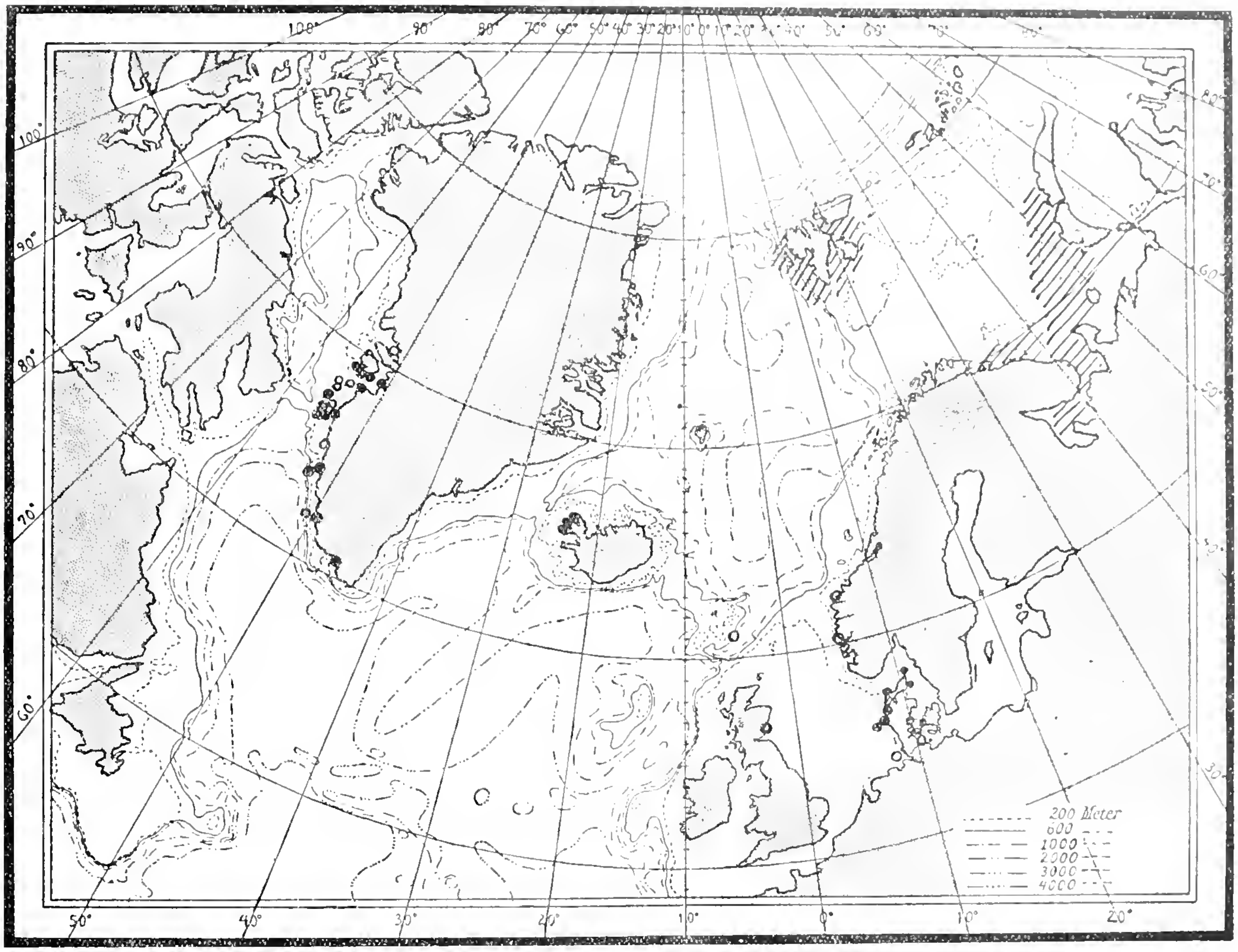

Chart VII. ● Finds of *Bougainvillia superciliaris* L. Agassiz. ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched regions the species is commonly occurring.

13) — Lat. 66°44′ N., Long. 56°08′ W. "Store Hellefiskebanke". July 5th 1908. Ringtrawl, 70 m wire. "Tjalfe" stat. 100c. — 1 specimen, 5 mm high.

14) — Lat. 66°38′ N., Long. 54°35′ W. June 27th 1908. "Tjalfe" stat. 83. — Numerous specimens, 3—7 mm high.

15) — Lat. 66°13′ N., Long. 55°05′ W. Moberg. — 12 specimens.

16) — Godthaab Fjord. June 15th 1908. Ringtrawl, 70 m wire. "Tjalfe" stat. 54. — 9 specimens, 3—5 mm high.

17) — Harbour of Godthaab. Holm 1884. — 4 specimens.

18) — Lat. 63°57′ N., Long. 52°41′ W. "Fyllas Banke". June 26th 1895. "Ingolf" Exped. stat. 26. — 1 specimen, 7 mm high.

19) — North of Frederikshaab. July 2nd 1909. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 48 specimens, 3—7 mm high.

20) — Harbour of Frederikshaab. July 8th 1909. Surface. "Tjalfe" stat. 519. — 2 specimens, 8 mm high.

21) — Mouth of Bredefjord. July 21st 1909. Ringtrawl, 100 and 125 m wire. "Tjalfe" stat. 544. — 22 specimens, 5—9 mm high.

Iceland:

22) — Önundarfjord. June 11th 1904. "Thor" stat. 135 (04). — 1 specimen, 9 mm high.

23) — Dyrefjord. May 30th 1895. "Ingolf" Exped. — 1 specimen, 8 mm high.

24) — Dyrefjord. July 14th 1892. Lundbeck. — 21 specimens, 5—8 mm high.

25) — Patreksfjord. June 22nd—23rd 1904. "Thor" stat. 159 (04). — 4 specimens, 5—7 mm high.

Geographical distribution and seasonal occurrence.

Hartlaub (1911, p. 173) has given a detailed list of the localities known up to then. I shall, therefore, be content to give a summary report of the distribution with addition of new localities.

Greenland: The distribution off the west coast of Greenland extends all along the coast from the southernmost part to Umanakfjord (about Lat. 70°40′ N.), where a single specimen was found by Vanhöffen (1897, p. 273). The medusa is fairly common in the Disco Bay, where it was found a. o. in two localities by the 2nd Thule Expedition in 1916. On the other hand, the species was altogether lacking on the dense series of stations of the same expedition from Disco to Thule. There can hardly be any doubt, therefore, but that the northern limit of the species at the west coast of Greenland is found about Lat. 70° N., as also pointed out by Jespersen (1923, p. 108—109), who has published the above-mentioned two finds from the Thule Expedition in his paper on the plankton collections of that expedition. — A complete list of all other Greenland localities, known up to now, is published in the Conspectus Faunæ Groenlandicæ (Kramp 1914, p. 406). The occurrence of the medusa is mainly restricted to the cold coastal regions and above the submarine banks, where the depth is less than 200 m, and where the cold water touches the bottom nearly throughout the year; it is lacking in the warmer, atlantic volumes of water in the Davis Strait. Besides, the medusa occurs in some of the fjords, partly such as Godthaab Fjord (loc. 16), in which the water is cold right down to the bottom, partly in fjords, like Bredefjord (loc. 21), in which the deeper strata consist of relatively warm (atlantic) water with temperatures above 3° C.; but in such fjords the medusa is only found in the upper, cold water layers. In the said locality (loc. 21) the medusa was found in great abundance in the strata with the lowest temperatures (below 1°), but never in the deeper strata (temp. 3—3°7). — Thus, the occurrence of *Bougainvillia superciliaris* off the west coast of Greenland clearly demonstrates the arctic character of the species. — As to the seasonal occurrence at the west coast of Greenland, the species has been found from May to July: young individuals in May and June, middle-sized and full-grown specimens in June and July.

East coast of North America. — The distribution of *Bougainvillia superciliaris* extends from the Davis Strait southwards along the coast of Labrador and the northern part of New England as far as Woods Hole, i. e. as far as the influence of the Labrador Current is perceptible. South of Cape Cod the medusa only occurs in spring and disappears soon after the beginning of April. North of Cape Cod it may be observed as late as in August (Bigelow 1914, p. 8).

Spitzbergen and Bear Island: Very numerous, found in many localities. To the localities mentioned by Hartlaub may be added: Recherche Bay, July 3rd, 5th, and 16th 1898, at the surface (Aurivillius 1899, pp. 9 and 56); Green Harbour, July 28th 1901; near Bear Island, Sept. 4th 1900, specimens up to 10 mm high (Kramp & Damas 1925, p. 264). Within this area the medusa is found from June to September. I have seen a great number of specimens from Treurenberg Bay, collected on June 21st 1905 ("Belgica", see Hartlaub), mostly small individuals, the smallest being 3 mm high, though a few reach a size of 6 mm.

White Sea and eastern part of the Barents Sea: Very abundant, somewhat rarer in the western part of the area. According to Linko the medusa is found at the Murman coast in winter, from November to May or June. This statement does not seem to agree with the find of middle-sized specimens, 5—8 mm high, on July 31st 1907 near Vardö in the eastern part of the arctic Norway (Kramp & Damas 1925).

Iceland: Only observed, up to now, in the fjords of the north-western part of the country (loc. 22—25) between the end of May and the middle of July. As the majority of the specimens found are of considerable size, the medusa seems to occur somewhat earlier at the coast of Iceland than at the west coast of Greenland and at Spitzbergen. — The find of "Thor" stat. 159 (04), recorded above as loc. 25, is mentioned by Hartlaub, who, however, has omitted any further records of locality or date of capture.

The southward distribution in the eastern part of the area of distribution is somewhat peculiar. The medusa seems to be very rare off the west coast of Norway, the only finds, hitherto recorded, being: a very young specimen near Bergen on March 1906, and one specimen, 3 mm high, near Aalesund on April 22nd 1906 (Kramp & Damas 1925, p. 264). — The species is not recorded from the Faeroe Islands; but on the "Michael Sars" Atlantic expedition 1910 a specimen was found in the Faeroe-Shetland Channel in August; it was taken by a horizontal haul with 400 m wire out, accordingly rather far below the surface; it seems probable, therefore, that the specimen has been carried southwards to this locality by the East-Icelandic Polar Stream. — From the British Isles only one single find is recorded, viz. at St. Andrews on the east coast of Scotland, April 26th 1899 (see Hartlaub 1911, p. 173). — On the other hand, in the south-eastern part of the North Sea the species occurs quite commonly, from February to May or June (Hartlaub), and it has been found occasionally in all parts of the Danish waters as far as in the western part of the Baltic, partly young individuals. Hartlaub has even found the corresponding hydroid in the neighbourhood of Mandal, near the south point of Norway. The seasonal occurrence in the Danish waters is from February to April.

Pacific Ocean: Further must be mentioned that a specimen of *Bougainvillia superciliaris* has been found at Attu Island in the northern Pacific on June 11th 1906 (Bigelow 1913, p. 9).

Summary.

Bougainvillia superciliaris is an arctic species. It is very abundant in the arctic parts of the Atlantic area, whence the distribution extends rather far towards the south; westwards it follows the Labrador Current to the northern parts of the New England coast; eastwards the area of distribution comprises the North Sea and the Danish waters. In its native waters of the Arctic the medusa occurs during the summer, from May to July or September (as to the Murman coast, see above). In the southern parts of the area of distribution it is only found in early spring, mainly from February to April.

Bougainvillia principis (Steenstrup).

(Chart VIII).

Margelis principis Steenstrup 1850, in Lütken. Vidensk. Medd. naturhist. Foren. Copenhagen, p. 35.
i. p. *Nemopsis heteronema* Haeckel 1879. System der Medusen, p. 93.

This medusa was briefly described by Steenstrup in a note to Lütken (1850, p. 35). The type specimens from Sandvaag (Faeroe Islands) are in the Zoological Museum of Copenhagen. Later on the species was more thoroughly described and the same specimens figured by Haeckel (1879, p. 88, Taf. VI, figs. 14—16). More recent descriptions have been given among others by Browne (1895, p. 266) and by Hartlaub (1911, p. 177). The medusa is distinguished from the other larger northern species of *Bougainvillia* by the globular form of the umbrella and the thick jelly, the considerable breadth of the marginal bulbs, and the oral tentacles ramificating from their base. Stomachal peduncle is almost always lacking, but sometimes the subumbrella mesogloea is a little projecting, thus giving rise to an insignificant stomachal peduncle. The base of the stomach is cross-shaped as in the other species of the genus, and attached to the subumbrella along the borders of a perradial cross; the walls of the stomach are deeply incurvate interradially. Besides these few remarks I have nothing to add to Hartlaub's excellent description. — No quite young specimens are known of this medusa.

Haeckel (1879, p. 93, Taf. V, figs. 6—9) has described a new species of Bougainvilliidæ, which he called *Nemopsis heteronema*; the description was based upon living specimens from Sognefjord on the west coast of Norway. With some reservation he referred to the same species some badly preserved medusæ from Iceland, collected by Steenstrup in 1839. There are two specimens which are still in the Zoological Museum of Copenhagen. They are, indeed, in a very bad condition, among other things the oral tentacles are completely lacking. I am able to state, however, that the corners of the manubrium are not prolongated along the radial canals as in the genus *Nemopsis*. As, moreover, the shape and size of the marginal bulbs agree perfectly with the same structures in *Bougainvillia principis*, I do not hesitate to refer the specimens to that species.

Material (see Chart VIII).

Iceland:

1) — Iceland. Steenstrup 1839. — 2 specimens (*Nemopsis heteronema* Haeckel).

2) — Lat. 66 17′ N., Long. 14° 27′ W., near Langenes, North-East Iceland. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 3 specimens, 6—9 mm wide.

3) — Lat. 66 46′5 N., Long. 14 57′ W. August 20th 1904. Depth 102 m. "Beskytteren", Gemzöe. — 1 specimen, 9 mm wide.

4) — Axarfjord. August 12th 1903. Near the surface. "Beskytteren", C. V. Otterström. — 1 specimen, 6 mm wide.

5) — Lat. 66 38′ N., Long. 16 18′ W. August 15th 1904. Depth 102 m. Young-fish trawl, 15 m wire. "Thor" stat. 258 (04). — 3 specimens, 9—10 mm wide.

6) — Lat. 66°14′ N., Long. 17°28′ W., Skjalfandi Bay. July 21st 1904. Depth 200 m. "Thor" stat. 208 (04). — 28 specimens, 5–7 mm wide.

7) — Lat. 66°23′ N., Long. 21°21′ W., north of Skagi. August 24th 1904. Depth 108 m. "Thor" stat. 266 (04). — 1 specimen, 11 mm wide.

8) — Lat. 64°06′ N., Long. 23°14′ W., Faxebugt. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 3 specimens, 8—10 mm wide.

9) — South of Iceland. July 11th 1903. — 1 specimen, 10 mm wide.

10) — South of Myrdalsjökel. August 17th 1903. "Michael Sars". — 6 specimens, 4–9 mm wide.

11) — Lat. 64°35′ N., Long. 11°45′ W. August 8th 1904. Depth 348 m. — 1 specimen, 11 mm wide.

Faeroe Islands:

12) — Sandvaag. Steenstrup 1845. — 1 specimen (Type).

13) — Lat. 60°55′ N., Long. 8°56′ W., Faeroe Bank. August 13th 1902. Near surface. "Michael Sars" stat. 78 (02). — 24 large specimens (in the Museum of Bergen).

Scotland:

14) — Little Minch, Hebrides, Lat. 57°36′ N., Long. 7°05′ W. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 5 specimens, 4–6 mm wide.

15) — East of the north point of Scotland, Lat. 58°39′ N., Long. 1°20′ W. June 26th 1903. Dahl's net. "Michael Sars" stat. 140 (03). — 11 specimens, 8—9 mm wide.

Some of the above localities are mentioned in Hartlaub (1911, p. 177—178). It is, however, necessary to call attention to a few mistakes in Hartlaub's list of localities. It is of less importance that the position of "Thor" stat. 203, July 20th 1904 (loc. 2 in the above list) is Long. 14°27′ W., not 14°24′. But Hartlaub's subsequent record of the species being found by the "Michael Sars" in an Icelandic locality called "unter Dahls Island" is rather unfortunate. It is true that the specimens, collected on August 17th 1903, were found near the coast of Iceland (see above, loc. 10); but the locality, stat. 140, June 26th 1903, is the same as the above-mentioned loc. 15 east of the north point of Scotland. In stating the locality as "Dahls Island", Hartlaub has been the victim of a pardonable misunderstanding: I much regret to say that by the labelling of material collected by the Norwegian vessel "Michael Sars" the localities are usually left out on the labels, which are, as a rule, only provided with number of station, date of capture, and appliance used. In the present case the appliance is "Dahl's hov" (i. e. Dahl's net), which indication Hartlaub has evidently understood to be the finding place and read as "Dahl's Isl.". Besides no island of that name is found at the coast of Iceland.

Geographical distribution and seasonal occurrence.

Iceland. — During my stay at Liége with Prof. Damas in 1920 I had the opportunity to see some notes by Dr. G. Stiasny (now in Leiden, Holland), among others on *Bougainvillia principis*. As the notes were accompanied by copious descriptions, I have no reason to doubt the correctness of the identification; besides, that part of the material, which was collected off the Norwegian coasts by the "Michael Sars", was at hand for verification of the identification. Among these notes I found three records from Iceland

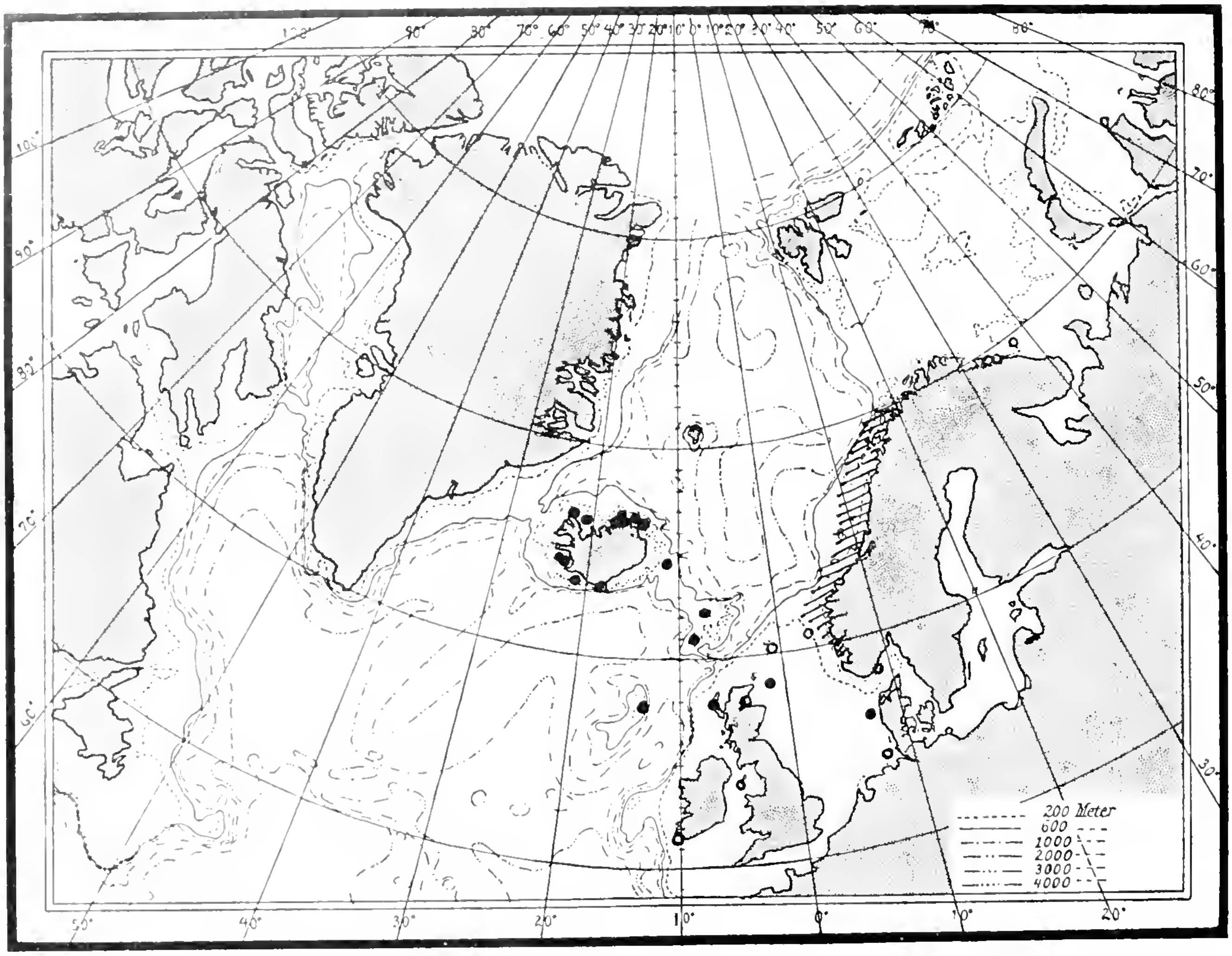

Chart VIII ● Finds of *Bougainvillia principis* (Steenstrup). ○ Occurrence in the North Atlantic and adjacent waters according to the literature In the hatched regions the species is commonly occurring.

("Thor" 1904) of considerable interest, which I shall communicate in details; they are also represented in Chart VIII:

Lat. 66° 29′ N., Long. 22° 26′ W. June 2nd 1904. "Thor" stat. 131 (04). — 7 specimens.

Lat. 64° 44′ N., Long. 23° 29′ W., Faxebugt. June 27th 1904. "Thor" stat. 164 (04). — 3 specimens.

Lat. 63° 30′ N., Long. 21° 03′ W. July 15th 1904. "Thor" stat. 189 (04). — 14 specimens, height of the bell 4—11 mm, diam. 5—11 mm.

The finds are interesting, because two of them are from June, while all other Icelandic finds are from July and August; moreover because fairly small individuals are found in the middle of July. — *Bougainvillia principis* is fairly common all around the coasts of Iceland, though it was never found in the fjords in the north-western part of the country (comp. *B. superciliaris*). It has been found from the beginning of June towards the end of August. Unfortunately Stiasny has failed to note the size of the individuals from June; if they had been very young, he would, however, surely have made a note of it. — Probably the medusa appears at the coasts of Iceland in May; fairly young individuals may still be met with in the middle of July. Specimens from August are all of considerable size; accordingly the species probably disappears from the plankton soon after that time.

At the Faeroe Islands the medusa was found by Steenstrup (loc. 12) and by Hartlaub in July (Hartlaub 1911, p. 177). During my stay at Liége I further saw 24 large specimens found on the Faeroe Bank in August (loc. 13).

Off the coasts of Scotland *Bougainvillia principis* seems to be fairly common, particularly in April—May, though it has been found as late as in August. The specimens from Little Minch, May 27th (loc. 14) are fairly small, 5—6 mm wide. The specimens from June 26th, east of Scotland (loc. 15) are large, 8—9 mm wide. Another locality east of Scotland is: Lat. 58°30′ N., Long. 1°18′ W., June 28th, recorded by Hartlaub (1911, p. 178) under the heading of "Helgoland". According to Romanes (1876, p. 526, and 1877, p. 190) the medusa may be found in Cromarty Firth until August (*Bougainvillia fruticosa* and *allmani*). — The species has also been found on the Rockall Bank on the "Michael Sars" North-Atlantic Expedition 1910 (Lat. 57°45′ N., Long. 13°40′ W. August 6th 1910, surface. "Michael Sars" stat. 99. 2 specimens, 9 mm wide, not included in Kramp 1920a). — *Bougainvillia principis* may also occur further south off the coasts of the British Isles, but is evidently rare. It has been found at Port Erin, Isle of Man in May and at Valencia Harbour, Ireland in April and May (Browne 1895, p. 266; 1900, p. 708, *Margelis principis*).

At Heligoland the species has been found only once, in May (Hartlaub 1911, p. 178). Off the northern part of the west coast of Jutland several large specimens were found on August 1st 1906 ("Michael Sars" stat. 329 (06), Kramp), and it is recorded from Sandnæsfjord on the south coast of Norway in July (Broch 1905, p. 6).

Strangely enough this medusa was never, until quite recently, recorded in the literature as occurring at the west coast of Norway; in Kramp & Damas (1925, pp. 264 and 265) it was demonstrated that the species is really very common in that area, particularly off the northern and middle parts of the coast, somewhat decreasing in number southwards towards the region about Bergen. It mainly occurs in the fjords, but may also be found in the open sea between the southern Norway and the Shetland Islands. It has its main occurrence in May, though it has also been found in June, July, and August.

In the Barents Sea the medusa occurs during spring and summer (Linko, see Hartlaub 1911, p. 178).

Summary.

Bougainvillia principis is a neritic medusa, inhabiting the coastal areas of the north-eastern part of the Atlantic region; it has never been found off the coasts of Greenland and America. The main occurrence is in the northern-boreal regions: Iceland and northern Norway. Towards the south it is distributed as far as Heligoland and the south-west coast of Ireland. It is indigenous on the banks round the Faeroe Islands and Rockall, at the coasts of Scotland, and off the middle part of the west coast of Norway. South of these places it probably only occurs as an occasional guest from the north. — *Bougainvillia principis* is, thus, a northern-boreal form, not a well marked arctic species as *B. superciliaris*; the latter proceeds, it is true, almost as far south as *B. principis*, but it avoids the areas washed by the Gulf Stream, and its real home is the Polar Sea. It is also interesting to compare the seasonal occurrence of the two species: *B. principis* is found at Iceland and Norway from May to August, in the southernmost localities somewhat earlier; but the difference between the seasonal occurrences in the north and the south is by far not so great as in the case of *B. superciliaris*.

Genus Lizzia Forbes.

Lizzia blondina Forbes.

(Chart IX.)

Lizzia blondina Forbes 1848. British Naked-eyed Medusæ, p. 67. Pl. XII, fig. 4.
Cubogaster gemmascens Haeckel 1879. System der Medusen, p. 76. Taf. VI, figs. 8—11.
Dysmorphosa minima Haeckel 1879. ibid. p. 78. Taf. VI, fig. 7.
Lizzia claparedei Haeckel 1879. ibid. p. 82.
— *blondina* Haeckel 1879. ibid. p. 82.

The fully developed *Lizzia blondina* possesses 3 tentacles on each of the perradial marginal bulbs, and one tentacle on each of the interradial bulbs. "*Lizzia claparedei*" is the previous stage of development with only 2 tentacles on each perradial bulb; "*Dysmorphosa minima*" is the youngest stage with altogether 8 tentacles, one on each of the eight bulbs. In certain geographical regions the development of the medusa never exceeds the *Dysmorphosa* stage. — The hydroid polyp is unknown. The medusa has a great capability of reproduction by budding, which may result in a vast number of medusæ originating from a small stock of hydroids. The identity between *Lizzia blondina* and *Cubogaster gemmascens* Haeckel was supposed by Hartlaub (1911, p. 144) and demonstrated by Kramp & Damas (1925, p. 266); Haeckel's medusa was characterized by possessing only two marginal tentacles, but in the quoted paper it was demonstrated (and figured, textfig. 13, p. 266) that the number of tentacles may be greatly reduced even in sexually mature specimens of *Lizzia blondina*.

The budding of the medusa was thoroughly examined by Chun (1896), and the general structure of the medusa is well-known from descriptions by Browne and Hartlaub. I shall only call attention to the fact, strongly emphasized by Hartlaub, that the oral tentacles issue somewhat above the margin of the mouth. I quite agree with Hartlaub that from a systematical point of view this is a very important feature, which joins the genera *Lizzia*, *Köllikeria*, *Bougainvillia* etc. in one group, whereas another group is established by *Podocoryne*, *Rathkea* etc., in which genera the mouth arms are mere prolongations of the mouth rim (the corners of the mouth). — There is one structural feature, separating *Lizzia* from *Bougainvillia*, to which I wish to call attention, because it may prove to be of systematical importance: In *Lizzia*, though the lateral walls of the stomach are interradially incurvated, the base of the stomach is not cross-shaped (as in *Bougainvillia*), but the entire, square, aboral wall of the stomach is attached to the broad, pyramidal stomachal peduncle (in *Bougainvillia superciliaris*, which likewise has a well-developed stomachal peduncle, the mambrium is attached along the borders of a perradial cross).

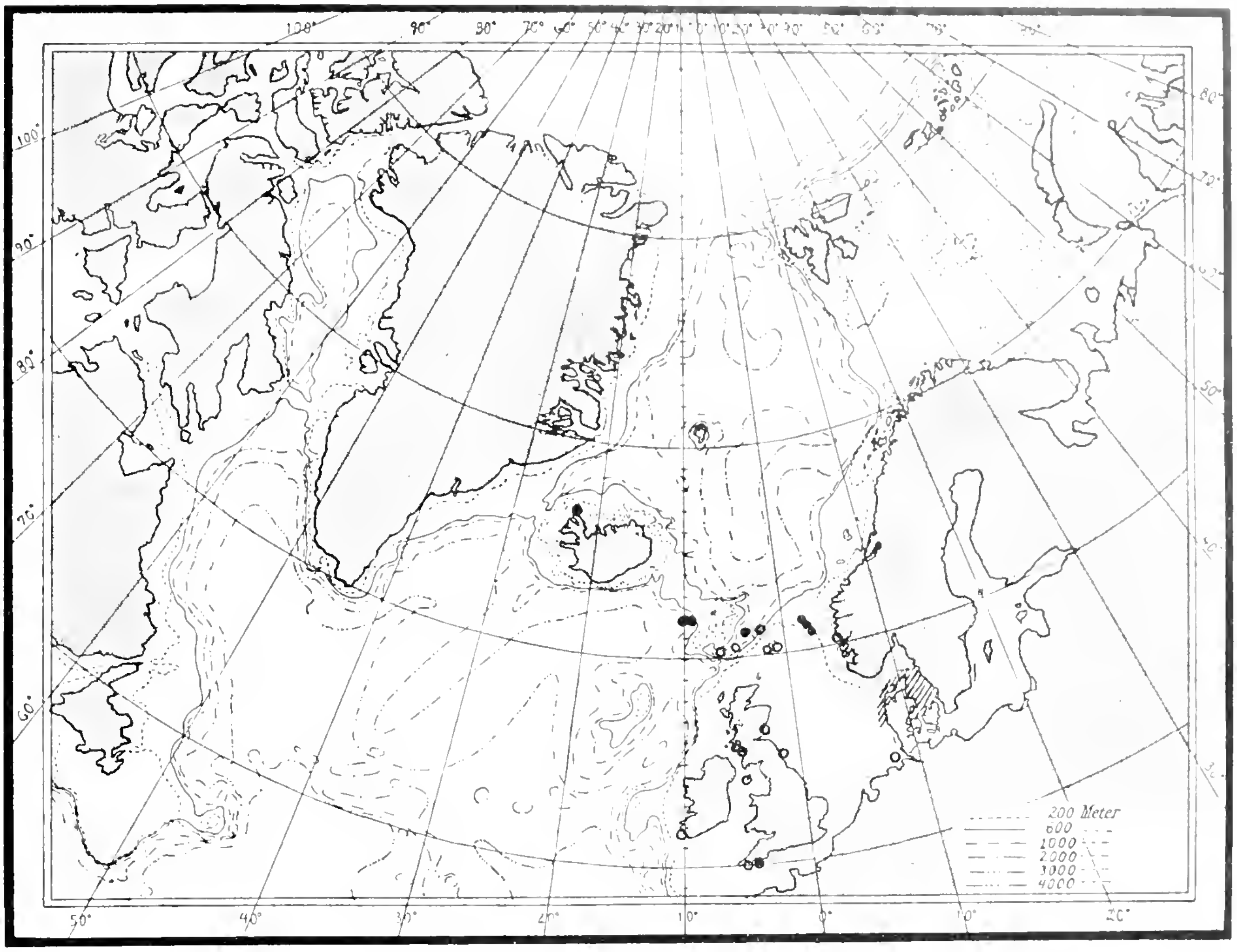

Chart IX. ● Finds of *Lizzia blondina* Forbes. ○ Occurrence according to the literature. In the hatched regions the species is commonly occurring.

Material (see Chart IX).

Iceland:

1) — Lat. 66°36′ N., Long. 21°57′ W, near Cape Nord. July 24th 1902. "Diana", A. Ditlevsen — 4 specimens, budding.

West of the Faeroe Islands.

2) — Lat. 61°42′ N., Long. 10°11′ W. August 14th 1895. Surface. "Ingolf" Exped. stat. 43. — 6 specimens.

3) — Lat. 61°42′ N., Long. 9°36′ W. August 14th 1895. Surface. "Ingolf" Exped. stat. 44. — 16 specimens.

Faeroe—Shetland Channel:

4) — Lat. 61°13′ N., Long. 4°30′ W. August 16th 1895. Surface. "Ingolf" Exped. — 8 specimens.

Between the Shetland Islands and Norway (The East-Greenland Expedition 1900)[1]:

5) — About Lat. 60°54′ N., Long. 2°26′ E. June 19th 1900, 4 o'clock p. m. — 5 specimens.

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[1] The exact localities cannot be stated; we only know the mid-day position of the vessel for each day, whence the fishing places must be calculated by interpolation, according to the hours of fishing.

6) — About Lat. 61°01′ N., Long. 2°15′ E. June 19th 1900, 5 p. m. — 5 specimens.
7) — About Lat. 61°25′ N., Long. 1°50′ E. June 19th 1900, 10 p. m. — 9 specimens.
8) — About Lat. 61°30′ N., Long. 1°46′ E. June 19th 1900, 11 p. m. — 2 specimens.
9) — About Lat. 61°34′ N., Long. 1°42′ E. June 19th—20th 1900, midnight. — 1 specimen.
10) — About Lat. 61°38′ N., Long. 1°39′ E. June 20th 1900, 1 a. m. — 1 specimen.

The Channel:

11) — 6—6½ miles south of Eddystone lighthouse. May 19th 1914. Depth 71 m. Ringtrawl. Kramp:

Surface — 1 specimen.
Intermediate haul — 4 specimens.

Remarks on the material:

Among the 5 specimens from the Channel in May 1914 (loc. 11) four have medusa buds, and 3 tentacles on each of the perradial bulbs; the fifth individual (intermediate haul) is sexually mature, but it is considerably smaller than the other specimens, each of the perradial bulbs carries only one tentacle, and two of the interradial bulbs are even destitute of tentacles; thus the specimen has althogether 6 tentacles.

The specimens from loc. 5—10, between the Shetland Islands and Norway in June, are all very small; most of them are budding, and none possesses more than 8 tentacles.

The material collected by the "Ingolf" Expedition in August 1895 in the surroundings of the Faeroe Islands (loc. 2—4) consists of 30 specimens, many of which are badly preserved. Among 25 specimens, 18 have medusa buds, 7 being sexually mature. I was able to count the number of tentacles in 15 individuals. As a matter of course, this number of specimens is too small to serve as base for extensive general conclusions. I should like, however, to present the results of the enumeration in summary: In 6 individuals there is only one tentacle on each of the perradial bulbs; in 9 individuals some or all perradial bulbs have 2 tentacles (total number of perradial tentacles being 6—8). It appears that most budding specimens have more than 4 perradial tentacles, but among the mature specimens the greater number have only four. The facts may be illustrated by the accompanying table, but as mentioned above, the number of specimens is too small for a reliable generalisation of the results. When, nevertheless, I publish the enumerations, such as I have found them, it is because they indicate a problem, which it would be interesting to have elucidated by further examinations. Specimens with reduced number of tentacles are smaller, i. e., less developed than specimens with a greater number of tentacles, which probably means that such small individuals are younger, have been living a shorter time, than the more completely developed individuals found at the same time. It is natural, therefore, that among budding individuals we may find small specimens with few tentacles as well as larger (older) ones with more tentacles. We know from observations that such budding individuals may cease budding and enter into the stage of sexual maturity. But small mature individuals

	Number of perradial tentacles	
	4	more than 4
budding	3	7
mature	3	2
Total number of specimens	6	9

with few tentacles must be supposed to be of younger age than large budding individuals with a greater number of tentacles; they have, accordingly, only passed a shorter development and may, possibly, never have been budding. It would be very interesting to state, by examination of material from different seasons, the numerical distribution of such individuals with foreshortened development and to know whether they are, perhaps, particularly common towards the end of the occurrence of the stock. I have seen a great number of *Lizzia* from the Danish waters, but in this area the medusæ never seem to develop more than 8 tentacles; they do not, accordingly, afford a suitable material for solution of the problem in question. — On the other hand, the Danish material is interesting in another sense, because it demonstrates a biological difference between *Lizzia blondina* and two other budding species of Anthomedusæ, *viz. Rathkea octopunctata* and *Hybocodon prolifer*. During the first months of pelagical occurrence of the latter two species, only budding individuals are found in the plankton, but during the last month the entire stock practically consists of mature specimens, and the transition is rather abrupt. In *Lizzia blondina*, on the other hand, budding as well as mature specimens are found together almost throughout the period, when the medusa occurs in the plankton (from July to November or December, in the Kattegat), though the relative number of mature individuals is gradually increasing towards the end of the period. This indicates that, normally, every individual reaches sexual maturity, whereas in *Rathkea* and *Hybocodon* the individuals of the first budding generations probably never become sexually mature, this state being reserved for the last few generations.

Geographical distribution and seasonal occurrence.

This pretty little medusa has its main distribution at the British coasts. Hartlaub (1911, pp. 144 and 147; 1917, p. 405) has shown that the species also occurs in the Mediterranean (Cette, Naples, Trieste). It is not known from America. As Hartlaub's list of localities is rather deficient and includes a number of misprints, I shall give the following revised list of North-European localities:

France: Concarneau, at the beginning of June (Hartlaub 1911, p. 146).

Channel: Plymouth, May to September (Browne 1896, Brit. Hydr. & Med., p. 475; Plymouth Mar. Invert. Fauna 1904, p. 192). In the latter paper the following interesting records are given of the occurrence in 1898: on May 2nd a large shoal was observed in Plymouth Sound; from May 12th the species disappeared from the coast, but was found off the Eddystone from May 16th to 26th. — On May 19th 1914 I found the medusa 6—6½ miles south of the Eddystone (see above, loc. 11). — Falmouth (Vallentin) and Fovey (Peach), according to Browne 1896.

Irish Sea: Port Erin, Isle of Man, at the beginning of May 1894 (Browne 1895, p. 265).

Ireland: Valencia Harbour, 6 specimens at the end of May 1895, 2 specimens on June 9th 1897 (Browne 1900, p. 707); 1 specimen in February 1901 (Delap 1906, p. 9).

West coast of Scotland: Arran, September 1859 (Claparède; *Lizzia claparedei*, Haeckel 1879, p. 82); Firth of Clyde, June to October (Browne 1905, p. 753; Kölliker 1864, p. 234; Hartlaub 1911, p. 146).

East coast of Scotland and England: St. Andrews Bay, August 9th—11th 1888 (McIntosh 1890, pp. 340 and 344, *Lizzia blondina* and *Lizzia minuta*). — Off the coast of Northumberland, August—

September 1924, sometimes in great quantities, (Meek 1925, p. 55). This is the first time this species was observed on the east coast of England.

Shetland Islands: Brassay Sound and off Fitful Head in the autumn 1845, with medusa buds (Forbes 1848, p. 67); Brassay Sound, July 1892, very abundant (Hartlaub 1911, p. 146); west of the Shetland Islands, Lat. 60°13′ N., Long. 1°50′ W. July 28th 1908 (Hartlaub, ibid.).

Faeroe—Shetland Channel: July 30th—August 6th 1896, July 7th 1897, frequently in great abundance (Fowler 1898, pp. 1022—1023 and 1030). Hartlaub (1911, p. 146) only quotes the statement of Fowler on p. 1030 of the multitudinous occurrence, adding in parenthesis: "Juli?" Further details are, however, found on previous pages of Fowler's paper: pp. 1022—1023 contain a tabular view showing the stations, where the different species were found, and the dates of the stations are given in the "General Data" on p. 1016. Fowler lays great stress on the distinction between the warm and the cold area, respectively west and east of the Wyville Thomson Ridge; as *Lizzia blondina* was only found in the upper strata, the Gulf Stream water, it is unimportant that all the finding places of the medusa were situated within the "cold area". — The "Ingolf" Expedition found some specimens of *Lizzia* in the same area in August 1895 (see above, loc. 4); they were taken in the "cylinder net", an appliance hauled after the ship while this was going ahead full speed.

Between the Shetland Islands and Norway. June 19th—20th 1900 (see above, loc. 5—10).

Norway: Puddefjord near Bergen, August—September 1905 (Broch 1905, p. 5, *Dysmorphosa minima*); Puddefjord and Björnefjord, near Bergen, October 1908 (Kramp & Damas 1925, p. 266).

West of the Faeroe Islands: August 1895, "Ingolf" (loc. 2—3).

Iceland: near Cape Nord, July 1902 (loc. 1). This is the northernmost locality, in which the species has been found up to now.

Heligoland: August 1865 (Haeckel 1879, p. 78, *Dysmorphosa minima*). Not rare in July and August, mostly young individuals; two specimens in November 1901 (Hartlaub 1894, p. 189, *Dysmorphosa minima*; 1911, p. 147, *Lizzia blondina*). — It it doubtful, whether the medusa mentioned and figured by Böhm (1878, p. 188; Pl. 6, fig. 5) under the name of *Lizzia blondina*, belongs to this species or to *Podocoryne carnea*, the latter supposition seems to me the more probable (obs. the shape of the oral tentacles and the lack of medusa buds).

Danish waters: Occasionally occurring off the west coast of Jutland, probably carried southwards from the mouth of the Skagerrak, where it is indigenous, though not abundant; fairly common, sometimes very abundant, in the Kattegat from July to late autumn, sometimes met with as late as in December (Kramp).

Browne (1900) declares himself unable to understand, why *Lizzia blondina* is rare at Valencia Harbour. It might, possibly, be explained in the following manner: from a hydrographical point of view the west coast of Ireland is characterized by the coastal water being constantly removed and replaced by oceanic water. As everything indicates that *Lizzia* is a neritic species, the oceanic water cannot carry a new stock of the medusa to the coast, where, accordingly, only specimens of local origin are found, and even many of these specimens are quickly carried off to other regions. It is different in the Channel, the Firth of Clyde and the waters around the Shetland Islands; these areas receive a constant inflow of coastal water from the western British coasts, and owing to the budding the *Lizzia* medusæ, carried away with this water, increase greatly in number during the transportation. It is comprehensible, therefore, that the species may occur in vast swarms in these areas, even though the local stock may not be any more abundant than at the west coast of Ireland. The probable correctness of this explanation is confirmed by the dates of capture as stated in the literature. At Valencia Harbour the medusa is found in May and June but not later in the year; off Plymouth and in the Firth of Clyde area it likewise appears in May or June, but it is also found in variable number, occasionally in large quantities, throughout the summer to September or October. It seems probable, therefore, that the hydroid, wherever it occurs (at the southern and western coasts of the British Isles) liberates the medusæ in May—June, but soon after the time of liberation the medusa has generally disappeared from the surroundings of Valencia Harbour, whereas the other areas, mentioned above, constantly receive new supplies of *Lizzia* throughout the summer and autumn.

The rare occurrence of the medusa off the east coast of Scotland and northern England indicates that the hydroid does not live in that area.

In the Faeroe—Shetland Channel and at the Shetland Islands *Lizzia* has not been found earlier than July, which may be due to lack of observations from the previous months. In any case, the occurrence of several specimens between the Shetland Islands and Norway in June 1900 makes it probable that the species is indigenous at the Shetland Islands. If the said stock of medusæ had originated from the west coast of Scotland, it seems hardly possible that it might have reached so far away (north of the Shetland Islands and from there more than half-way to the Norwegian coast) at this early time; it was undoubtedly a shoal of medusæ liberated in the neighbourhood of the Shetland Islands in June or, perhaps, in May.

As mentioned above, *Lizzia blondina* is common in the surface water (the Gulf-Stream water) of the Faeroe—Shetland Channel, also in the western part of the channel, whereto it may hardly be supposed to come from the Shetland Islands, but rather from the west coast of Scotland. In any case *Lizzia* does not belong to the Gulf-Stream water; its occurrence in the Faeroe—Shetland Channel, therefore, seems to me to demonstrate that the Gulf-Stream water in the channel is mixed up with coastal water from the western coasts of the British Isles. Accordingly the inflow of coastal water from the Atlantic coasts to the North Sea does not only take place south of the Shetland Islands but also through the channel north of the islands.

It is interesting that *Lizzia blondina* has now been recorded from Iceland (see above, loc. 1). It is possible that the species is not indigenous at the north-west coast, but the specimens found there (near Cape Nord) cannot possibly have originated from more distant places than the south coast of Iceland, where, thus, the species must be indigenous, and whence the medusa may be carried to the western and north-western coasts by the Irminger Current.

The species is indigenous in the Kattegat, but is never found until about the middle of July; this late appearance may be due to the low temperatures which prevail during the spring and early summer in the deeper parts of the Kattegat, where alone the hydroid may be supposed to live (for reasons which shall be dealt with in another paper). In the western part of the Skagerrak the medusa appears somewhat earlier.

The distribution of the medusa in the Danish waters seems to indicate that the unknown hydroid only lives in areas with soft, clayey bottom.

The late appearance at Heligoland (July) cannot be due to low temperatures; perhaps the hydroid does not occur on the sandy bottom in the neighbourhood of Heligoland.

Summary:

In the north-western Europe *Lizzia blondina* is a southern-boreal species, being abundant at the southern and western coasts of Great Britain, less common in more northerly localities. The unknown hydroid lives in the neighbourhood of the coasts, though, probably, not in very shallow water. It is distributed from the north coast of France to the south coast of Iceland, the Faeroe Islands, and the southern parts of the Norwegian coast; it is not generally distributed in the North Sea, where it seems to have its main occurrence in the northern parts (Shetland Islands, the entrance to the Skagerrak etc.); it also occurs in the Kattegat. — The medusa is liberated in May to June or July. The life duration of the single individual is, probably, not very long, but owing to the continuated reproduction by budding the shoals may be found, in favorable localities, during a considerable space of time, throughout the summer and autumn to October, November, or even December. While carried away by the currents the shoals increase in number, which may account for the abundance in the Faeroe—Shetland Channel. The ultimate fate of the shoals depends on the physical conditions of the waters, into which they are carried by the currents.

Genus **Rathkea** Brandt.

Rathkea octopunctata (M. Sars).

(Chart X).

Cytaeis octopunctata M. Sars 1835. Beskrivelser og Iagttagelser etc., p. 28. Pl. 6, fig. 14.
Oceania Blumenbachii Rathke 1835. Mém. Acad. Imp. Sci. St. Pétersbourg, tome 2, p. 321.
Rathkia Blumenbachiana Brandt 1837. Bull. Sci. Acad. Imp. St. Pétersbourg, vol. I, no. 24, p. 187.
Hippocrene octopunctata Forbes 1841. Ann. Mag. Nat. Hist. vol. VII, p. 84.
Lizzia octopunctata Forbes 1848. British Naked-eyed Medusæ, p. 64. Pl. 12, fig. 6.
— L. Agassiz 1862. Contrib. Nat. Hist U. S., vol. 4. p. 345.
Rathkia blumenbachii — ibid.
Lizzia grata A. Agassiz 1865. North Amer. Acal., p. 161, figs. 251—258.
Margellium octopunctatum Haeckel 1879. System der Medusen, p. 95.
— *gratum* ibid.
Rathkea Blumenbachii ibid., p. 96.
octopunctata ibid., p. 97.
blumenbachii Hartlaub 1911 and 1917. Nordisches Plankton, pp. 229 and 408.
octopunctata Kramp 1913 b. Medusæ, "Tjalfe" Exped. — Vid. Meddel. Dansk naturh. Foren. Bd. 65, p. 266.
1914. Conspectus Faunæ Groenlandicæ. — Meddel. om Grönland, Bd. 23, p. 408.

Among Hartlaub's additions to the Anthomedusæ in the "Nordisches Plankton" (Hartlaub 1917, p. 408) the following remark concerning my paper on the medusæ of the "Tjalfe" expedition (Kramp 1913b) is found: "Trotzdem ich mir Exemplare von *R. blumenbachii* aus dem Schwarzen Meer besorgte, sie eingehend mit Exemplaren von *Rathkea octopunctata* verglich und zu dem Resultat ihrer Identität mit letzter Art kam (cf. pag. 235), zieht es Kramp, ohne zu sagen, auf welche Erfarungen gestützt, vor, den Sars'schen Namen *octopunctata* beizubehalten."

Hartlaub's treatment of the Margelidæ in the "Nordisches Plankton" (Hartlaub 1911) did not come into my hands until my paper on the medusæ of the "Tjalfe" expedition was almost completed. The reason why I did not at once, on Hartlaub's authority, replace the specific name of *octopunctata* by *blumenbachii* was that I did not feel convinced of the justification of this alteration and preferred retaining the old name, which was safe from causing any misunderstanding, till I should have formed a well founded opinion concerning this question. Already the following year I entered on the problem (in the "Conspectus Faunæ Groenlandicæ", Kramp 1914, p. 410), and after having taken it into serious consideration I put forth my reasons for keeping the name *octopunctata*. Hartlaub has known and used the paper in question, but as it is written in Danish it is very natural that the passage concerning the specific name of *Rathkea* has escaped his attention. As my reasons were rather briefly stated in 1914, I shall here once more take them up for discussion and more definitely explain, why I am constantly of opinion that the specific name *octopunctata* ought to be retained; thus I hope to ascertain a well-known name for this widely distributed and in some places very numerous medusa.

Before two species are joined into one, their identity must first be proved, after which investigations are to be made as to which of the species was described the first, for the purpose of establishing the correct specific name. Has Hartlaub proved *Oceania blumenbachii* Rathke to be identic with *Cytæis octopunctata* Sars? The only answer given by Hartlaub (in 1911) is as follows: "Mit den im Schwarzen Meer vorkommenden Exemplaren, von denen ich durch die Güte des Herrn Sernov in Sevastopol eine Anzahl untersuchen konnte, ist, wie bereits Haeckel vermutete, *R. octopunctata* Sars identisch" (1911, p. 235). Thus Hartlaub has stated the specimens of *Rathkea* collected by Sernov as belonging to the species known from the North-European seas; but their identity with the form described by Rathke is taken for granted without any discussion, and Rathke's specific name *blumenbachii* is employed for the Atlantic specimens as well as for those from the Black Sea. Though further inspection makes it evident that this identity is practically beyond any doubt, it cannot be presumed without a single argumentation.

As mentioned by Hartlaub, Haeckel has already (1879) stated that he supposed Rathke's medusa to be identic with *octopunctata* Sars, as he presumed Rathke's description of the form of the mouth-rim to be wrong, and further the revealing of four interradial canals to be due to a mistake. Apart from these two points the description is all in all very clear and adequate and together with the elaborate figures it at once calls forth the image of *Rathkea octopunctata*. Rathke did not find any medusa buds, which may be due to the advanced season (April 20th; Markow found numerous budding individuals in February). But it is somewhat astonishing that the gonads were very scantily developed, far from encircling the manubrium; in *R. octopunctata*, as we know it from the North-European seas, the development of the gonads is, as a rule, accelerated even before the last medusa buds have disappeared. This may, however, not prevent us from considering the medusa, described by Rathke, to be identic with the North-European form, described by Sars. As a matter of fact, even before 1905 *Oceania blumenbachii* could with some certainty be identified with *Rathkea octopunctata*, but Sernov's find of the latter species in the same sea (published by Markow 1908, p. 664) greatly confirms this supposition. I have no doubt that the two forms are indeed identic.

The next question is, which specific name will be the correct one. — When Hartlaub worked out the Margelidæ for the "Nordisches Plankton" (1911) he introduced the name *blumenbachii*, without indicating that it may be doubted whether *blumenbachii* Rathke or *octopunctata* Sars is the elder name. Only in the additions (1917, p. 408), Hartlaub enters on this side of the discussion, saying: "Die Arbeit von Rathke und die von Sars stammen, soweit die Titelblätter und das Erscheinen in Betracht kommen, beide aus dem Jahr 1835. Das Vorwort von Sars ist datiert 12. Februar 1834, und der Aufsatz von Rathke wurde vor der Petersburger Akademie gelesen 1833. Mithin hat der Rathke'sche Species-Name "*blumenbachii*" die Priorität." — Already in 1914 I discussed this question and at that time wrote among others: "the description of *Oceania Blumenbachii* having been read aloud in the Imperial Academy of St. Petersburgh on October 4th 1833 can hardly be taken into consideration here; it is the date of printing which counts . . ." This latter cannot with certainty be stated. According to a note on the inside of the title page, the volume of the Russian periodical was published in August 1835, and Rathke's paper is rather past the middle of the volume. The preface to Sars's "Beskrivelser og Iagttagelser" (Descriptions and Observations) is dated February 12th 1834. Thus there is at least an equal probability of Sars's paper having appeared before that of Rathke, than of the opposite. Then why not keep the name which has for so many years been the common one for this well-known medusa, the name under which the species is known by all who have occupied themselves with the medusæ of the European seas? I do not see any reason whatever for introducing any other name for *Rathkea octopunctata* (M. Sars).

I shall not enter on a discussion of the different generic names under which this species has been mentioned in the literature, but be content to call to mind that Haeckel established a new genus *Margellium* differing from *Rathkea* in the four perradial tentacular bulbs carrying a greater number of tentacles than the four interradial ones (*Margellium octopunctatum* $\frac{3333}{2222}$, *M. gratum* $\frac{5555}{3333}$), whilst in *Rathkea* all the bulbs had an equal number of tentacles (*Rathkea octopunctata* $\frac{3333}{3333}$). This distinction was given up long ago, especially since Browne (1895 and 1896) had stated through a series of thorough investigations of a great many individuals from the British coasts that the individuals gradually develop from the juvenile *Margellium octopunctatum* stage to the *Rathkea* stage, often proceeding to a *Margellium gratum* stage with full number of tentacles ($\frac{5555}{3333}$). The final stage thus agreeing with Haeckel's definition of the genus *Margellium*, Browne makes use of the latter generic name, keeping it in his later works, whereas most recent authors retain the name *Rathkea*, as established by Brandt (1837).

Whilst Rathke did not find medusa buds on his specimens from the Black Sea, Sars found these formations on specimens from Norway, yet without at once comprehending their real nature (1835, p. 29). Already in 1837 (p. 406) Sars found out that these bodies were young medusæ, and in 1846 (p. 10) he gave a thorough description of the gemmiparity. Microscopic-anatomical investigations of the formation and development of the buds have been made by Böhm (1878), Fewkes (1881), and Chun (1896). Chun has further stated the regular consecutive order in which the buds are developed. — According to Böhm (1878, p. 129) the budding starts as a thickening of the ectoderm in the manubrium of the mother animal, after which a prolongation from the endoderm extends into this thickening, both the primary layers of the mother animal thus participating in the formation of the bud. Fewkes gives a completely corresponding description of the phenomenon, whereas Chun comes to the astonishing result that the young originates exclusively from the ectoderm of the mother animal, which is through some sort of schizogony differentiated into ecto- and endoderm; only later on a connection between the gastral cavities of the mother and the young is established. This was likewise found by Chun to be the case in *Lizzia claparedei*. Concerning this matter Braem has written a speculative paper (1908) treating the mode of development of the bud as a transitory stage between sexual and asexual reproduction: "Ein Ektoderm, welches Ekto- und Entoderm liefert, kann kein richtiges Ektoderm sein". The buds originate from a particular kind of cells which "die organbildende Kräfte beider Keimblätter, d. h. des Gesamtorganismus, in sich vereinigt". Of such cells we only know "Keimzellen". The author points out that the buds are formed in the same places where later on the gonads are situated and that sexual reproduction does not commence until the asexual reproduction has ceased. This latter postulate is not correct; individuals carrying medusa buds and well-developed gonads at the same time have been observed by several authors (Böhm 1878, p. 129, Hartlaub 1911, p. 232). I too have observed this phenomenon several times. Braem thinks that the mother cells of the buds are really germ-cells. This peculiar mode of reproduction is of course to have a name of its own: "Gonoblastie". The matter is of rather essential interest, but, as far as I am aware, no recent investigations are at hand. The problem is too extensive for any further discussion in the present paper. I have cut some sections of budding *Rathkea*-medusæ, but the material has not been fixed with a view to this problem, so that I am prevented from giving any definite explanation. It is true that the gastral cavity of the mother animals is only rather late connected with the gastrovascular cavity of the bud; still I am sure to have observed that the supporting lamella of the manubrium of the mother animal is pierced at an early developing stage of the bud, so that the endoderm of the latter is directly connected with that of the mother medusa. On the other hand I dare not with certainty declare, whether this piercing of the supporting lamella takes place already before the first formation of the endoderm of the bud; but I do not think it excluded that further investigation will prove that the base of the endoderm of the bud is made up of endoderm cells which have immigrated from the stomachal epithelium of the mother medusa.

After Hartlaub (1911) has given a new and good definition of the genus *Rathkea* with the structure of the mouth rim as a principal character, this genus now only contains one species, *Rathkea octopunctata* Sars, the American form ("*Lizzia grata*" Agassiz) being identic with the European form.

Material (see Chart X):

Greenland:

1) — Jakobshavn, Disco Bay. Bergendal 1890. — 1 specimen, with medusa buds

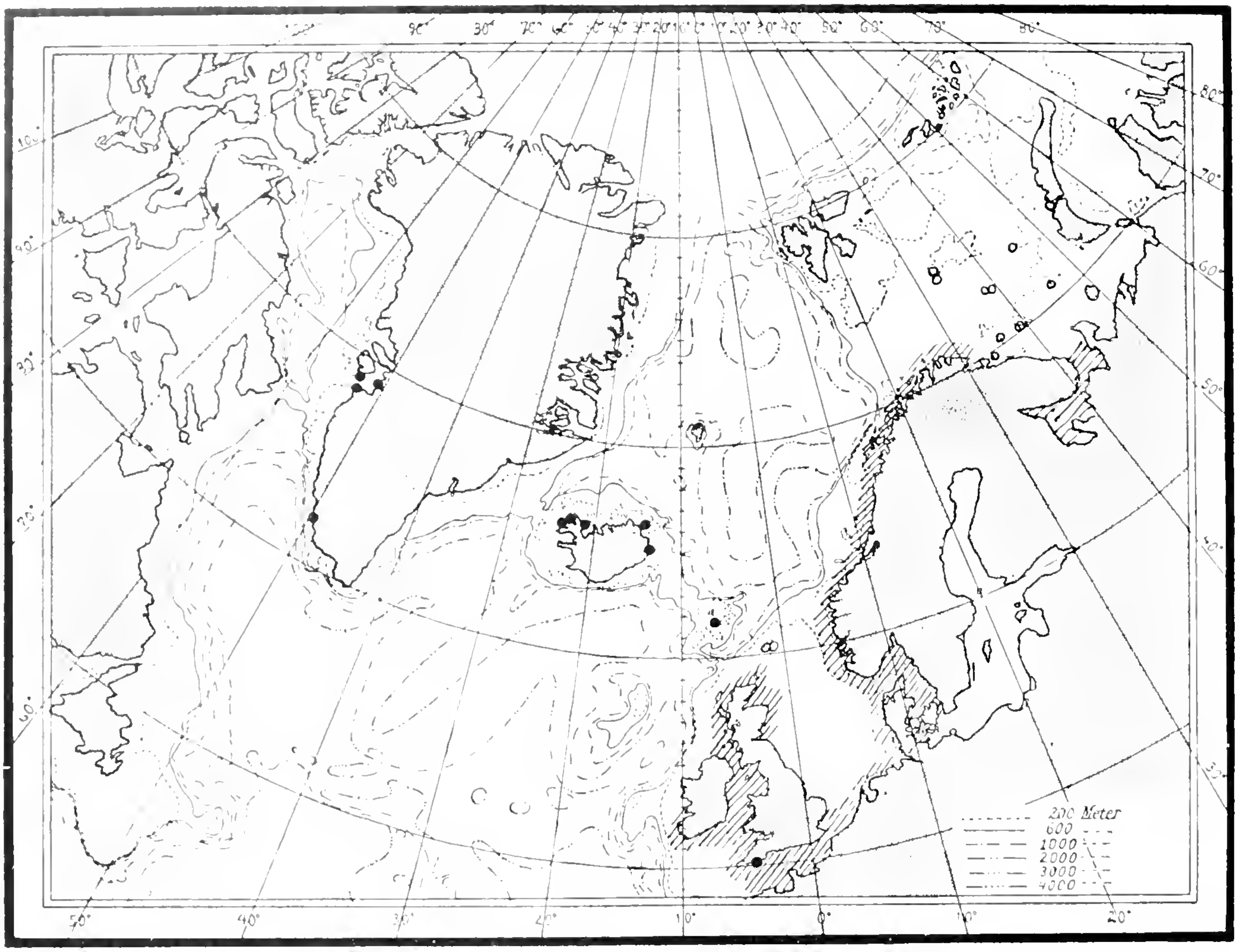

Chart X. ● Finds of *Rathkea octopunctata* (M. Sars). ○ Occurrence in the North Atlantic and adjacent waters according to the literature. In the hatched regions the species is commonly occurring.

2) Lat. 69 27′ N., Long. 53 40′ W. South coast of Disco. August 18th 1919. Surface. Porsild. — 4 specimens.

3) Egedesminde. Bergendal 1890. — 2 specimens, with medusa buds.

4) North of Frederikshaab. July 2nd 1909. Depth 265 m. Ringtrawl, 100 m wire. "Tjalfe" Exped. stat. 502. — Numerous specimens.

Iceland:

5) Mófjord, east coast of Iceland. August 11th 1904. Surface. "Thor". — Numerous specimens, with medusa buds.

6) — Lat. 66 17′ N., Long. 14 27′ W. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 4 specimens, with medusa buds.

7) — Ingolfsfjord. July 12th 1902. "Diana", A. Ditlevsen. — 6 specimens, 3 of which with medusa buds.

8) — Hesteyrifjord. June 25th 1902. Surface. "Diana", A. Ditlevsen. — 41 specimens, 14 of which bear medusa buds, most of the others are sexually mature.

9) — Mouth of Hrafnsfjord. June 27th 1902. Vertical haul from 23 m. "Diana", A. Ditlevsen. — 48 specimens, 28 of which bear medusa buds.

10) — Hrafnsfjord. June 24th 1902. "Diana", A. Ditlevsen. — 11 specimens, 6 of which bear medusa buds.

11) — Isafjord. June 6th 1895. "Ingolf" Exped. — 27 specimens, all with medusa buds.

12) — Skutilsfjord. June 5th 1892. Lundbeck. — 5 specimens, with medusa buds.

13) — Dyrefjord. May 31st—June 1st 1895. "Ingolf" Exped. — 12 specimens, all with medusa buds.

Faeroe Islands:

14) — Trangisvaag. May 9th 1895. "Ingolf" Exped. — 2 specimens with medusa buds.

15) — Trangisvaag. May 7th 1896. "Ingolf" Exped. — 1 specimen, with medusa buds.

16) — Trangisvaag. May 3rd 1905. Fr. Johansen. — 1 specimen, with medusa buds.

British Isles:

17) — Rame, off Plymouth Sound. May 12th 1914. Kramp. — 2 specimens, sexually mature.

Under the heading: "West coast of Greenland" Hartlaub (1911) records this species from the locality "Knudshoved, September 24th 1900". Knudshoved was, however, one of the fixed plankton stations examined by Joh. Petersen in 1898—1901, and it is found at the Great Belt in Denmark. Besides, September 24th would be a peculiar date of capture of this species in the Danish waters, and, as a matter of fact, the statement is due to a mistake. The glass contains a label, written by Hartlaub, and a small medusa, which has evidently been dried up but afterwards replaced in alcohol; consequently, it is not easily identified, but having cleared it in xylol I was able to state that it was no *Rathkea* but, probably, a small Eucopid. Neither is *Rathkea* recorded by Johansen & Levinsen (1903) as occurring at Knudshoved in September. — The record (Hartlaub 1911, p. 233) of *Rathkea* being found at Egedesminde in Greenland on October 20th 1890 by Bergendal is likewise due to a mistake; the date, as written on the label, is not the date of capture, but the date when the specimens were handed over to the collections of the Zoological Museum of Copenhagen. The same mistake has been made by myself (Kramp 1914, p. 410).

Geographical distribution and seasonal occurrence:

Black Sea: Sevastopol, April 20th 1833 (*Oceania Blumenbachii*, Rathke 1835) and January 3rd-April 29th 1905 (*Cytacis octopunctata*, Markow 1908, pp. 664—665).

Mediterranean: Trieste in March, rare (Neppi & Stiasny 1911, p. 399); Trieste and Cette (Hartlaub 1911, pp. 231 and 233).

Atlantic coast of France: Concarneau in the beginning of June, partly with well-developed gonads (Hartlaub 1911, pp. 231 and 233).

Channel: Boulogne-sur-mer, abundant in spring (Giard 1888, see. Hartlaub 1911) — Falmouth and Fowey (Vallentin and Peach, see. Browne 1896, p. 479). — Plymouth, abundant, appears in February, disappears in May or June (Garstang 1894, pp. 213 and 214; Plymouth mar. Invert. Fauna 1904, p. 192; Lebour 1917, p. 161). According to Lebour a single specimen was also found in September.

Ireland: Valencia Harbour; from January or March to May or June; a single, budding specimen found July 29th 1897; young specimens in October and November 1896 (Browne 1900, p. 710 and tables I and III).

Irish Sea: Port Erin, Isle of Man, until June; may be very common, but in some years it is very rare (Browne 1895, pp. 270—295; Herdman 1897, p. 34).

West coast of Scotland: Firth of Clyde, February to June or July, (Browne 1905, p. 755, tables I and II). The records from 1902 are very interesting; according to Browne the species occurred from February 19th to July 23rd, but was absent during June. "It was abundant during the first half of May. Specimens taken up till the end of April had medusa-buds upon the stomach. In May gonads were developing round the stomach. In July either gonads or medusa-buds were present on the stomach, so that there was a mixture of adults and intermediate stages." — Also found at Millport in June, by Hartlaub (1911, p. 233).

East coast of Scotland: St. Andrews, from March to June (*Lizzia octopunctata,* McIntosh 1890, p. 298; Crawford 1895, p. 257). In 1888, according to McIntosh, the species disappeared in the first half of June, but reappeared at the surface in August (?). — Off Firth of Forth, August 14th 1872, at the surface (Schultze 1875, p. 137).

Shetland Islands: In the bays of the eastern and western coasts (*Lizzia octopunctata*, Forbes 1848, p. 64). Lerwick in June and July (Hartlaub 1911, p. 233).

In the International Plankton Bulletins for 1908—1911, *Rathkea* is recorded from the Channel in August 1908, from Ireland in November 1908, May 1910 and 1911, and August 1911; in previous bulletins it is noted from the Channel, the Bristol Channel, south of Ireland, and the Irish Sea, everywhere found in May (Kramp 1913a, p. 524 and Pl. XCV).

Southern North Sea: Ostende, abundant in spring (van Beneden 1867, p. 94). — Borkum Reef, May 23rd 1910, in great abundance, with much developed gonads; off the island Sild, May 30th 1894 (Hartlaub 1911, p. 232). Heligoland, from January or February until May (Böhm 1878, pp. 129 and 133; Hartlaub 1894, p. 191 and 1911, p. 232).

Denmark: Found everywhere from the North Sea to the western part of the Baltic; appears in winter, December—February; increases greatly in number until it reaches a well-marked maximum in April—May; after that time almost only mature specimens are found; the species usually disappears in May or in the beginning of June, but may occasionally be met with in July (Johansen & Levinsen 1903, pp. 279 and 290—291; Hartlaub 1911, p. 232; Kramp 1913a, p. 524; Kramp 1915; material in the Zoological Museum of Copenhagen, hitherto unpublished).

Norway: In Kristianiafjord and near Risör at the Norwegian Skagerrak coast, in March and April (Broch 1905, p. 6; Sverdrup 1921, p. 21). — Common all along the west coast of Norway until Vardö at the extreme north-east point, mainly occuring in the fjords, but also found in the open sea; the medusa usually appears in March, is the most abundant in May, disappears in June or July; also found once in November, near Bergen (M. Sars 1835, p. 29, Browne 1903, p. 15; Hartlaub 1911, p. 231; Kramp & Damas 1925, p. 271).

Barents Sea: Common in the western part, mostly in the fjords and in considerable depth; in the eastern part it may also be found far out at sea and close by the surface (Linko 1904 b, p. 216). — "It has been found in the Barents Sea, but only in August. In 1903 it was very rare; in 1904 it occurred in the western part of the area, even up to . . . Lat. 75° N.; in 1906 it was very numerous throughout the whole of the Barents Sea" (Kramp 1913a, p. 524 and Pl. XCV). — Matotschkin Scharr, July (Hartlaub 1911, p. 232).

White Sea: Abundant in summer (Wagner 1885, *Lizzia blondina*, p. 73, Taf. III, figs. 2—5; *Bougainvillea superciliaris*, p. 73—74; the figures 5, 6, and 7 on Taf. II are evidently mature specimens of *Rathkea octopunctata*, whereas the other figures, Taf. II, figs. 8—17 and Taf. III, fig. 1, are figures of *Bougainvillia*. — *Cytacis octopunctata*, Linko 1900, p. 152, Pl. fig. 2. — Schlater, see. Hartlaub 1911, p. 232).

Faeroe Islands: Hitherto only found in Trangisvaag on Syderö in May (see above, loc. 14—16).

Iceland: Abundant in the fjords on the north-west and north coast, where it is found in June and July; at this time about half of the individuals are budding, the others being sexually mature. In Möfjord on the east coast (loc. 5) numerous individuals were found as late as August 11th, and they were all budding, thus less developed than the specimens found in an earlier season at the north-west and north coast. This is in perfect agreement with the fact that the east coast, being washed by the polar current, is colder than the north coast, so that the time of development of *Rathkea* coincides with that known from other arctic regions.

West coast of Greenland: Partly in the southern part, near Frederikshaab, partly in and about the Disco Bay. Only two dates of capture are known, July 2nd and August 18th.

East coast of North America: Fogo Island, Newfoundland, July; Massachusetts Bay February—June; Woods Hole region April—August; Newport, Rhode Island February—June; (Bigelow 1909, p. 306, and 1914, pp. 9—10).

Bermuda Islands: May and June (Fewkes 1883, p. 79).

Pacific: Dutch Harbour in May, at the surface (Bigelow 1913, p. 11). Japan: Misaki, Hamana Inlet, Omura Bay, common in winter (*Lizzia shimiko*, Kishinouye 1910, p. 25).

Summary:

Rathkea octopunctata is a northern-boreal species. Apart from a few localities in the Black Sea and the Mediterranean, the European area of distribution extends from the Atlantic coast of France to Novaya Zemlya and the north coast of Iceland; it has not been found at Spitzbergen as yet. In the western Atlantic it is distributed from Newport in North America to Disco Bay in Greenland. — In the boreal parts of the Atlantic area it mainly occurs during the spring, but in arctic regions during the summer. All records from England, Ireland, southern North Sea, and the Danish waters agree that the medusa appears in January or February, increases in number during the following months, and disappears in May or June. On rare occasions single individuals have been found at other seasons. It is beyond doubt that the medusæ of this species are destroyed in May—June, when the breeding is completed; further that the polyps (hitherto unknown), which are the outcome of that breeding, normally liberate their young medusæ in the middle of the winter. When single specimens of the medusa are occasionally found in the autumn, they are certainly not to be regarded as retarded individuals belonging to the medusa-generation of the same year, but as individuals liberated very early from their hydroid polyps, thus belonging to the new generation, most members of which do not appear until later on during the subsequent winter. — The seasonal occurrence seems to fall somewhat later at the coasts of Scotland than in more southerly parts of the British coasts, and according to the records at hand, the duration of the pelagic period seems to be somewhat longer (see above). The statement by McIntosh, quoted above, concerning the occurrence at St. Andrews, seems to me, however, very peculiar, and I cannot suppress a doubt of the correctness of the identification (did the specimens from August belong to *Lizzia blondina*?). — At the southern part of the west coast of Norway the species occurs during the spring, towards the north the occurrence is gradually retarded. In the Barents Sea the medusa is found in July and August, as also at the west coast of Greenland. At the coasts of Iceland mature specimens are found at the north coast in June—July, whereas on the colder east coast the individuals are still budding in August. — Within one and the same area the development of the medusa (the velocity of the budding and the time when it ceases) is dependent on the actual temperature of the water, the budding being accelerated and ceasing earlier, when the temperature is comparatively high, than when it is low. I have been able to state this fact on examining Danish material.

Family **Tiaridæ.**

Genus **Paratiara** Kramp & Damas.

Paratiara digitalis Kramp & Damas.

(Chart XI).

Hartlaub (1913) with full right points out the difficulty of determining which genera of the Tiaridæ are to be regarded as the most primitive. Inferior stages of the phylogenetic development may be recognizable, either on the gonads being smooth and simple, or on the likewise simple mouth rim, or on the lacking of the socalled mesenteries. In the genus *Protiara* Haeckel all these primitive characters are united, and the species of this genus are further distinguished by having only four (perradial) tentacles. In the genus *Merga* Hartlaub the mouth rim is also simple, four-lobed, and the gonads have a smooth surface, but the perradial edges of the stomach are in all their length connected with the radial canals (thus mesenteries are present, but shortened in vertical direction). On the other hand, in *Halitholus* Hartlaub the gonads are greatly developed (folded in a rather complicated manner), the mouth rim at any rate somewhat folded, but mesenteries lacking. The genus *Paratiara* was established by Kramp & Damas (1925, p. 274) and is characterized in the following way: Tiaridæ with smooth, interradial gonads, mouth opening with four simple lips, mesenteries well developed, four perradial tentacles with abaxial spurs. In the species *Paratiara digitalis* the manubrium is cross-shaped in transverse section, with deep interradial creases, and the manubrium is twisted, the perradial borders all curving to the same side. The genus resembles *Protiara* in having only four tentacles, the gonads being simple and smooth, and the mouth lips simple; it is at the same time distinguished from *Protiara* in the perradial borders of the manubrium being rather extensively connected with the radial canals, and in the tentacles being provided with well-developed abaxial spurs.

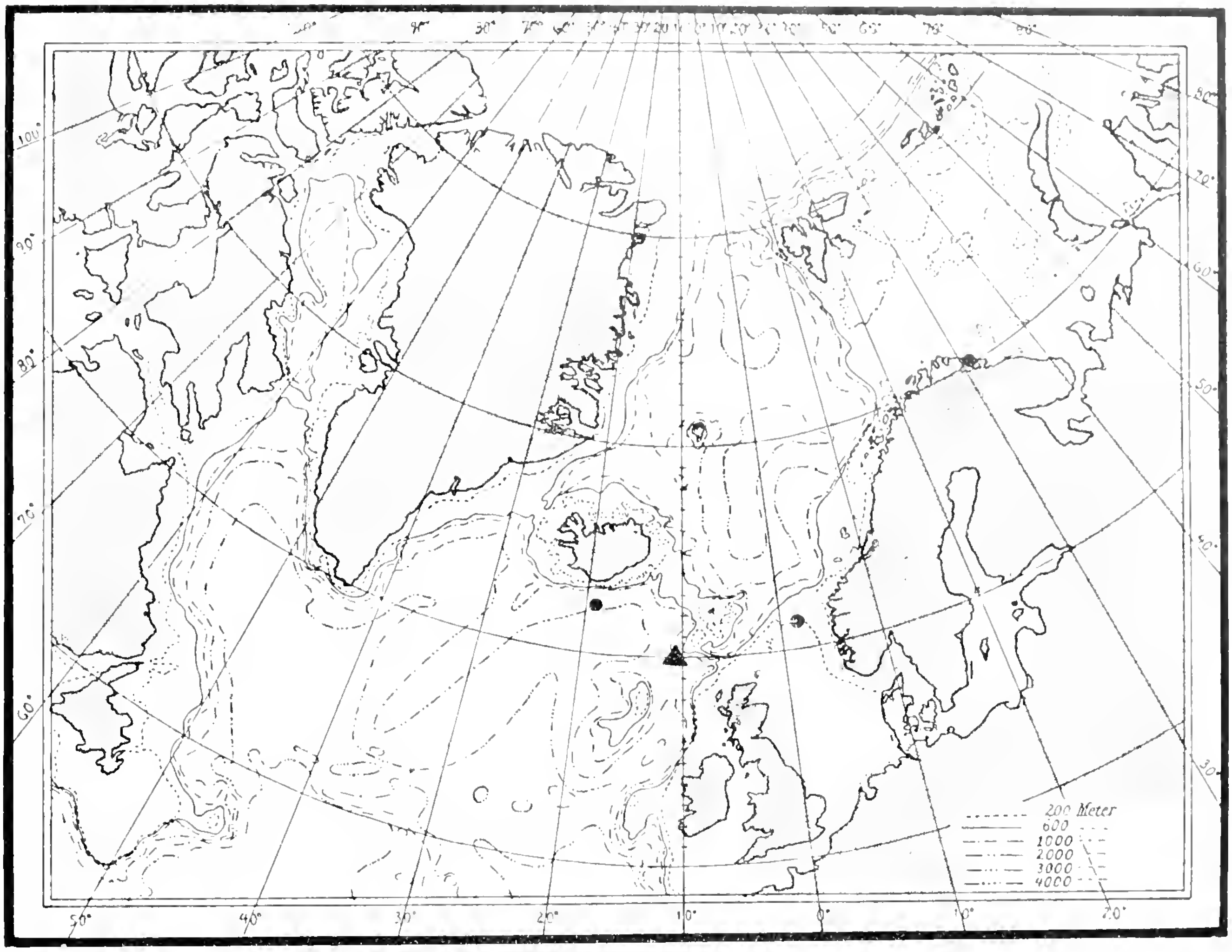

Chart XI. ● Occurrence of *Paratiara digitalis* Kramp & Damas. ▲ Occurrence of *Tiaranna affinis* Hartlaub in the North Atlantic.

Material (see Chart XI):

1) — Lat. 62°42′ N., Long. 18°53′ W., south of Iceland. July 11th 1904. Depth 1340 m. Young-fish trawl, 25 m wire. "Thor" stat. 184 (04). — 3 specimens, height of the bell 7—8—10 mm.

2) — Lat. 61°14′ N., Long. 1°19′ E., between Shetland Islands and Norway. July 21st 1905. Depth 160 m. Young-fish trawl, 25 m wire. "Thor" stat. 120 (05). — 1 specimen, height 10 mm.

Further distribution:

Near Vardö, the north-eastern point of Norway, July 31st 1907, surface (Kramp & Damas 1925).

All the specimens known till now of this medusa were found in July near the surface of the water. Although it has been found at Vardö in arctic Norway, it would not be right to state it as an arctic form. The finds south of Iceland and north-east of the Shetland Islands show that it would be more correctly termed a Gulf-Stream form. Neither is there anything to prevent its being carried by this current to the northernmost part of Norway in summer time. On account of these few finds, however, no definite statement can, of course, be given as to the zoogeography of this species.

Genus Tiaranna Hartlaub.

Tiaranna rotunda (Quoy & Gaimard).

In the course of later years I have repeatedly had the opportunity of studying this morphologically and systematically as well as zoogeographically interesting medusa. I gave a new description of it in my treatment of the Anthomedusæ and Leptomedusæ from the "Michael Sars" Atlantic Expedition in 1910 (Kramp 1920a, p. 6, Pl. I, figs. 2—4), and in Kramp & Damas (1925) there is another description based on notes taken down by Damas while investigating newly collected material from Norwegian fjords. One of the most characteristic features of this species are the small dwarf tentacles, in structure much recalling the marginal clubs (cordyli) in the Laodiceidæ among the Leptomedusæ (further dealt with in Kramp 1919).

Since this species was described from the Straits of Gibraltar by Quoy & Gaimard (1827, p. 181, Pl. 6A, figs. 1—2, *Dianæa rotunda*) it has been found several times in the same locality and its nearest neighbourhood (Haeckel 1879, p. 57; Maas 1910, p. 8; Kramp 1920a, p. 6; Kramp 1924, p. 5), but it also occurs in northern seas. Hartlaub (1913, p. 266) found a young specimen in the northern part of the North Sea; Damas has taken it in Hjörundfjord, one of the deep fjords on the west coast of Norway (Kramp & Damas 1925, p. 275); in the same paper it was stated that "*Rotundula brochii*" Hartlaub from the Trondhjem fjord (Hartlaub 1917, p. 411) is identic with *Tiaranna rotunda*. Finally I have found it myself in rather large numbers in deep water (650 m) in the Skagerrak.

Tiaranna affinis Hartlaub.

Plate I, figs. 15—17. Chart XI.

This species was described by Hartlaub (1913, p. 269) according to some specimens, treated with osmic acid, from the "Michael Sars" Atlantic Expedition in 1910. The collection of Tiaridæ from this expedition was placed at the disposal of Hartlaub for the "Nordisches Plankton", before it was sent to me to be worked out. In the material were, however, left by mistake three specimens in rather good condition which had not been sent to Hartlaub. By means of these three specimens I was able to correct and supply Hartlaub's description on a few points, and to give a new figure of a better preserved individual (Kramp 1920a, p. 6, Pl. I, fig. 1). In the Zoological Museum of Copenhagen there is one more specimen from the northern Atlantic Sea. It is fairly well preserved, and after having examined this specimen, I can fill out the last gap in the description of the species. In the specimens from the "Michael Sars" all the tentacles were broken off; I was, however, able to state (1920a) that two series of tentacles had been present, about 32 large tentacles alternating with as many small; but as to their form nothing could be said. In the North-Atlantic specimen some parts of the bell margin are so well preserved that the possibility of describing the marginal organs is now at hand.

The specimen is 14 mm in diameter and has 30 fully developed tentacles. On Plate I, fig. 17 part of the bell margin is figured, seen from the exumbrella. The exumbrella jelly is continued some way below the circular canal, thus forming a sort of false bell margin; somewhat upwards on the inner side of the bell the circular vessel is situated, from which the tentacles issue. The tentacular bulbs are rather strongly laterally compressed, the adaxial border convex; with the abaxial border they are attached to the inside of the descending part of the exumbrella, not however clasping the free margin with a hook or spur, as for instance in *Leuckartiara octona*. The tentacles are gradually tapering outwards, and judging from their appearance in this state of conservation and contraction, they may attain a considerable length when fully extended. Alternating with these fully developed tentacles we find just as many rudimentary ones. They are however somewhat differing in degree of reduction. Plate I, fig. 16 represents a side view of a rudimentary tentacle in a rather advanced degree of development (the same as figured in fig. 17, the farthest to the right); it will be seen that it has still kept a quite small, tapering, filiform part; from the base of the rudimentary bulb, on the abaxial side, a small prolongation, nothing more than a narrow streak of thickened ectoderm, extends some way outwards on the exumbrella. This prolongation may be much longer, almost grasping round the inferior curving border of the exumbrella (Pl. I, fig. 15); it may be designated as some sort of abaxial spur. Most of the secondary tentacles are still more rudimentary, looking like that on fig. 15 and the two in the middle of fig. 17, the filiform part being reduced to a diminutive conical or knob-shaped projection, close to the circular vessel. These organs evidently are strongly reduced tentacles having kept their attachment to the exumbrella as the last remnant of their original tentacle form. Special attention must be called to the fact that there is nothing in the structure of these rudimentary tentacles recalling the cordylus-like dwarf tentacles in *Tiaranna rotunda*. The primary tentacles also greatly differing in the two species, it is probably incorrect to refer them both to the same genus. As emphasized by Hartlaub a natural grouping of the genera and species belonging to the Tiaridae is however extremely difficult, and I shall not commence a revision in separating genetically the two species of *Tiaranna*. It is also very uncertain, how much systematic value we may apply to the cordylus-like dwarf tentacles in *Tiaranna rotunda*, as corresponding organs of quite similar fundamental structure are found in *Bythotiara* (see Kramp 1924, pp. 12 ff.).

Material (see Chart XI):

Lat. 60°00′ N., Long. 10°35′ W., between the Faeroe Bank and the Rockall Bank. August 29th 1905. "Thor" stat. 165 (05). — 1 specimen, diam. 14 mm.

The above locality is considerably farther to the north than the two localities from which the species was known hitherto, *viz.* Lat. 48°29′ N., Long. 13°55′ W., south-west of Ireland, and Lat. 46°58′ N., Long. 19°06′ W., between Ireland and the Azores. In these two places althogether 7 specimens were found in July 1910. They were caught by the young-fish trawl with 300 m wire out; unfortunately we do not know the depth, in which the specimen of the "Thor" was captured, but the finds of the "Michael Sars" demonstrate, that the species is not a deep-sea medusa; it is, therefore, quite possible that the frequency of the species decreases northwards, and evidently it is not common off the northern parts of the British Isles, neither further north towards Iceland, as it has only been found this single time by the "Thor" and was never found at all during the interesting cruise of the "Armauer Hansen" in 1913.

Genus Amphinema Haeckel.

Amphinema dinema (Péron & Lesueur).

Syn. *Amphinema titania* Haeckel 1879.

The general shape of this little characteristic medusa recalls a young *Leuckartiara octona*; it has only two large, opposite tentacles and a number of tenon-like rudiments, usually about 5 in each quadrant besides one in each of the two perradii destitute of real tentacles. In the fully extended tentacles the nematocysts are seen to be collected into roundish groups, which form together a unilateral line running in an open spiral down the surface of the tentacle, just as in *Leuckartiara octona* which shall be described below. — I found several specimens of this medusa at Plymouth in May 1914. One of these specimens shows a curious abnormity: one of the two non-tentaculiferous radial canals, which ought to open into the circular vessel midway between the two large tentacles, takes a wry direction and communicates with the circular vessel close beside one of the tentacles.

Material:

1) — 2 miles E.S.E. of Balta Sound, Shetland Islands. May 23rd 1906. "Michael Sars" stat. 198 (06). — 3 specimens, 3½—4 mm high.

2) — Lat. 60° 38' N., Long. 2° 35' E., between the Shetland Islands and Norway. June 28th 1906. "Michael Sars" stat. 291 (06). — 4 specimens, 2½—3 mm high.

These specimens are in the collections of Bergen's Museum.

Further distribution: British coasts from the Channel to the Shetland Islands. Possibly also in the Mediterranean and off the east coast of North America (Hartlaub 1913, pp. 261—262).

Genera *Halitholus*, *Leuckartiara*, *Neoturris*, and *Catablema*.

When I worked out the medusæ from the "Tjalfe" Expedition (Kramp 1913b), Hartlaub's excellent revision of the Tiaridæ in the "Nordisches Plankton" had not yet been published, and when my catalogue of the Greenland medusæ was printed in the "Conspectus Faunæ Groenlandicæ" (Kramp 1914), Hartlaub's paper had not yet come into my hands. As to the identification of the species of Tiaridæ I was, therefore, mainly dependent on Haeckel's monograph (1879). The identification of the species of Tiaridæ in my two papers, mentioned above, therefore wants a thorough revision. In the following the finding places of the species will be mentioned, according to the revision which I have now been able to carry out by means of Hartlaub's work. Some of the Tiaridæ, identified by me, were sent to Hartlaub for investigation on his special wish, and on these specimens Hartlaub has given his opinion in his "Anhang" or Addenda (1917), also putting forth different suppositions concerning other Tiaridæ of the "Tjalfe" Expedition. To these new identifications and suppositions I shall make the following remarks:

Hartlaub's supposition that the specimens ("Tjalfe" stat. 502) referred by me to "*Tiara conifera*" do belong to *Halitholus cirratus*, turns out to be correct.

Two of the specimens, identified by me as "*Tiara pileata*", have been referred by Hartlaub to *Leuckartiara breviconis*, yet with a? for the small specimen. The large individual (from Julianehaab, "Tjalfe" stat. 583) no doubt belongs to *L. breviconis*; on the other hand, I cannot recognize the small specimen (from Frederikshaab, "Tjalfe" stat. 519) as a young individual of that species; it is most certainly an adult *Halitholus pauper* (see below).

Hartlaub correctly identifies the two Haeckelian species *Catablema campanula* and *eurystoma* with *C. vesicarium* A. Agassiz. Hartlaub has not expressed any doubt of my identification (in 1913) of the two Haeckelian *Catablema*-species as really belonging to that genus, especially to the species *C. vesicarium*, and therefore none of the specimens were, unfortunately, sent to him for revision. It turns out that the greater part of the material really does belong to *C. vesicarium*; still some few specimens of *Halitholus pauper* and *cirratus* are interspersed, and most of the individuals from Julianehaab ("Tjalfe" stat. 583) belong to *Catablema multicirrata* Kishinouye, a species which is now for the first time stated from the Atlantic area.

I very much regret not having waited for the publishing of Hartlaub's revision of the Tiaridæ, which I did not know would appear so soon; several annoying erroneous identifications would thus have been avoided. I do, however, trust that no great harm is done; every medusologist knows that any specific identification of Tiaridæ, published before Hartlaub's important revision of the group, must be regarded with due reservation, and is sure to contain mistakes.

Genus **Halitholus** Hartlaub.

Halitholus pauper Hartlaub.

Plate II, figs. 1—3. Chart XII.

Remarks on the morphology. — I shall only add a few remarks to Hartlaub's description of this species (Hartlaub 1913, p. 272). As pointed out by Hartlaub, the gonads are of the *Leuckartiara* type with a conspicuous horseshoe fold from which ridges are radiating towards the perradii as well as upwards towards the dorsal side of the stomach. The base of the stomach is cruciform. There are no lateral mesenteries, but the dorsal wall of the stomach is attached to the subumbrella along the borders of a large perradial cross, the arms of which reach to the upper ends of the lateral, perradial borders of the stomach (Plate II, fig. 1). Seen from above the area of attachment is, in a way, cross-shaped, but the arms of the cross are very broad in their proximal part, quickly tapering distalwards; the folds of the interradial stomach-walls proceed, however, almost to the middle of the stomach below the area of attachment (see the figure). — The tentacular bulbs are not laterally compressed as in *Leuckartiara*, but are broad, conical or somewhat bulbous. Hartlaub's figures and description do not give quite a correct impression of the shape of the tentacular bulbs; these are not constricted in their proximal, basal part, but possess a broad, round base (Plate II, fig. 2), connected in the adaxial side with the circular vessel and, in the case of the four perradial tentacles, with a small dilatation of the radial canal; the base of the bulb expands outwards on the thick inferior border of the umbrella, and on the abaxial side it has a faint indication of a pointed spur. The tentacles are able to coil themselves spirally, and their nettle armature is arranged in fine and dense transversal wrinkles. In certain states of contraction a number of deep transversal folds are observed in the adaxial side of the distal part of the tentacle (see Plate II, fig. 3, and compare *Leuckartiara*).

As described by Hartlaub, there are 8 marginal tentacles: 4 large perradial and 4 somewhat smaller interradial; in each of the adradial spaces between the tentacles there are 1—3 very tiny rudiments, undoubtedly never developing into tentacles; in any case, no indication of such development is present in the material examined by me.

From Holstensborg in Greenland (see below, loc. 3) we possess a number of young specimens, smaller than any of the smallest individuals examined by Hartlaub; like these latter they are by Levinsen referred to "*Tiara conifera*". The smallest of these individuals have a bell 1.8 mm high; two opposite tentacles are large but not equal; the third perradial tentacle is much smaller, and the fourth has only just begun developing. The four interradial tentacles are visible as tiny rudiments. In two individuals, 2 mm high, four tentacles are developed; two opposite ones are very large, compared with the size of the animal, and somewhat different; the two others are much smaller and likewise of unequal size. A specimen 2.5 mm high has four tentacles, all differing in size. From this it becomes evident that two opposite tentacles are developed the first, one of which may be more advanced in development than the other; probably the medusa is hatched with only these two tentacles. At a bell height of nearly 2 mm, first the third and then the fourth of the perradial tentacles are developed. The first tiny rudiments of the four interradial tentacles are established simultaneously, but do not begin developing until the medusa has become 5 mm high.

The largest of the individuals examined by Hartlaub were 10 mm high. From Dyrefjord in Iceland (see below, loc. 8) a somewhat larger specimen is at hand, height 12 mm (of which apical cupola 6 mm), diam. 11 mm. At this size the interradial tentacles are still much smaller than the perradial. In each of the adradial intervals there are the usual three tiny rudiments, the median one being, however, in this large specimen a little larger than the two others.

Material (see Chart XII):

West coast of Greenland:

1) — Egedesminde. Traustedt. — 14 specimens, 5—10 mm high by 5—9 mm wide (the type specimens of Hartlaub).

2) — Lat. 67°22′ N., Long. 56°14′ W. July 7th 1908. Ringtrawl, 0—100 m wire. "Tjalfe" stat. 105b. — 5 specimens, 3—5 mm wide.

3) — Holstensborg. Traustedt. — 10 specimens, 1.8—3.0 mm high by 1—2 mm wide.

4) — Mouth of Bredefjord. July 21st 1909. Ringtrawl, 100 and 125 m wire. "Tjalfe" stat. 544. — 11 specimens, 4—7 mm wide.

5) — North of Frederikshaab. July 2nd 1909. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — Numerous specimens, 4—8 mm wide.

6) — Harbour of Frederikshaab. July 8th 1909. Ringtrawl, surface. "Tjalfe" stat. 519. — 9 specimens, 5—8 mm wide.

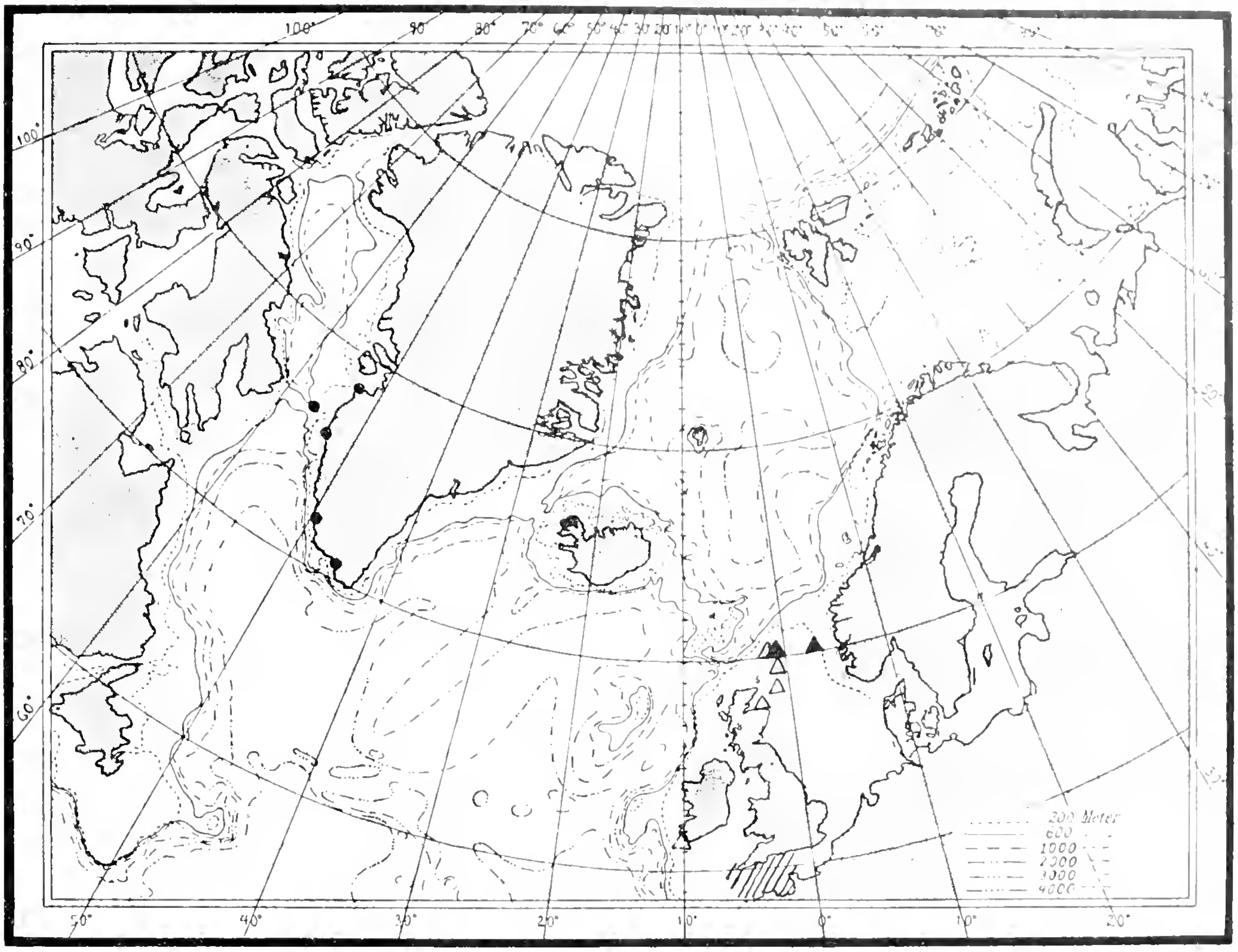

Chart XII ● Occurrence of *Halitholus pauper* Hartlaub. ▲ Finds of *Amphinema dinema* (Péron & Lesueur). △ and hatching: Occurrence of *Amphinema dinema* according to the literature.

Iceland:

7) — Hesteyrifjord, N.W. Iceland. June 25th 1902. Surface. "Diana", A. Ditlevsen. — 1 specimen, 6 mm high by 5 mm wide.

8) — Dyrefjord. May 30th 1895. "Ingolf" Exped. — 3 specimens, 8—12 mm high by 8—11 mm wide.

The specimens from Iceland are typical in every regard; they are the only specimens as yet found outside the waters of western Greenland. — The species occurs along the west coast of Greenland from Frederikshaab in southern Greenland to Egedesminde at the entrance to the Disco Bay. Most individuals are found near the coast or in the fjords. Exact statements of the temperature of the water are not at hand from the localities in which the medusa was found by the "Tjalfe" Expedition. Not far from stat. 502 (North of Frederikshaab, loc. 5) the following temperatures were measured: in 100 m ÷ 0°13; in 50 m 0°42; at the surface 3°14. The surface temperature has probably been about the same in the Harbour of Frederikshaab, where the medusa was found at the surface (loc. 6). In Bredefjord (loc. 4) the medusa was found 50—75 m below the surface; the temperatures were: in 25 m ÷ 0°10, in 150 m 0°05. As to the open sea, the species has only been found in one, northerly locality (loc. 2), in a region where the cold coastal current bends westwards towards Baffin Land. Thus the medusa seems to be an inhabitant of the cold water of the coastal region. — All Greenland finds, of which dates of capture are at hand, have been made in July, and young as well as full-grown individuals have been found.

Halitholus cirratus Hartlaub.

Plate II, fig. 4. Chart XIII.

Syn. *Tiara pileata* auctorum, partim.

This species is thoroughly described by Hartlaub (1913, pp. 274 ff.), who also figures a number of variational and developmental forms of the gonads. The present drawing (Plate II, fig. 4) has been made after an exceptionally well-preserved specimen from Nyborg in the Great Belt, Denmark. On board the floating laboratory of the "Danish Biological Station" there is a "pond", a fairly large water-reservoir, which is in direct connection with the sea through a number of holes in the side of the boat. Great shoals of medusæ sometimes appear in this reservoir, whence they easily may be picked up by means of small glass bowlers and carefully fixed without having been squeezed and damaged in a plankton net. Very fine specimens may be obtained in this manner, and the specimen of *Haliotholus cirratus*, figured on Plate II, is one of those. It is 9 mm high (whereof the apical mesogloea 4 mm) and 9 mm in diameter, thus not quite full-grown, as the medusa may attain a size of 16 mm in height and 14 mm in diameter; much larger specimens than the one figured here are, however, rare in the western part of the Baltic, though they are quite common in the cold, deep water of the Baltic proper. — The specimen has a distinct stomachal peduncle. The gonads are not fully mature; they are provided with 3—4 pairs of lateral transversal folds and a distinct, though not very conspicuous, horse-shoe fold ("Leuckartiara-fold"). There are 22 well-developed tentacles of somewhat different size, and 3 small rudiments. The order in which the tentacles are developed seems to be rather irregular in this specimen as well as in others which I have examined. As demonstrated by Hartlaub, the very young medusa has two opposite tentacles; later on the two other perradial tentacles are developed, and then the four interradial; afterwards the development is rather irregular; it is not even certain that four interradial tentacles are always developed immediately after the four perradial. — As will be seen from the figure (Plate II, fig. 4) the tentacles are very long and may be spirally coiled. The tentacular bulbs are not very conspicuous; the bulb is laterally compressed and provided with a short abaxial outgrowth, attached to the somewhat down-hanging border of the exumbrella (see the figure). The surface structure of the tentacle recalls that in *Leuckartiara octona*, being provided with fine transversal wrinkles which are branched and more densely crowded on the abaxial than on the adaxial side; in *Halitholus cirratus* I have not observed such deep transversal folds in one side of the tentacles as in several other species of Tiaridæ.

Material (see Chart XIII).

West coast of Greenland:

1) — Mouth of Bredefjord. July 21st 1909. Ringtrawl, 100 and 125 m wire. "Tjalfe" stat. 544. 1 specimen, 8 mm high by 6 mm wide.

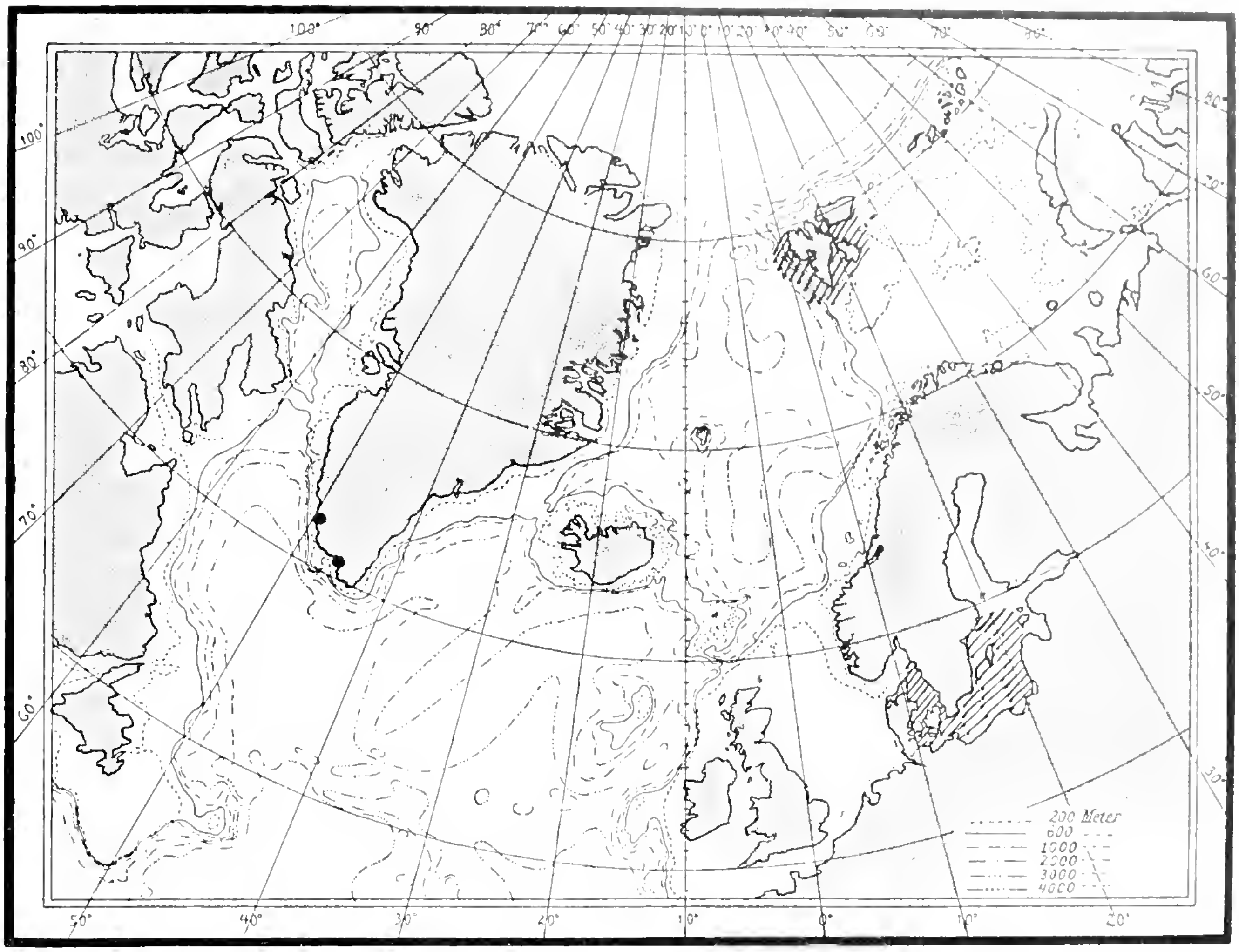

Chart XIII. ● Finds of *Halitholus cirratus* Hartlaub. ○ Occurrence according to the literature. In the hatched regions the species is commonly occurring.

2) — North of Frederikshaab. July 2nd 1909. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 11 specimens, 6—8 mm high by 5—7 mm wide.

Further distribution: Spitzbergen and Barents Sea (Hartlaub). — Baltic and Kattegat (Hartlaub 1913 and Kramp). — Collinson Point, Camden Bay, north coast of Alaska, September—October, under the ice (Bigelow 1920, p. 7).

Halitholus cirratus is an arctic medusa. It is very common at Spitzbergen, where it is found in June, July, and August, more sparingly occurring in the Barents Sea. In the present paper it is for the first time recorded from the west coast of Greenland, where it seems to be rare. In the deep, cold basins of the Baltic it is an arctic survivor; it is very abundant and occurs throughout the summer. It is somewhat less common in the Danish Belts and in the Kattegat, though it occurs in moderate numbers every spring from February to April; it is very rarely observed in May, because it disappears when the temperature of the water exceeds about 6° C., also hereby revealing its character as a well-marked cold-water species. — The find of a number of specimens, at the north coast of Alaska (Bigelow 1920) shows that the species has a circumpolar distribution.

Genus Leuckartiara Hartlaub.

Leuckartiara octona (Fleming).

Plate II, figs. 5—7. Textfig. 35. Chart XIV.

Syn. *Tiara octona* and *pileata* auctorum, partim.
For further synonymy, see Hartlaub (1913, p. 285).

This medusa has been the subject of careful examination by Hartlaub (1913, pp. 285 ff.); to his thorough description I shall only add some remarks on the structure of the tentacles (see the figures). — The strongly compressed tentacular bulb which is provided with a large, hook-shaped, apical spur, proceeds into an elongated, evenly tapering part with smooth or faintly warty surface, from which it is again smoothly passing into the long, filiform tentacle, which is able to extend itself to an extraordinary length. The elongated conical bulb is usually a little concave on the outer (abaxial) side, thus bending somewhat outwards. When contracted the tentacle is spirally coiled; throughout its length it is provided with a faintly protruding keel on the inner (adaxial) side (Plate II, fig. 5), so that a cross-section becomes somewhat pear-shaped. The figure, Plate II, fig. 6, represents a piece of the proximal part of a tentacle in the second coil. The nematocysts are placed in fine transversal wrinkles. These are not, however, unbroken rings completely encircling the tentacle, but are interrupted in front (on the abaxial side), thus forming some kind of "clasps". In some of these clasps the free ends almost meet in the abaxial median line of the tentacle, while in others the free ends are far from reaching the median line. While running from one side of the tentacle round the hind (adaxial) edge, each of the clasps is divided into a number of branches (2—4) which unite once more on their way towards the front on the other side; there are, accordingly, a much greater number of transversal wrinkles on the adaxial than on the abaxial side of the tentacle. When the tentacle is contracted, the abaxial side is more foreshortened than the adaxial, causing the tentacle to be spirally coiled. — Plate II, fig. 7 represents the middle part of a fully extended tentacle; here the nematocysts are placed in round protuberances, arranged in a single row along one side of the tentacle; on account of the twisting of the tentacle, the line of protuberances forms an open spiral; the effect of this arrangement is that in any contractile stage of the tentacle the nematocysts will lie exposed on the outward turned edge, thus in the most convenient situation for acting up to their destination as protective organs. The endodermal lumen of the tentacle is excentric, placed next to the smooth side, opposite the row of nettle-warts.

Concerning the mode of development of the tentacles, I shall make the following remarks: — As a characteristic feature, in contradistinction to *Leuckartiara breviconis* and *nobilis*, Hartlaub strongly emphasizes the permanently vestigial tentacular rudiments ("rudimentär bleibende Anlage", "Ocellarkolben"). As a specific character this feature is very applicable to *Leuckartiara octona*, but the expression is in some way misleading, because all these rudiments possess the possibility of developing into tentacles, if sufficient time is left for them; they are not rudimentary in the sense that they are reduced tentacles, like e. g. the secondary tentacles in *Tiaranna affinis* (see above), but they are the beginnings of tentacles proper. In accordance herewith, we always find that they have exactly the same appearance in a young medusa, in which the fully developed tentacles are still few in number, as in an old individual with a larger number of tentacles, but all the "rudiments" in the young medusa will in time develop into tentacles. Also in full-grown specimens of the other species of *Leuckartiara* we find tiny rudiments of tentacles, which will hardly reach beyond this juvenile stage before the natural death of the individual. The difference between the species consists in the mode of development. Hartlaub states, in text and figures (fig. 248, p. 300) that in *Leuckartiara octona* the number of rudiments between two successive tentacles varies from 1 to about 8; I will not deny that such a great number may be present, but I myself have never seen more than 3 at a time. Between two successive tentacles we always find at least one small, bud- or club-shaped organ; at a certain moment another of the same kind is developed on each side of the aforesaid, but at the same time the first one starts growing, assuming the appearance of a tiny tentacle; when it has reached a certain size, the same phenomenon is repeated, in so far as a new club-shaped organ appears on each side of the two already present, and so forth. The characteristic feature is that the young budding tentacle remains in an arrested, club-shaped form, until its precedent has reached a somewhat considerable size, and the older the specimen, the slower the development of the tentacles, which will appear from the following observations.

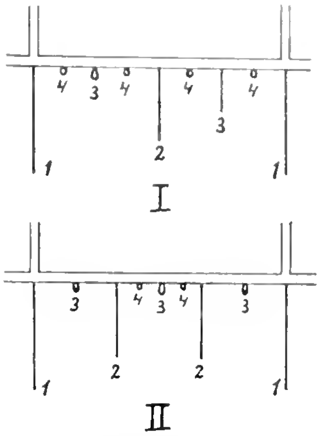

Fig. 35. *Leuckartiara octona.* Diagrams illustrating two different ways of successive development of the tentacles. Diagram I, octagonal development, one of the adradial tentacles (no. 3) still in a juvenile, club-shaped stage. — Diagram II duodecimal development. For further explanation, see the text.

The typical number of tentacles in *Leuckartiara octona* is 16, but in old specimens the number frequently amounts to about 20; Hartlaub states the maximal number to be 28; the largest number observed by me is 23. In younger individuals there is rarely more than one club-shaped rudiment between every two successive tentacles, because that one is quickly developed into a tentacle, as soon as the two next clubs make their first appearance; on the other hand, in older individuals, even if the number of fully developed tentacles does not exceed 16, three successive clubs are frequently found, the median one being only slightly larger than the two others, which means that it remains in an arrested state for rather a long time, and the majority of the clubs never start developing into tentacles; but every particular club bears in itself the same possibility of development as any of the others. It is very possible that, in old individuals, still more club-shaped rudiments may appear between the tentacles, without the preceding ones ever being further developed.

The successive development of the tentacles requires a few words. — At the time of liberation the young medusa is provided with two opposite tentacles which grow to a very considerable length before the two other perradial tentacles begin developing (*Amphinema*-stage). After the four perradial tentacles normally four interradial and then 8 adradial are developed; the latter are, however, usually not developed exactly at the same time. We often find younger individuals with 12 tentacles. In such an individual we find, provided the development is proceeding in the usual, regular manner, that one of the adradial tentacles in each quadrant is still a "club", flanked by a still smaller rudiment on either side (see diagram I, textfig. 35). But a stage with 12 tentacles may sometimes be realized in a different manner (illustrated in diagram II, textfig. 35): no interradial tentacles are developed, but in each of the quadrants there are two equally developed tentacles, nos. 2 in the diagram, dividing the quadrant into three equal parts; in this case the development is duodecimal, while normally it is octagonal. In the middle of each of the three parts of the quadrant appears a club-shaped rudiment of a tentacle of 3rd order, one of which is placed interradially; the latter is usually a little further advanced than the others and flanked by rudiments of 4th order. Later on we shall see that such duodecimal development of the tentacles may also occasionally occur in other species of Tiaridæ.

Number of tentacles in relation to size of individuals. — In the North-atlantic material, which exclusively will be dealt with in the following, the smallest specimens are 3 mm wide (5 mm high). One of these have only 8 tentacles, the four interradial of which are still very small; the other specimens of this size have 12 tentacles. Specimens 5 mm wide (about 7 mm high) usually have 16 tentacles; sometimes the adradial are still small, sometimes all 16 tentacles are almost alike; in specimens of this size I have, however, sometimes found 8 or 12 tentacles. I have never seen a larger number of tentacles than 16 in specimens less than 8 mm in diameter, but in specimens more than 8 mm wide the number is usually larger. As mentioned above, the largest number observed by me is 23, which was found in two individuals, 9 and 11 mm wide (12 and 14 mm high, respectively). The largest specimen examined ("Armauer Hansen" stat. 17, 1913[1]) is 12 mm wide by 16 mm high and has 22 tentacles and 1—3 rudiments between every successive pair of tentacles.

Material (see Chart XIV):

1) — Lat. 63°20′ N., Long. 20°49′ W., south of Iceland. August 31st 1904. Depth 124 m. "Thor" stat. 283 (04). — 8 specimens, 6—9 mm wide.

2) — South of the Myrdalsjökel, Iceland. August 17th 1903. "Michael Sars". — 3 specimens, 8—10 mm wide.

3) — Lat. 63°12′ N., Long. 11°45′ W., south-east of Iceland. August 7th 1904. Young-fish trawl, 20 m wire. "Thor". — 1 specimen, 5 mm wide by 7 mm high.

4) — Lat. 60°55′ N., Long. 8°56′ W., Faeroe Bank. August 12th 1902. Depth 130 m. "Michael Sars". — 1 specimen, 9 mm wide by 12 mm high.

5) — Lat. 57°36′ N., Long. 7°05′ W., west of the Hebrides. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 4 specimens, 3—5 mm wide.

6) — Lat. 57°33′ N., Long. 4°26′ E., North Sea. September 6th 1905. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 172 (05). — 2 specimens, 5—7 mm wide by 7—10 mm high.

7) — Bergen, Norway. August 6th 1911. Th. Mortensen. — 1 specimen, 5 mm wide by 7 mm high.

Geographical distribution. — *Leuckartiara octona* is a very common medusa at the coasts of north-western Europe, especially around the British Isles and in the North Sea area. For details, see Hartlaub (1913, pp. 289 ff.). It enters the Skagerrak and the Kattegat, but is not found in the Belt Sea and the Baltic. It is also common at the southern part of the west coast of Norway, found as far north as Lofoten (Kramp & Damas 1925, pp. 278—279). Hartlaub does not mention it from the Atlantic north of the

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[1] Besides the material in the Zoological Museum in Copenhagen, I have made use of material, previously examined by me, from the cruise of the "Armauer Hansen" in 1913 (Kramp 1926 b) and the Norwegian collections, dealt with in Kramp & Damas 1925.

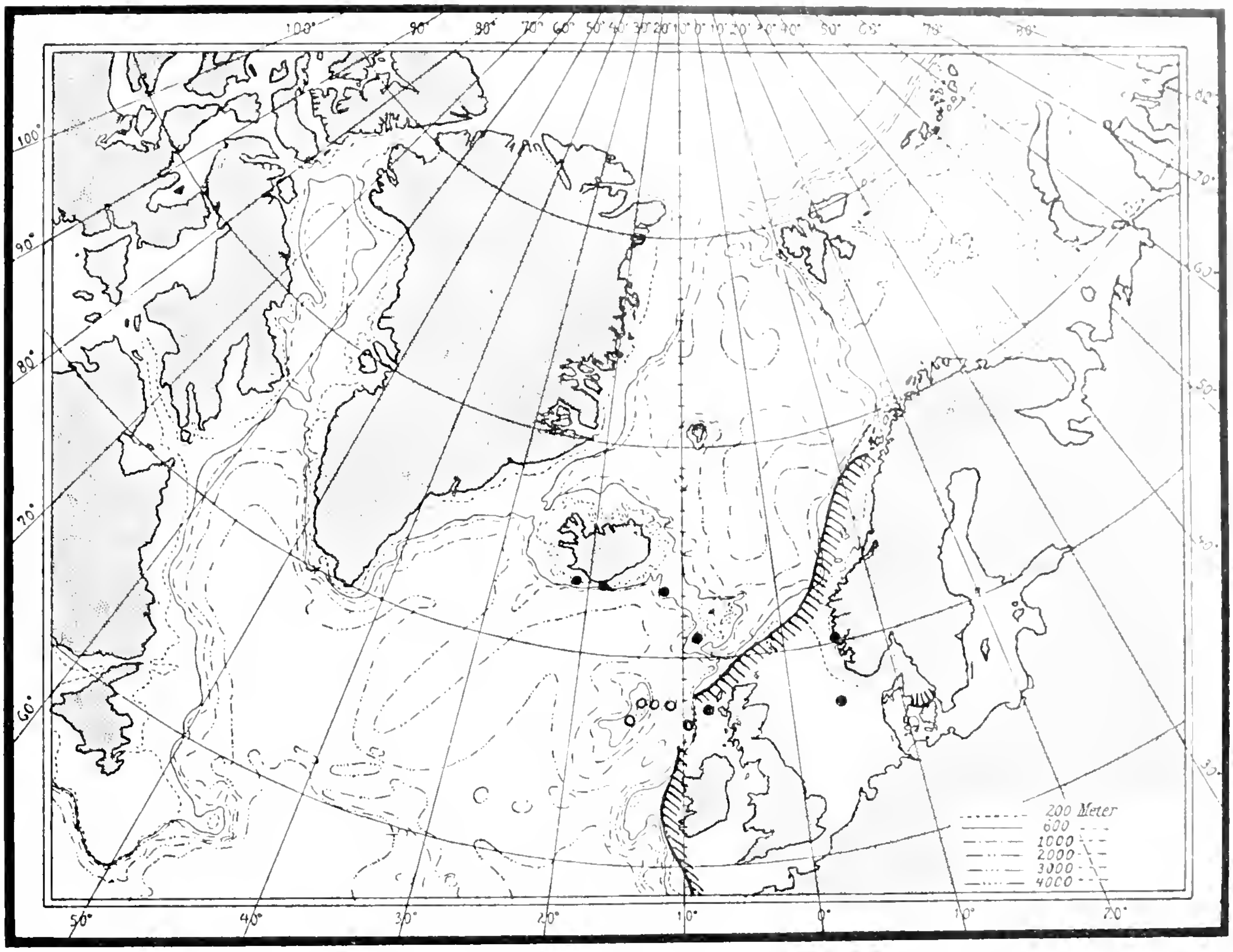


Chart XIV. ● Finds of *Leuckartiara octona* (Fleming). ○ Occurrence in the North Atlantic and adjacent waters according to the literature. Within the hatched lines the species is commonly occurring.

Shetland Islands, but as appears from the above list, it occurs at the southern coasts of Iceland; it is, however, not found at the west coast and the other coasts of Iceland. The hydroid (*Perigonimus repens*) is a littoral form, but the duration of life of the medusa is long enough to allow the animal to be carried rather far out at sea by the currents. Possibly the occurrence at the south coast of Iceland is due to transportation with the Irminger Current. On the cruise of the "Amauer Hansen" in 1913 (Kramp 1920b, p. 3) a number of specimens were found on two of the easternmost stations, in the neighbourhood of Rockall, but the species was lacking farther west in the Atlantic.

At the coasts of northern Europe, *Leuckartiara octona* must be designated as a southern species, sometimes carried by the warm currents (the Gulf Stream and the Irminger Current) into northern-boreal areas, but never into the arctic regions.

The medusa also lives in the Mediterranean (Hartlaub 1913, Kramp 1924) and at the east coast of North America (Hartlaub). According to the latter author, it has been found in various localities in the Pacific and in the Malayan Archipelago.

Seasonal occurrence. — The medusa is found at the British coasts from April or May (young individuals) to October or November. In Danish waters the young individuals first appear in May or June; during the autumn *L. octona* is one of the most abundant medusæ in that region; in certain years a number of individuals may surpass the winter and be observed in the plankton as late as in March or April the next year. At the west coast of Norway the medusa appears in June and occurs at least until November. The specimens from the Faeroe Bank and Iceland were all found in August.

Leuckartiara breviconis (Murbach & Shearer).

Plate II, fig. 8. Chart XV.

Turris breviconis Murbach & Shearer 1902. Ann. Mag. Nat. Hist., Ser. VII, vol. 9, p. 73. — 1903. Proceed. Zool. Soc. London, vol. 2, p. 170, Pl. 18, figs. 1, 2.

Leuckartiara brevicornis Hartlaub 1913. Nordisches Plankton, p. 304. — 1917. "Anhang", p. 410.

Remarks on the morphology. — In this species the gonads are usually somewhat more irregularly folded than in *L. octona* and *L. nobilis*, though they possess the typical horse-shoe fold or "Leuckartiara-fold". The name *breviconis* alludes to the apical gelatinous projection being, as a rule, low and rounded; it may however sometimes be rather conspicuous, though always rounded and domeshaped. The mesenteries may sometimes be rather short, especially in younger individuals, which may then bear a considerable likeness to the species of *Halitholus*, from which they are however recognizable by the broad radial canals, the more complexly folded mouth rim, and the densely crowded marginal tentacles, which are almost always placed in a fairly regular manner, fully developed alternating with small ones. — The tentacular bulbs are strongly laterally compressed, grasping the border of the exumbrella, yet destitute of a true, conspicuous spur as found in *L. octona*. Thus the tentacular bulb resembles that of *Halitholus cirratus*, but in the distal part of the tentacle there are a great many deep transversal folds on the abaxial side (Plate II, fig. 8), which is peculiar, because in other species, which I have examined (*Halitholus pauper*, *Leuckartiara nobilis*, *Neoturris pileata*, *Catablema vesicarium* etc.), similar foldings, if present, are found on the adaxial side of the tentacles. The transversal folds are deep, comprising both ectoderm and endoderm of the tentacle.

Development of the tentacles. — In the material collected by Damas (Kramp & Damas 1925), I have seen a specimen from the Shetland Islands, 5 mm high and wide, with 12 tentacles, like the young specimens of the same size, described by Hartlaub (p. 306); the 12 tentacles are all well-developed, and alternating with them are 12 small tentacular rudiments. The individual is clearly differing from *Leuckartiara octona* of the same size and with the same number of tentacles, partly by the shape of the tentacular bulbs, partly by the tentacular rudiments in *L. breviconis* being larger, and not all of the same size, and besides knob- or cone-shaped, never club-shaped. — Another specimen from Damas's collection is 5 mm high by 4 mm wide and has 16 tentacles: 4 perradial fully developed, 4 interradial of about half their full size, 8 adradial quite small, and besides a few tiny rudiments. As in *Leuckartiara octona*, the successive development of the tentacles in the young *L. breviconis* usually seems to be octagonal, but sometimes duodecimal. The tentacles are developed much more gradually in *L. breviconis* than in *L. octona*, in so far as they are not at any time kept in an arrested state (as the "clubs" in *L. octona*), but each particular tentacle seems to grow quickly, very soon reaching full size; this appears from the fact that in almost every stage of development we find fully developed and quite small tentacles very nearly regularly alternating, some of the young ones however still being in a rudimentary stage; as soon as a young tentacle has reached a certain, somewhat considerable size, a new one appears on either side of it. This regular succession however ceases, when a certain maximal number of tentacles has been reached; in younger individuals many tiny rudiments are found between the tentacles, in older specimens only very few. The largest number of tentacles which I have observed, (in a specimen, 30 mm high, 26 mm wide, from "Thor" stat. 241 (04), see below, loc. 7), is 105, about every second of which are fully developed, the others much smaller but of different sizes, only a few tiny rudiments. The velocity of the development of the tentacles is very variable. I have counted e. g. the following numbers: Diam. 4 mm, 16 tentacles; 5 mm, 12—32 tentacles; 7 mm, 16—46 tentacles; 10 mm, 40—68 tentacles; 11 mm, 38—65 tentacles. The largest individual in the collections examined by me, is 34 mm high and 30 mm wide (same locality as above, loc. 7) it has 89 tentacles, large and small alternating, and only 5 small rudiments, thus apparingly having very nearly attained its maximal number of tentacles. As mentioned above, I have found 105 tentacles in a somewhat smaller individual, and Hartlaub states the maximal number as 140.

Material (see Chart XV).

West coast of Greenland:

1) — North of Julianehaab. August 4th 1909. Ringtrawl, 350 m wire. "Tjalfe" stat. 583. — 1 specimen, 11 mm wide by 13 mm high.

Iceland:

2) — Lat. 64°06′ N., Long. 23°14′ W., Faxebugt. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 2 specimens, 6—10 mm wide.

3) — Lat. 62°43′ N., Long. 20°42′ W., south coast of Iceland. July 9th 1904. "Thor" stat. 179 (04). — 1 specimen, 7 mm wide.

4) — Portland Head, south coast. July 18th 1903. "Thor" stat. 176 (03). — 2 specimens, 11—17 mm wide by 11—22 mm high.

5) — Inside the Vestman Islands. July 12th 1904. "Thor". — 4 specimens, 16—23 mm wide.

6) — Myri Bay. August 2nd 1904. "Beskytteren", Gemzöe. — 2 specimens, 16—20 mm wide.

7) — Lat. 64°35′ N., Long. 11°45′ W., east of Iceland. August 8th 1904. Depth 348 m. "Thor" stat. 241 (04). — 6 specimens, 21—30 mm wide.

British Isles:

8) — East of Rockall. July 28th 1913. Depth 1860 m. 150 m wire. "Armauer Hansen". — 1 specimen, 13 mm wide by 15 mm high (apical jelly 8 mm). — This specimen is in Bergen's Museum.

9) — Lat. 57°36′ N., Long. 7°05′ W., west of the Hebrides. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 4 specimens, 4—7 mm wide.

10) — Lat. 59°00′ N., Long. 3°34′ W., Orkney Islands. May 21st 1908. Depth 66 m. Surface. "Thor" stat. 2 (08). — 2 specimen, one of which is 7 mm wide by 8 mm high.

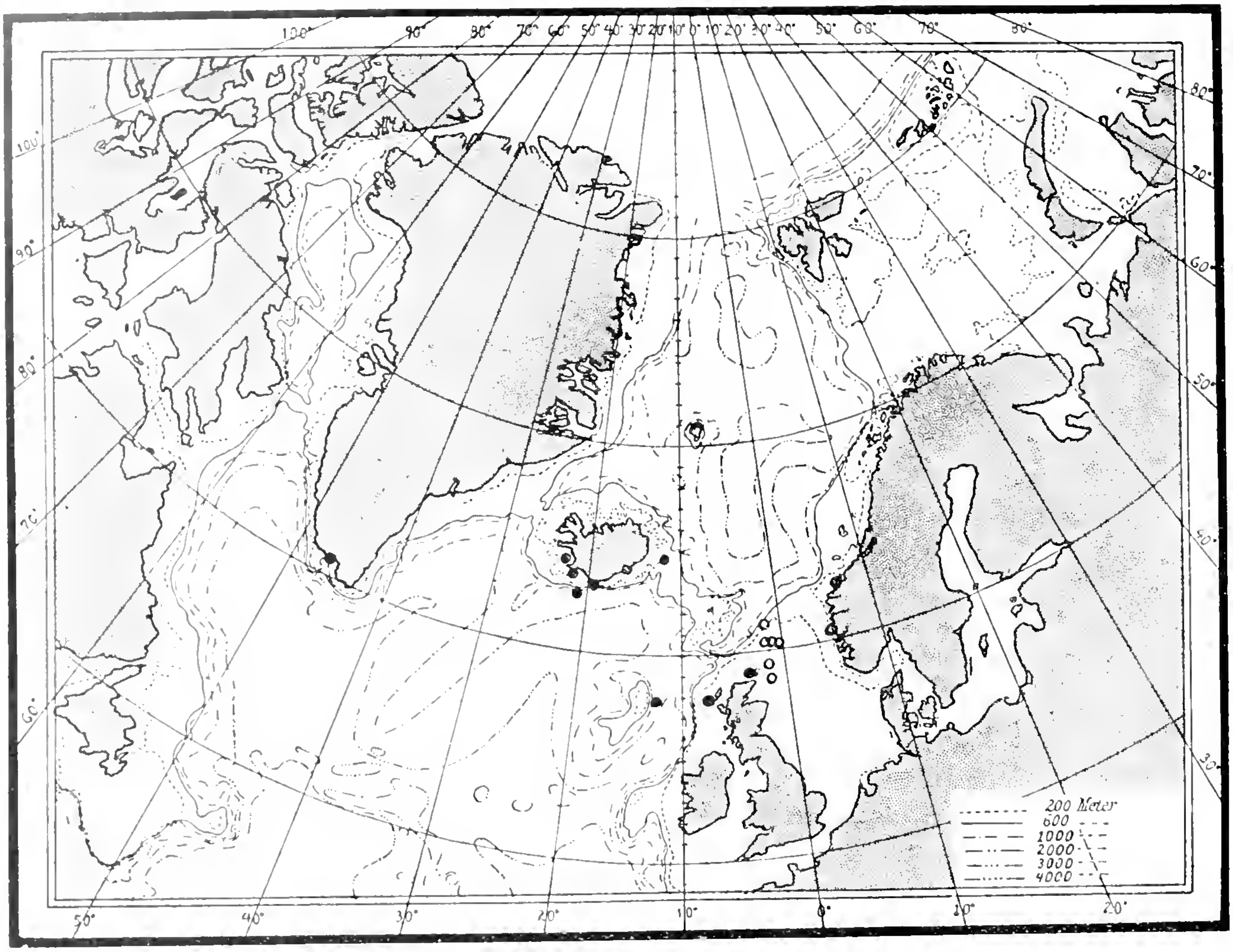


Chart XV. ● Finds of *Leuckartiara breviconis* (Murbach & Shearer). ○ Occurrence in the North Atlantic and adjacent waters according to the literature.

Geographical distribution. — This species was first described from Alaska, by Murbach & Shearer (1902, p. 73). Hartlaub (1913, p. 304) records it from five localities in the northern part of the North Sea from about the north point of Scotland to a little north of the Shetland Islands. Damas has found it at the Shetland Islands and in certain fjords near Bergen and Aalesund in the southern part of the west coast of Norway (Kramp & Damas 1925, pp. 278 and 280). The present material greatly increases the known area of distribution, the species being stated not merely from north and west of Scotland (Orkney Islands, Hebrides, Rockall) but also from several localities at the southern coasts of Iceland and even from southern Greenland (loc. 1).

Seasonal occurrence: — Hartlaub's specimens from the northern part of the North Sea were found in June; one was stated to be a young individual. Damas found young specimens at the Shetland Islands and near Bergen in May, very large specimens near Aalesund in July. The specimens collected by me onboard the "Thor" at the Orkney Islands and the Hebrides at the end of May 1908, were all young. Near Rockall a medium-sized individual was found by the "Armauer Hansen" at the end of July (see above, loc. 8). The specimens from Iceland were all found in July or August some of them, especially from August, are very large, but also middle-sized and young individuals are present. The Greenland specimen is fairly young, 11 mm wide, though it was found as late as August 4th. These data clearly show that *Leuckartiara breviconis* appears at the coasts of Scotland, the Shetland Islands, and southern Norway in spring, probably in May, and reaches full size in July, whereas in the northernmost part of the area of distribution it has a somewhat later occurrence.

The area of distribution, as known up to now, is too small to serve as base for a decisive statement of the zoogeographical habit of the species. Apart from the peculiar occurrence in southern Greenland, all finding places known till now are within the areas of the Gulf Stream and the Irminger Current; it might seem natural, therefore, if in future the species should prove to have a more extensive distribution towards the south.

Leuckartiara nobilis Hartlaub.

Plate II, fig. 9. Textfigs. 36 *a-c*. Chart XVI.

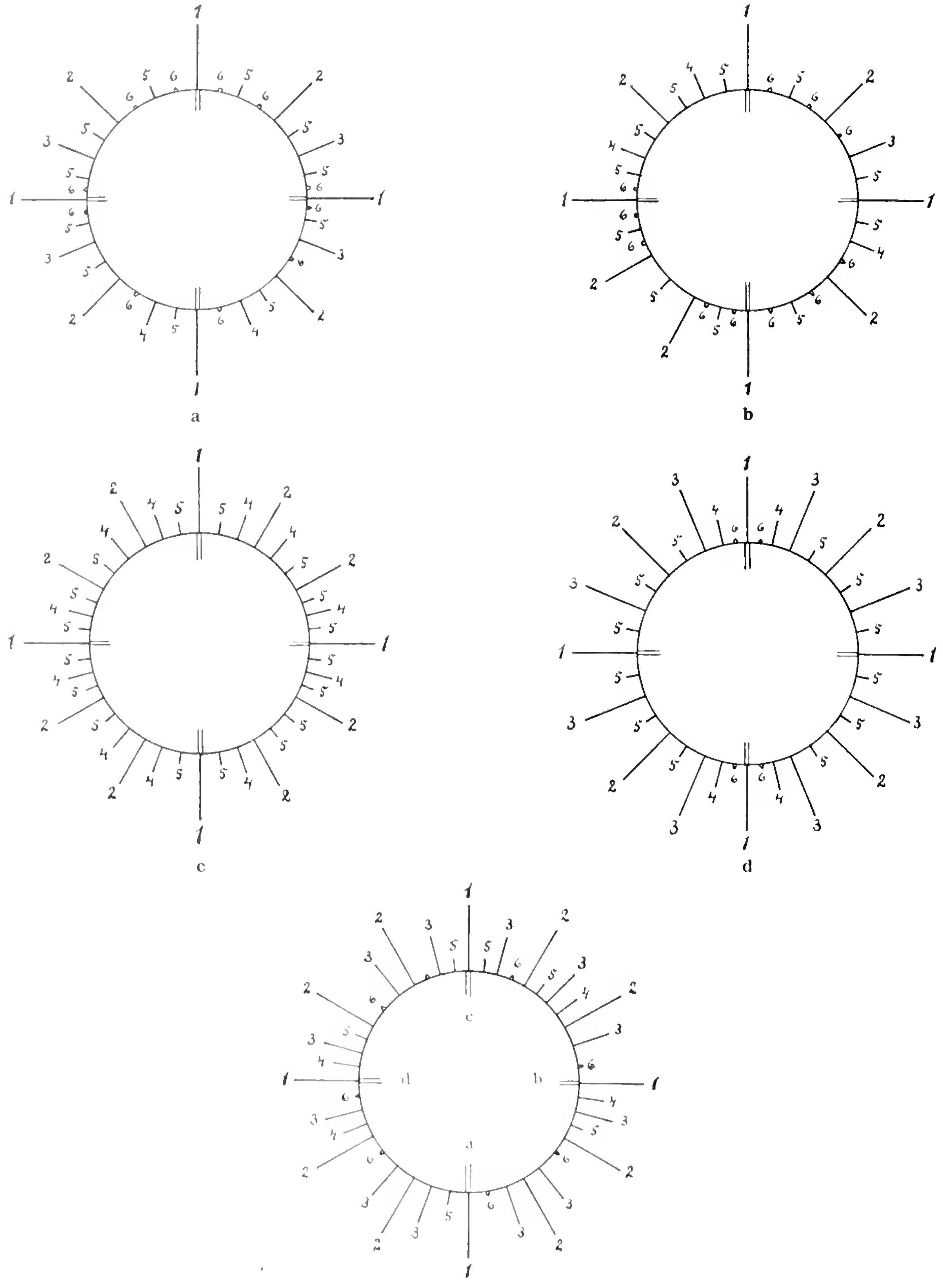
Syn. *Tiara pileata* var *coccinea* Haeckel 1879.

In all specimens of *Leuckartiara nobilis*, examined by me, the gonads are of the typical Leuckartiara-type and are greatly and complexly folded. The species can always be distinguished from other species of Tiaridæ by the shape of the gonads, the long mesenteries, the broad and denticulate radial canals, in connection with a comparatively small number of tentacles, the young rudiments of which are never club-shaped. Young individuals badly preserved may bear some resemblance to *Leuckartiara breviconis*, but have fewer tentacles. The tentacular bulbs are laterally compressed and destitute of a well-developed abaxial spur, thus very much like the bulbs in *L.breviconis*. The tentacles may be coiled up spirally with the concavity on the outward (abaxial) side; the adaxial side is provided with a row of deep transversal grooves or pits. Hartlaub (1913, p. 311, textfig. 259) has figured a piece of a tentacle with these pits seen from the adaxial side; a lateral view of the tentacle is presented in Plate II, fig. 9 of the present paper. The figure shows that the grooves are not confined to the ectoderm, but are deeply sunk into the endoderm, causing a deep folding of the inner epithelium.

Development of the tentacles. — The number of specimens at my disposal is not very great, and as the development of the tentacles is rather interesting, I shall give a short description, illustrated by diagrams, of the development in all the individuals, in so far as they are sufficiently well preserved for the purpose.

1) — Textfig. 36, diagram *a*. — Diameter of the bell 9 mm, height more than 8 mm ("Thor" stat 11 (08), see below, loc. 4): 4 large perradial tentacles (1), 4 somewhat smaller interradial (2), 17 young tentacles of three different sizes (3—5), 11 tiny rudiments (6). Well-marked symmetrical arrangement according to the perradii, but not according to the interradii. Development thoroughly octagonal. — Altogether 25 tentacles + 11 rudiments = 36.

2) — Diagram *b*. — Diameter 10 mm, height 12 mm ("Armauer Hansen" stat. 17, 150 m wire, see Kramp 1920b): 4 perradial tentacles (1); there are 5 tentacles of second order (2), two of which are placed



a b c d e

Fig. [illegible] *[illegible] nobilis*. Diagrams illustrating the successive development of the tentacles. For explanation see the text.

in one quadrant dividing it into three equal parts; in the middle of each of these three parts there is a very small tentacle (5); the two outermost of these latter are flanked by a tiny rudiment on either side (6); in this quadrant the tentacles of 2nd order are placed according to a duodecimal plan of development, whereas in the three other quadrants the development is regularly octagonal, though tentacles in corresponding situations are not always in corresponding stages of development. — Altogether 24 tentacles + 11 rudiments = 35.

3) — Diagram *c*. — Diameter 11 mm, height ca. 16 mm ("Armauer Hansen" stat. 17, 1000 m wire, see Kramp 1920b): In all quadrants the tentacles of 2nd order (2) are placed according to a duodecimal plan of development. The subsequent tentacles are all very small; I have numbered them 4 and 5 in the diagram, none of intermediate size being present, though I am aware that some of the tentacles, designated as no. 4, ought to be called no. 3, but I cannot tell which. In the interspaces between two fully developed tentacles there is sometimes one small median tentacle (no. 4) flanked by two still smaller ones (5); but as a rule the duodecimal development is continued, only two small tentacles being present in each interspace, either of different size (4 and 5) or both alike (5). The tentacles are distinctly symmetrically arranged according to the perradii. The total number of tentacles is 40. The number of tiny rudiments was not determined.

4) — Diameter 15 mm, height 19 mm ("Thor" stat. 183 (04), see below, loc. 2): 16 fully developed tentacles in regular octagonal arrangement, alternating with 16 small ones.

5) — Diagram *d*. — Diameter 20 mm, height 27 mm ("Thor" stat. 181 (04), see below, loc. 1): 16 fully developed tentacles of equal size (no.s 1—3 in the diagram) in regular octagonal arrangement, alternating with 16 small tentacles, even the largest of which are much smaller than the 16 fully developed, they are called no. 5 in the diagram except the one on either side of two opposite perradii which are a little larger (4), each separated from the neighbouring perradial tentacle by a very young tentacle (6). There are no traces of any more tentacles being developed, so that this large individual has evidently attained its maximal number of tentacles. The total number is: 4 + 4 + 8 + 4 + 12 + 4 = 36.

6) — Diagram *e*. — Diameter 20 mm ("Thor" stat. 12 (08), see below, loc. 3): 12 fully developed tentacles (1st and 2nd order, all alike), 22 young tentacles (3rd—5th order), and 8 tiny rudiments, altogether 42. The arrangement is somewhat irregular, though each of the quadrants contains about the same number of tentacles of each different size, as seen from the following table:

order of development	1	2	3	4	5	6	total number
quadrant a—b	1	2	3	1	1	2	10
— b—c	1	2	[illegible]	1	2	2	11
— c—d	1	2	[illegible]	1	2	[illegible]	11
— d—a	1	2	[illegible]	1	1	2	10
total	4	8	12	4	6	8	42

There is a tendency of symmetrical arrangement according to the perradii, but it is not complete. — It will be seen that in all quadrants the arrangement of the tentacles of 2nd order is duodecimal. Between every successive pair of fully developed tentacles there are either 3 young ones, the middle one of which is the largest, or only 2, in which case one is of 3rd order, the other of 6th order (tiny rudiment).

Finally, I shall mention a specimen, 7 mm wide, from the Great Belt (Denmark) with 10 fully developed tentacles; besides the 4 perradial tentacles, there are 6 tentacles of 2nd order: one in each of the

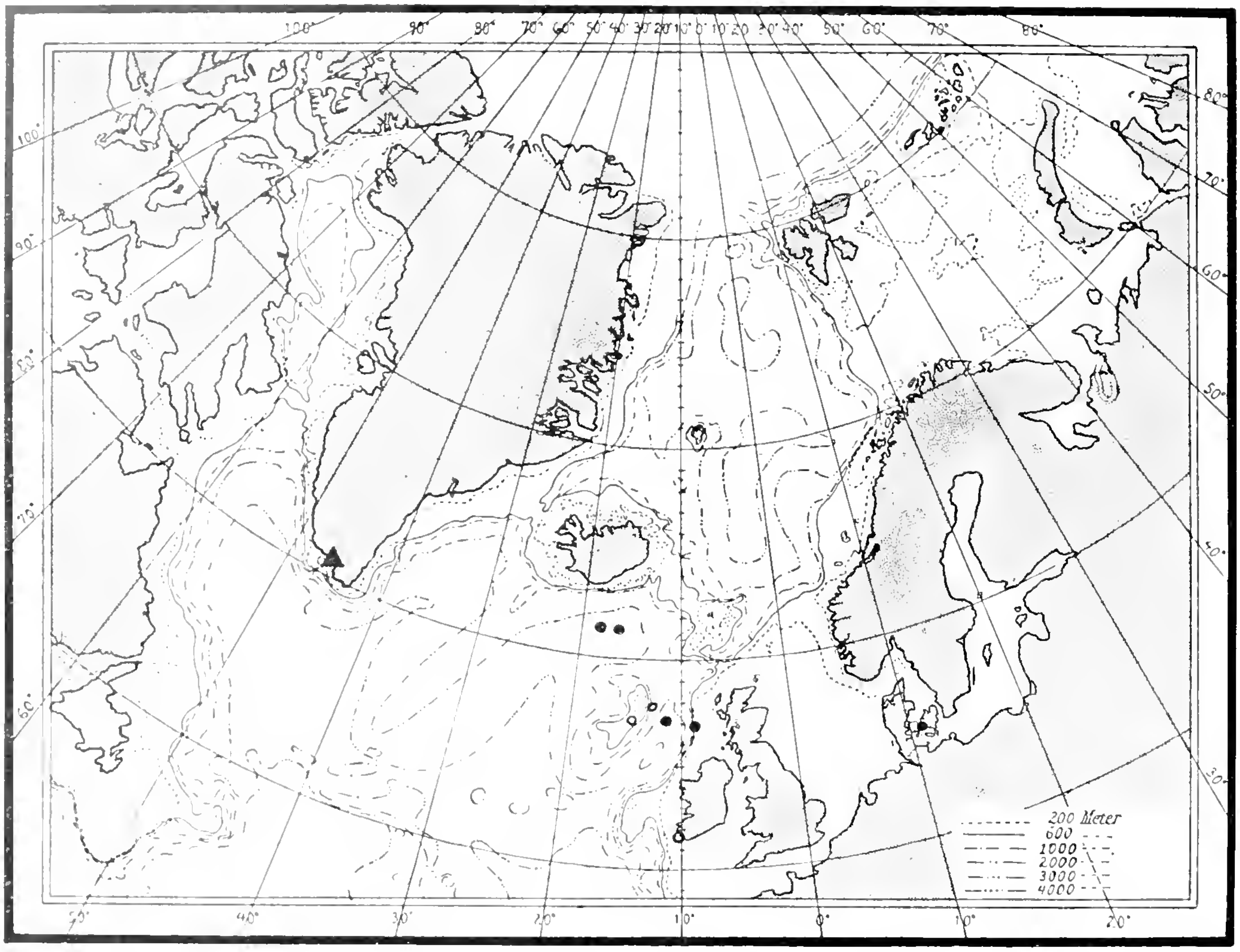


Chart XVI ● Finds of *Leuckartiara nobilis* Hartlaub ○ Occurrence in the North Atlantic according to the literature ▲ Occurrence of *Catablema multicirrata* Kishinouye in the North Atlantic.

two quadrants, two in each of the two others. The number and arrangement of young tentacles cannot be determined.

It appears from the above that the mode of development of the tentacles in *Leuckartiara nobilis* is sometimes octagonal, sometimes duodecimal, both cases about equally frequent, and sometimes both represented in one and the same individual, some of the quadrants having 2 tentacles of 2nd order, others only one, which is then placed interradially. Further it will be observed that even in the largest specimens the number of fully developed tentacles does not exceed 12 or 16 (according to the mode of development), and all the other tentacles are much smaller. During the first time the development of the tentacles proceeds very gradually, and tentacles of every size are found. At a diameter of about 10 mm the perradial tentacles are still somewhat larger than the next ones, but shortly afterwards the individual has evidently attained its maximal number of fully developed tentacles (12–16), and all the others remain much smaller, no middle-sized being found; the number of small tentacles is, however, continually increased, at least for some time. This fact establishes a characteristic difference between *L. nobilis* and *L. breviconis*; in the latter species small tentacles alternate almost regularly with fully developed, whereas in *L. nobilis* the number of small tentacles almost always exceeds the number of the fully developed. In this regard *L. nobilis* approaches *L. octona*.

Material (see Chart XVI).

South of Iceland:

1) — Lat. 61°34′ N., Long. 18°45′ W. July 10th 1904. Young-fish trawl, 70 m wire. "Thor" stat. 181 (04). — 1 specimen, 20 mm wide by 27 mm high.

2) — Lat. 61°30′ N., Long. 17°08′ W. July 11th 1904. "Thor" stat. 183 (04). — 1 specimen, 15 mm wide by 19 mm high.

West of Scotland:

3) — Lat. 57°03′ N., Long. 11°20′ W. May 28th 1908. Young-fish trawl, 65 m wire. "Thor" stat. 12 (08). — 1 specimen, 20 mm wide.

4) — Lat. 56°56′ N., Long. 9°01′ W. May 28th 1908. Depth 140 m. Young-fish trawl, 10 m wire. "Thor" stat. 11 (08). — 1 specimen, 9 mm wide.

Further distribution:

Mediterranean (see Hartlaub).

Valencia Harbour, south-west coast of Ireland, in May (Browne, see Hartlaub 1913, p. 300).

Near Rockall, in July ("Armauer Hansen", Kramp 1920b, p. 3).

Great Belt, Denmark, May 1923 (Kramp).

As far as known up to now, the distribution of *Leuckartiara nobilis* in the northern Atlantic area is confined to the regions of the Gulf Stream and the Irminger Current. The unusually strong influx of Atlantic water into the Danish seas in the spring of 1923 carried a specimen of this Atlantic medusa right into the Belt Sea, where it was seen for the first time.

Genus **Catablema** Haeckel.

Catablema vesicarium (A. Agassiz)

Plate II, figs 10—11. Chart XVII.

Syn. *Catablema vesicarium* + *campanula* + *eurystoma*, Haeckel 1879.

Tiara conifera, Haeckel 1879, partim.

In the species of *Catablema* the manubrium is very broad, with a cross-shaped base; the slit-shaped connections between the stomach and the radial canals (the mesenteries) are confined to the dorsal wall of the stomach as in the species of *Halitholus*. *Catablema* is, however, easily distinguished from the latter by the far more complicated folding of the gonads, which are, on the other hand, destitute of the horse-shoe fold, characteristic of *Halitholus* and *Leuckartiara*; further by the broad radial canals which are already in young stages ($3^1/_2$ mm in diameter) distinctly denticulate. Since Hartlaub has given a new and adequate description of *Catablema vesicarium*, this species cannot, indeed, be confounded with any other species of

Tiaridæ. — As far as the morphology of the species is concerned, I only wish to add one single remark to Hartlaub's description: As in *Leuckartiara nobilis*, *Neoturris pileata* and other species, the tentacles of *Catablema vesicarium* are provided with numerous deep transversal grooves or pits on the adaxial side (see Plate II, figs. 10 and 11).

Bigelow (1913, p. 17) describes the *Catablema vesicarium* from the northern Pacific as a special variety, *nodulosa*, which is said to be distinguished from the Atlantic form by the folds of the gonads anastomosing and frequently forming reticulate structures. This however perfectly agrees with the structure of the gonads as described by Hartlaub (1913), and also as observed by me in the present material. As a matter of fact, the most complete agreement seems to exist between the Atlantic and the Pacific forms of this species. Bigelow presents a couple of excellent photographic figures (Plate I, figs. 8, 9).

Development of the tentacles. — The smallest individual which I have seen ("Tjalfe" stat. 105b, West-Greenland, see below, loc. 10) is only 3½ mm in diameter; it has 4 large perradial tentacles, 4 somewhat smaller interradial, 8 adradial very short, thick, conical, still without a filiform part, and finally 16 tiny eradial tentacular rudiments. Thus, in this young individual, the development of the tentacles is perfectly regular. — Another young specimen, 4 mm wide ("Tjalfe" stat. 54, loc. 12) has 16 fully developed tentacles alternating with 16 small ones, pointed conical, and in most of the 32 interspaces there is a tiny rudiment. — On the other hand, a specimen, 7 mm wide ("Thor" stat. 203, Iceland, loc. 20) has only 8 fully developed tentacles, further in each quadrant about 6 very small tentacles and a few tiny rudiments; the total number is: 8 fully developed, 24 small tentacles and 12 rudiments, altogether 44. Thus the velocity of the development is very variable, but as far as the first 16 tentacles are concerned, the development always seems to proceed very regularly in octagonal succession. I have never observed duodecimal development in this species. — The development is often continued in the same regular manner; irregularities are, however, rather frequent in the older stages. Very rarely more than 32 tentacles reach full development. The size of the medusa, when all 32 tentacles are fully developed, is most variable: I have seen specimens, about 12 mm wide, with 32 almost equally developed tentacles, and specimens 18—20 mm wide, in which every second of the 32 tentacles are distinctly smaller than the others. Almost regularly alternating with the fully developed tentacles we always find about the same number of very small tentacles, which never reach beyond a juvenile stage; in younger specimens these organs are wart-like, in older individuals cone-shaped or pear-shaped; in very old individuals a few of these rudiments may be growing so far that they may be termed tentacles, as e. g. in the largest specimen, examined by me ("Tjalfe" stat. 170, loc. 8): it is 22 mm wide with 40 tentacles, and the youngest rudiments are all more or less pointed. — According to the above, the typical number of tentacles in *Catablema vesicarium* is 32 fully developed tentacles, regularly arranged in octagonal succession, alternating with the same number of small rudimentary tentacles.

Material (see Chart XVII).

West coast of Greenland:

1)	Greenland Moberg 1857.	1 specimen (Haeckel determ. *C. vesicarium*).
2)	Greenland Zimmer 1856.	2 specimens (Haeckel determ. *C. campanula*).

3) — Greenland. Olrik. — 1 specimen (Haeckel determ. *Tiara conifera*).

4) — Umanak. Olrik. — 7 specimens.

5) — Sakrak, Waigat. Traustedt 1892. — 1 specimen.

6) — Ritenbenk. Traustedt 1892. — 1 specimen.

7) — Godhavn, Disco. Olrik. — 1 specimen (Haeckel determ. *Tiara conifera*).

8) — Lat. 69°28′ N., Long. 54°54′ W., outside Disco Fjord. August 9th 1908. Ringtrawl, 40—80 m wire. "Tjalfe" stat. 179. — 1 specimen, 22 mm wide.

9) — Lat. 68°05′ N., Long. 55°06′ W. August 19th 1908. Ringtrawl, 80 m wire. "Tjalfe" stat. 200. — 1 specimen, 11 mm wide.

10) — Lat. 67°22′ N., Long. 56°14′ W., "Store Hellefiskebanke". July 7th 1908. Ringtrawl, 0—100 m wire. "Tjalfe" stat. 105b. — 1 specimen, 3½ mm wide.

11) — Lat. 66°11′ N., Long. 54°27′ W., outside Southern Strömfjord. August 28th 1908. Ringtrawl, 80 m wire. "Tjalfe" stat. 221. — 2 specimens, 12—18 mm wide.

12) — Kugssuk, near Godthaab (Lat. 64°15′ N.). June 15th 1908. Ringtrawl, 70 m wire. "Tjalfe" stat. 54. — 1 specimen, 4 mm wide.

13) — North of Frederikshaab (Lat. 62°12′ N., Long. 49°45′ W.). July 2nd 1909. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 3 specimens, 8, 9, 11 mm wide.

14) — Mouth of Bredefjord (near Julianehaab). July 21st 1909. Ringtrawl, 100 and 125 m wire. "Tjalfe" stat. 544. — 2 specimens, 5—8 mm wide.

15) — North of Julianehaab. August 4th 1909. Ringtrawl, 350 m wire. "Tjalfe" stat. 583. — 3 specimens, 8, 13, 14 mm wide.

16) — Julianehaab Fjord (about Lat. 60°40′ N., Long. 46°10′ W.). August 4th 1909. Ringtrawl, 300 m wire. "Tjalfe" stat. 585. — 4 specimens, 9, 12, 12, 16 mm wide.

North coast of Iceland:

17) — Axarfjord. August 12th 1903. Depth 38 m. Near the surface. "Beskytteren", Otterström. — 1 specimen, 21 mm wide.

18) — Lat. 66°14′ N., Long. 17°28′ W. July 21st 1904. Depth 200 m. Young-fish trawl, 30 m wire. "Thor" stat. 208 (04). — 1 specimen, 18 mm wide.

19) — Lat. 66°45′ N., Long. 15°36′ W. August 5th 1900. "Michael Sars" stat. 15 (1900). — 7 specimens, 14—22 mm high, diameter not measured; the specimens are in Bergen's Museum.

20) — Lat. 66°17′ N., Long. 14°27′ W. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 3 specimens, 7, 16, 20 mm wide.

Further distribution:

Umanakfjord, Greenland (Vanhöffen 1897, pp. 273, 291, *C. campanula* and *eurystoma*).

Spitzbergen, from June to August, very common (Hartlaub 1913, p. 316; Kramp & Damas 1925, p. 281).

Bear Island, August—September (Hartlaub; Kramp & Damas).

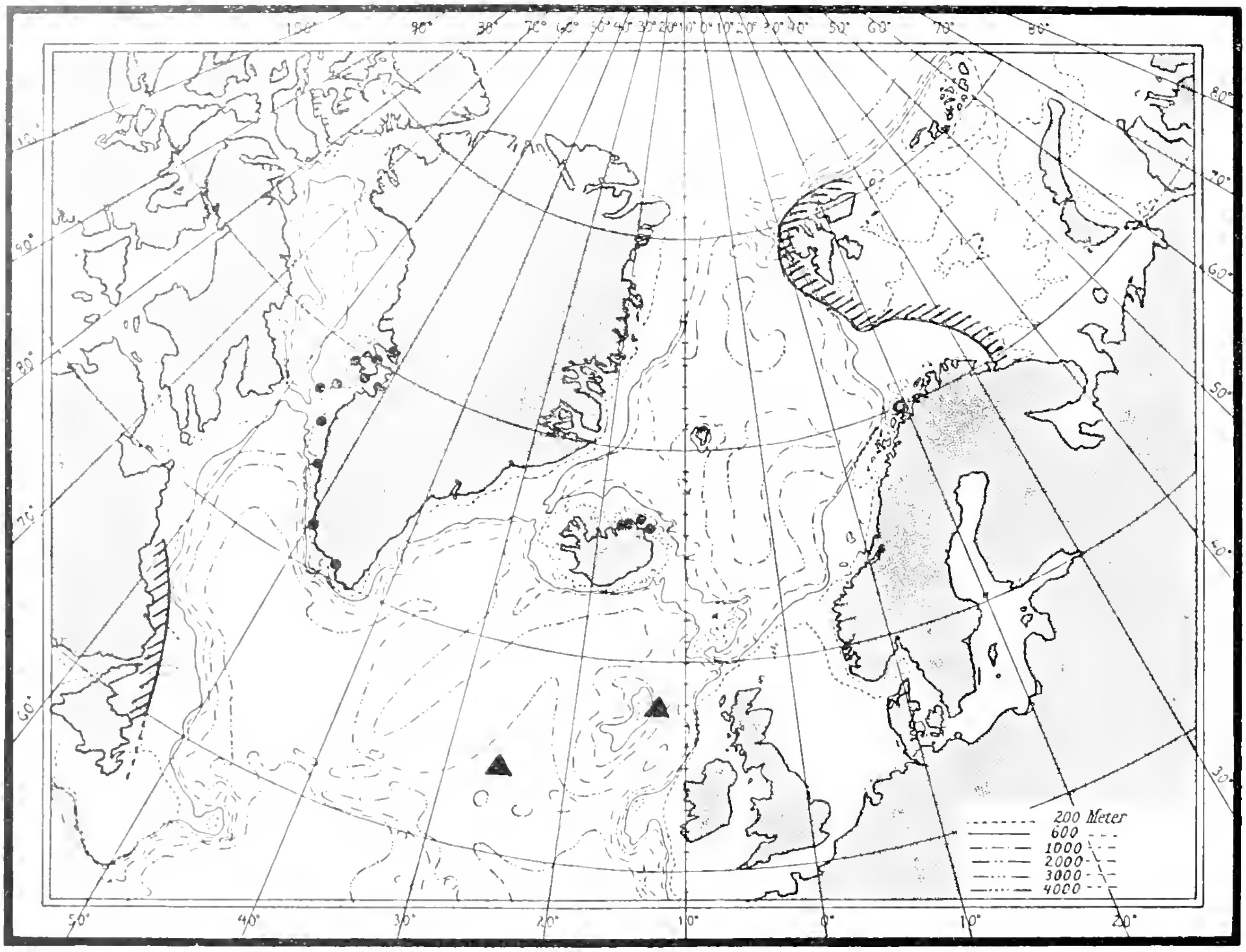


Chart XVII ● Finds of *Catablema vesicarium* (A. Agassiz). Within the hatched lines the species is commonly occurring. ▲ Finds of *Pandea rubra* Bigelow in the North Atlantic.

Barents Sea, July, widely distributed (Linko, Hartlaub).

White Sea, (Hartlaub).

Norway, northernmost part of the west coast, in June (Kramp & Damas, 1925).

North America, Atlantic coast fra Labrador to Cape Cod in May—August; occasionally occurring south of Cape Cod in May and June.

Bering Sea, Dutch Harbour, in May (Bigelow 1913, p. 17).

Catablema vesicarium is an arctic medusa. In the western Atlantic it is distributed from the Davis Strait as far southwards as the influence of the Labrador Current is perceptible, *i. e.* usually only as far as Cape Cod, which is only surpassed in the spring. In the eastern Atlantic area, where the species is very common at Spitzbergen and in the Barents Sea, it is far from penetrating so far southwards as in the western Atlantic. Only once has it been found at the Norwegian coast, and then only off the northernmost part, near North Cape. The occurrence at Iceland is confined to the cold north-eastern part of the country, where the coast is washed by the Polar Current. At the west coast of Greenland it mainly occurs in the surroundings of the Disco Bay (about 70° N.) and at the entrance to the Baffin Bay; further southwards it keeps itself within the cold coastal area.

Catablema multicirrata Kishinouye

Plate II, fig. 12. Chart XVI.

Hartlaub (1913, p. 321) has included this species in his work on the Anthomedusæ in the "Nordisches Plankton", though up till now it was only known from the Pacific. It was described by Kishinouye (1910, p. 24) from Paramushir, the northernmost of the Kurile Islands, where it was found in November 1904; a new description, accompanied by photographic figures, was given by Bigelow (1913, p. 10, Plate I, figs. 4—7) after four specimens found in the Bering Sea in May and July. In any stage of development the species may be distinguished from *C. vesicarium* by the much larger number of tentacles. The species is now stated to live in the Atlantic area, 9 specimens being found in two fjords in southern Greenland. These specimens agree very well with the description and figures of Bigelow; only the radial canals are not quite as broad as figured by Bigelow (Plate I, fig. 5), and they are somewhat more regularly provided with densely set lateral, tongue-shaped diverticula. The folds of the stomach all have an almost vertical direction, but in the lower (distal) part they are more or less dispersed into oblong grooves in a similar manner as in *C. vesicarium.* The dorsal wall of the stomach attached to the subumbrella is very broad (Plate II, fig. 12), almost square, the corners somewhat drawn out into short, broad mesenteries, continued a little way downwards along the perradial edges of the stomach; the lateral walls of the stomach are infolded interradially. The mouth tube, free of gonads, is comparatively long, in younger specimens being considerably longer than the broad, rather flattened stomach.

A characteristic feature is the very large number of densely crowded tentacles which apparently are very long. The specimens at my disposal are 7—15 mm in diameter. Bigelow had some much larger individuals, until 36 mm wide. — At the beginning, the development of the tentacles proceeds very regularly; in younger individuals fully developed tentacles alternate with as many smaller ones, and besides, there is a small tenon-like rudiment between every successive pair of tentacles; in older specimens almost all tentacles are full-sized, alternating with tiny rudiments, transitory stages being very rare. The smallest individual examined (7 mm wide) has 32 fully developed tentacles, 32 smaller tentacles, and 64 very small tenon-like rudiments, the development thus being perfectly regular so far. I have counted the following numbers of fully developed tentacles:

Diameter of individual	7	8	10	11	11	11	12	13
Number of tentacles, fully developed	32	50	80	88	112	120	88	98

Material (see Chart XVI).

Southern part of west coast of Greenland:

1) — Bredefjord, near Julianehaab. August 7th 1912. Ringtrawl, 200 m wire. "Rink" stat. 107, K. Stephensen. — 1 specimen, 15 mm wide.

2) — North of Julianehaab. August 4th 1909. Ringtrawl, 350 m wire. "Tjalfe" stat. 583. — 8 specimens, 7—13 mm wide.

These fjords both belong to the type of the Greenland fjords, the deep entrance of which allows the comparatively warm water of the lower strata in the Davis Strait to enter the fjord. The temperature of the surface water depends on the temperature of the air; not far below the surface there is a minimum of temperatures below 0° C.; from this depth the temperature slowly increases towards the bottom, reaching a maximal value of about 3° C. In both localities the individuals of *Catablema multicirrata* were found in rather considerable depths, below the minimum of temperature; as, moreover, the species has only been found in these southern localities, it may, probably, not be termed an arctic species.

Further distribution. — Paramuchir, Kurile Islands, November 1904 (Kishinouye 1910, p. 24). — Bering Sea: Prince William Sound in July and Dutch Harbour, Unalaska, in May (Bigelow 1913, p. 19).

Genus Neoturris Hartlaub.

Neoturris pileata (Forskal).

Plate II, figs. 13—14. Textfig. 37. Chart XVIII.

Syn. *Tiara pileata* auctorum partim.
Turris digitalis, Forbes 1848, Haeckel 1879.
— *coeca*, Hartlaub 1892.
For further synonymy, see Hartlaub 1913, p. 326.

This beautiful large medusa is easily distinguished from all other species of Tiaridæ by the characteristic structure of the gonads: each interradial quadrant of the gonads consists of two lateral rows of transversal folds with lobed margins, and a somewhat depressed median part with round pits. The mesenteries are long; the radial canals are broad and denticulate, the circular vessel smooth. The tentacular bulbs are strongly laterally compressed, grasping the border of the exumbrella, but they have no specially developed abaxial spurs. — Hartlaub (1913, pp. 326 ff.) has thoroughly described this species, also quite young individuals. He also shortly mentions the triangular cross-section of the tentacles. This feature is clearly seen in Plate II, fig. 14, representing a piece of a spirally coiled tentacle, the proximal fracture surface turning upwards. The tentacle is flattened on the outward (abaxial) side; on the adaxial side there is a conspicuous longitudinal keel; in the distal part of the tentacle the keel is interrupted by transversal grooves, deeply sunk into the endodermal cavity of the tentacle. When the tentacle is coiled into a spiral, the adaxial keel is turned outwards, whereas the flattened abaxial side forms the concavity. The nematocysts are placed in transversal ridges, forming rings or clasps round the tentacle, somewhat more numerous and densely set on the adaxial than on the abaxial side, thus the majority of the nematocysts are on the outward side, when the tentacle is spirally coiled.

There is a large number of tentacles. According to Hartlaub, 60 is the usual number, though sometimes there are almost 90. These numbers agree very well with my own observations, although I have never counted more than about 80 tentacles. — Development of the tentacles: One of the smallest individuals in the present material ("Thor" stat. 176 (03), Iceland, loc. 2) is 6 mm in diameter and has 16 tentacles regularly arranged: 4 perradial, 4 interradial, and 8 adradial, the latter being comparatively large; further a very small rudiment in each of the 16 interspaces. Another individual of the same size ("Thor" stat. 11 (08), loc. 9) has likewise 16 tentacles and 16 rudiments, but the arrangement is different from that in the former individual: in two opposite quadrants there are one well-developed interradial tentacle and 2 small adradial ones, but in each of the two other opposite quadrants there are 2 tentacles of 2nd order, dividing the quadrant into three equal parts, and besides a small interradial tentacle of 3rd order; thus in these two quadrants the arrangement is duodecimal (see the diagram, textfig. 37); the formula of development is: 4 + 6 + 6 = 16. The number of 16 may be attained in different ways:

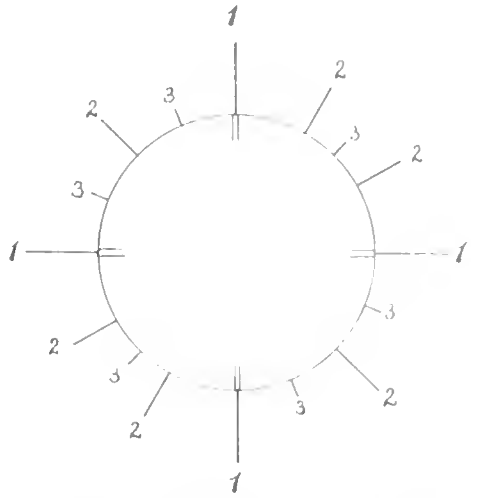


Fig. 37. *Neoturris pileata.* Diagram illustrating the successive development of the tentacles in a young individual with 16 tentacles; in this specimen the arrangement is octagonal in two opposite quadrants, duodecimal in the two other quadrants. Formula of development 4 + 6 + 6 = 16. Comp. the text.

	I	II	III	tot.
Arrangement purely octagonal	4	4	8	16
— — duodecimal	4	8	4	16
— mixed	4	6	6	16

As to the further development of the tentacles, we will find that it soon becomes very irregular. A regular alternation of large and small tentacles or of fully developed tentacles and tiny rudiments is never seen in *Neoturris pileata* after it has passed a rather young stage of development. We may shortly state that a *Neoturris*, after having reached a certain size, has as many tentacles as there is room for on the bell margin, and new tentacles are developed where any room happens to be left. — The number of tentacles in specimens of various sizes will be seen from the following table:

Diam. mm	Number of tentacles	Diam. mm	Number of tentacles
6	16, 16, 32	16	80
8	32, 40	18	80
9	64	19	60
10	48	22	60
12	50	23	64, 78
13	44, 56	25	80
14	51		

Material (see Chart XVIII).

Iceland:

1) — Lat. 64°44′ N., Long. 23°29′ W., Faxebugt. June 27th 1904. "Thor" stat. 164 (04). — 2 specimens

2) — Portland Head, south coast of Iceland. July 18th 1903. "Thor" stat. 176 (03). — 2 specimens, 6—16 mm wide.

3) — South of the Myrdalsjökel. August 17th 1903. "Michael Sars", Ad. S. Jensen. — 1 specimen, 9 mm wide.

Atlantic, between Iceland and Scotland:

4) — Lat. 61° 34′ N., Long. 19° 05′ W. July 10th 1904. "Thor" stat. 180 (04). — 1 specimen, 25 mm wide by 38 mm high.

5) — Lat. 61° 30′ N., Long. 17° 08′ W. July 11th 1904. "Thor" stat. 183 (04). — 1 specimen, 23 mm wide by 31 mm high.

6) — Lat. 59° 09′—59° 20′ N., Long. 15° 47′—15° 16′ W. Rink 1852. — 9 specimens.

7) — Lat. 58°—59° N. Rink 1852. — 1 specimen, (Haeckel determ. *Turris digitalis*).

8) — Lat. 57° 03′ N., Long. 11° 20′ W. May 28th 1908. "Thor" stat. 12 (08):
Young-fish trawl, 65 m wire. — 2 specimens, 22—23 mm wide.
— — 300 m — — 1 specimen, 12 mm wide by 14 mm high.

9) — Lat. 56° 56′ N., Long. 9° 01′ W. May 28th 1908. Depth 140 m. "Thor" stat. 11 (08):
Young-fish trawl, 10 m wire. — 2 specimens, 6—8 mm wide.
— — 65 m — — 1 specimen, 10 mm wide.

East coast of Scotland:

10) — Dunners Head, Moray Firth. Sept. 4th—5th 1904. "Thor" stat. 225 (04). — 2 specimens, 14—22 mm wide.

Channel:

11) — Lat. 49° 40′ N., Long. 6° 20′ W., western entrance to the Channel. August 24th 1906. Young-fish trawl, 25 m wire. "Thor" stat. 165 (06). — 1 specimen.

Further distribution:

Mediterranean (Hartlaub 1913, p. 328; Kramp 1924, p. 7).

North-western Europe: British coasts from the Channel to the Shetland Islands and in the North Sea (Hartlaub 1913). — East of the Rockall Bank ("Armauer Hansen", Kramp 1920b). — Between Rockall and St. Kilda ("Michael Sars", Kramp 1920a, p. 7). — North Sea, Shetland Islands, and off the west coast of Norway as far north as Lat. 64° N. (Kramp & Damas 1925, p. 278). — North west of Iceland, Lat. 66° 28′ N., Long. 25° 18′ W. (Kramp & Damas 1925, p. 278). — Skagerrak and northern Kattegat (Kramp).

Geographical distribution. — The occurrence of *Neoturris pileata* falls within two widely separated areas: Mediterranean and north-western Europe. It has not yet been found off the Atlantic coasts between the Straits of Gibraltar and the Channel; within the British waters it is by far the most common in the northern part, round Scotland and the Shetland Islands. The distribution extends into the northern and eastern parts of the North Sea (until Heligoland) and into the Skagerrak and the deep channels in the southern Kattegat. Off the west coast of Norway it mainly occurs in the open sea, but is rare in the fjords.

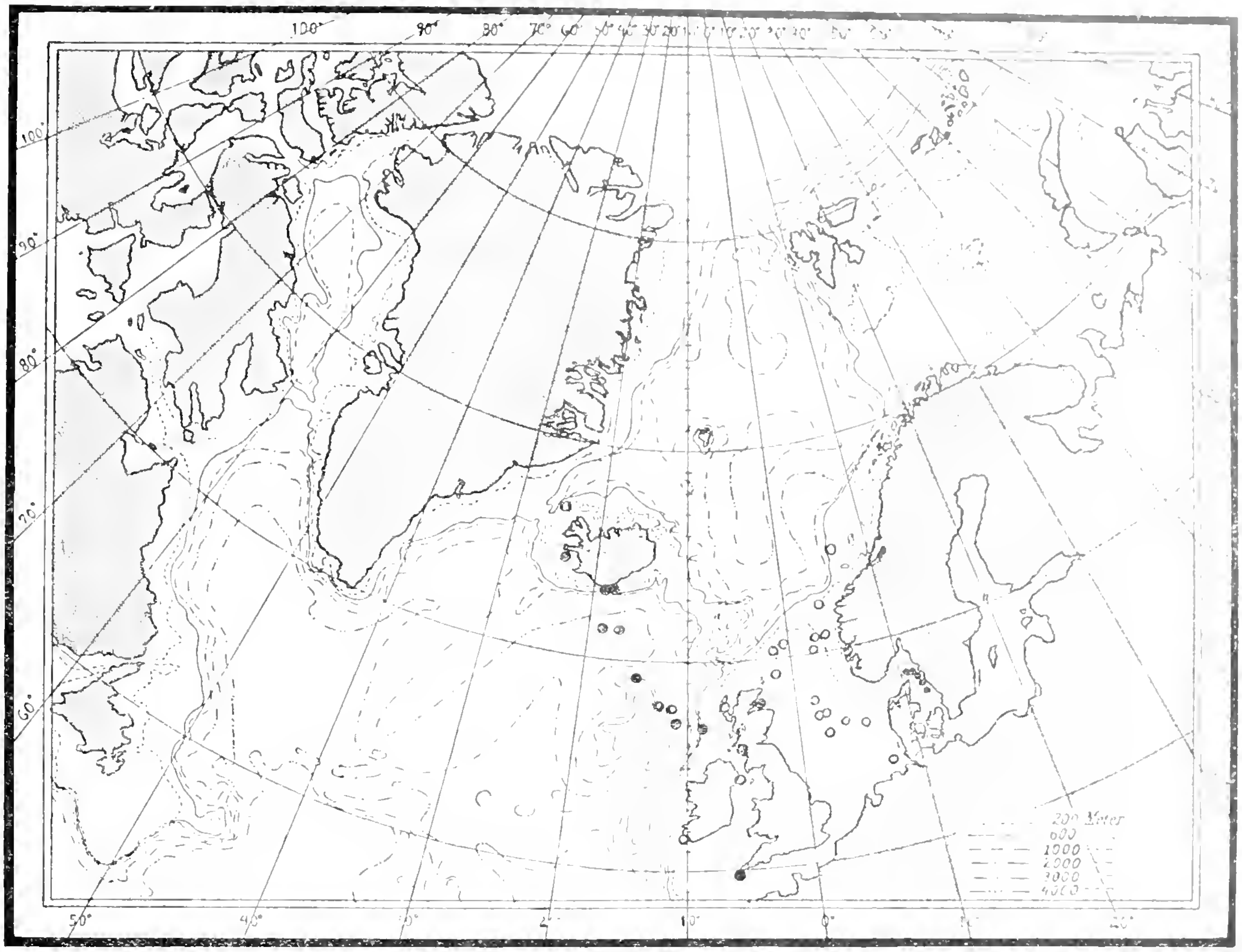


Chart XVIII ● Finds of *Neoturris pileata* (Forskal). ○ Occurrence in the North Atlantic according to the literature

It is fairly common south of Iceland, and may occasionally proceed northwards through the Danmark Strait, between Iceland and Greenland. It seems to have its main occurrence within the areas of the Gulf Stream and the Irminger Current, following the offshots of these currents though never penetrating into arctic regions. The medusa probably has a littoral origin (the hydroid polyp is unknown), but may be carried very far out at sea with the currents, as *e. g.* the large specimens found between the Rockall Bank and Iceland. These old individuals are certainly carried out to these offside places by the Irminger Current. On the other hand, the species is indigenous at the south coast of Iceland.

Seasonal occurrence. — At the north-western coasts of Europe the young individuals appear in May. Throughout the summer both young and fairly large specimens are found; old and very large specimens may be found from July to September, probably also later. I have found it in the Skagerrak and in the deep, cold channels of the northern Kattegat in October; in this region the medusa only attains a comparatively small size.

Genus **Pandea** Lesson.

Pandea rubra Bigelow.

Plate II, fig. 15. Chart XVII.

This peculiar medusa was first described from the northern Pacific by Bigelow in his interesting paper (1913, p. 14, Plate II, figs. 1—7); and in the same year, when Bigelow's description was published, two specimens were found in deep water in the northern Atlantic by the Norwegian M/S "Armauer Hansen" (see Kramp 1920b, p. 4). First of all, the medusa is remarkable for its considerable size; the specimens described by Bigelow were 37—38 mm in diameter (a still larger specimen could not be measured); the Atlantic specimens are 31—40 mm wide. A very interesting feature is the deep brownish-red colour of the entire endoderm of the manubrium the radial canals, the circular vessel, and the tentacles; Bigelow states the same colour to extend more or less (probably according to stage of growth) over the subumbrella. In the specimens, examined by me, the subumbrella cell-layers are very much destroyed, so that no colour can be distinguished; I am not able to state, therefore, whether the colour of the subumbrella is bound to the ectodermal epithelium or, possibly, to the endodermal lamella. The tentacles of the Atlantic specimens are in very good condition, clearly showing the dark pigmentation being exclusively bound to the endoderm, whereas the ectoderm is transparent and colourless. — Both specimens are rather defective, especially the smaller one. Sufficiently great parts of the manubrium are, however, well enough preserved to show that the complexly folded mouth-rim and the reticulate structure of the gonads are in perfect agreement with Bigelow's figures. The radial canals, which are very darkly pigmented, are very narrow in their proximal part, evenly increasing until more than double breadth in the distal part. The smaller individual has 8, the larger 12 marginal tentacles (Bigelow records from 14 to about 20 in the Pacific specimens). The tentacular bulb is oblong-conical, not laterally compressed; the circular vessel is somewhat expanded on both sides of the tentacular bulb (in a similar manner as in *Tiaranna rotunda*). The tentacular bulb has a large abaxial spur, grasping round the border of the exumbrella (see Plate II, fig. 15); this spur is deeply pigmented, though frequently the extreme end is transparent and colourless and embedded in the jelly of the exumbrella. The tentacles are about 20 mm long; beyond the conical basal bulb they are extremely thin, filiform; they have a smooth surface without visible wrinkles, but with distinct, though faintly developed, transversal grooves on the adaxial side.

The Atlantic individuals were found in the following localities (see Chart XVII):

Lat. 54° 05' N., Long. 26° 08' W. July 15th 1913. "Armauer Hansen" stat. 7. 1000 m wire. — 1 specimen, 40 mm wide by 38 mm high.

The deep channel east of Rockall, depth 1800 m. July 28th 1913. "Armauer Hansen" stat. 17. 1000 m wire. — 1 specimen, about 31 mm wide.

The specimens, described by Bigelow, were found in intermediate depths in the north-western Pacific.

Genus Bythotiara Günther.

Bythotiara murrayi Günther.

Textfigs 38–40.

This interesting medusa is thoroughly dealt with in my paper on the medusæ from the Danish expeditions to the Mediterranean (Kramp 1924, p. 12), where, a. o., I have demonstrated the existence of dwarf tentacles, strongly armed with nematocysts, in type of structure recalling the dwarf tentacles of *Tiaranna rotunda* and, through these latter, also the socalled cordyli (marginal clubs) in the Laodiceidæ among the Leptomedusæ (see also Kramp 1920a). — I have also (1924) mentioned the variations of the course of the radial canals in specimens from the Mediterranean. — Two specimens of *Bythotiara murrayi* are to hand from a locality S. W. of Ireland (see below), one of which presents a very interesting peculiarity, not seen in this species before. In several other species of Bythotiaridæ (*Calycopsis, Sibogita*) centripetal canals, issuing from the circular vessel, are normally present; in *Bythotiara*, on the other hand, such canals are not a normal feature, but now it appears from the specimen in question that they may occur. The individual is about 18 mm wide and 19 mm high. It has 7 radial canals, 6 of which issue in pairs from the base of the mambrium as in normal individuals; but the fourth corner of the manubrium only gives rise to one, unbranched canal. A marginal tentacle is present outside the termination of each of these 7 canals. But on the right hand side of the termination of the unbranched canal, at $^1/_3$ the distance to the next radial canal, an eighth tentacle is found, and at the base of this tentacle a centripetal canal takes origin, running straight upwards on the subumbrella, about $^1/_3$ of the way towards the base of the manubrium. The development of this centripetal canal must be considered as a new outcome of a tendency, which I have demonstrated in other specimens of *Bythotiara* with more or less abnormal course of the radial canals, a tendency towards reestablishment of symmetry, missing canals or canal-

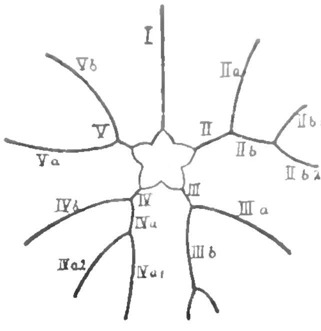


Fig. 38. *Bythotiara murrayi*. Diagram illustrating the course of the radial canals in a specimen from S. W. of Ireland, further mentioned in the text.

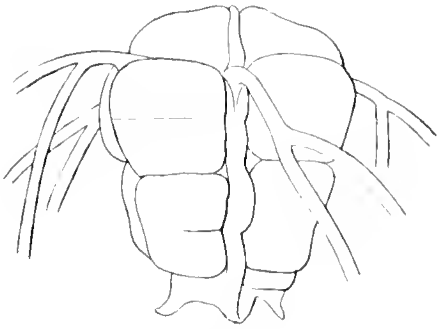


Fig. 39.

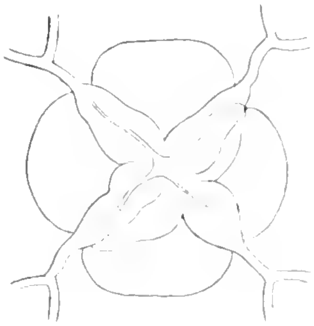


Fig. 40.

Figs 39–40. *Bythotiara murrayi*. — Fig. 39. Lateral view of manubrium, with proximal parts of radial canals. Fig. 40. Apical view of manubrium, showing the cross-shaped base and the normal mode of issue of the radial canals. Specimens from Norway, drawn by Damas.

branches being supplanted, either by a supernumerary canal being developed from the base of the manubrium, or by increased ramification of one or more of the canals already present. In the present individual the symmetrical equilibrium is reestablished by means of a centripetal canal which supplants the wanting branch of one of the ordinary radial canals.

The other specimen from the same locality (14 mm wide by 14 mm high) is also abnormally developed, but also here the abnormity finally results in a symmetrical arrangement of the primary tentacles; there are 8 canals and 8 primary tentacles, but the canals issue as follows: 2-2-1-2-1.

A third specimen from the same locality is in the Zoological Institute of Liége, Belgium, where I saw it during my stay with Professor Damas in 1920. It is a large individual with abnormally developed radial canals, figured in the adjacent diagram (textfig. 38), which is constructed in accordance with the diagrams in my paper on the Mediterranean medusæ (1924). The manubrium is pentagonal, and from its base issue 5 primary radial canals (I—V). No. I is unbranched, no.s II, III, and IV are three-pronged, no. V is bifurcate in the normal wise.

The textfigures 39 and 40 show the mode of issue of the radial canals in normal individuals, after drawings made by Damas.

Colour. — According to notes by Damas, who has seen this medusa alive in Norwegian fjords, the umbrella has a faint violet hue, and the gonadial part of the stomach is strongly brick-red ("couleur brique très forte"). The radial canals, the circular vessel, and the tentacles (including the terminal knob) are colourless in the living animal. Also Vanhöffen (1911, p. 215) mentions the strong red colour of the manubrium ("leuchtend zinnoberrot"). This colour seems to be characteristic of several different species of deep-sea medusæ (*Tiaranna rotunda*, *Chromatonema rubrum*, *Pantachogon rubrum* etc.), as the deep purple or brownish-red is characteristic of several other medusæ occurring in deep water.

Material:

Lat. 51 00′ N., Long. 11 43′ W. South west of Ireland. June 15th 1905. Depth 840—1350 m. Young-fish trawl, 1200 m wire. "Thor" stat. 82 (05). — 2 specimens, 14—18 mm wide.

Geographical distribution. — *Bythotiara murrayi* occurs in the intermediate strata above great depths in the oceans. Hitherto found: In two of the deep fjords on the west coast of Norway (Kramp & Damas 1925, p. 281). Norwegian Channel (Hartlaub 1913). West of Ireland (Günther). S.W. of Ireland (see above). Mediterranean (Maas, Mayer, Kramp). Off the mouth of Congo River (Vanhöffen). In the Indian Ocean west of Sumatra (Vanhöffen). — For details, see Kramp 1924, p. 12.

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Explanation of the Plates.

List of abbreviations.

ab.	abaxial.
ad.	adaxial.
c. v.	circular vessel.
dist.	distal.
end. l.	endoderm lamella.
ex.	exumbrella.
ex. inf.	inferior border of exumbrella.
ex. j.	exumbral jelly.
g.	gonad.
n. p.	nematocyst pad.
sp.	tentacular spur.
oc.	ocellus.
prox.	proximal.
r. c.	radial canal.
sub.	subumbrella.
sub. j.	subumbrella jelly.
t	tentacle.
v.	velum.

Plate I.

Plate I.

Figures 1—4 *Sarsia princeps* (Haeckel).

Figure 1. Tentacular bulb, lateral view, with a section of the adjacent part of the umbrella and the velum. — Greenland, "Tjalfe" stat. 124.

2. Part of external surface of supporting lamella of male manubrium, showing the longitudinal ribs, after the ectoderm has been removed. — × 67.

3. Part of radial canal, seen from the subumbrella, with lateral diverticula. — Greenland, "Tjalfe" stat. 124. — × 50.

4. Transversal section of radial canal, passing through one of the lateral diverticula on either side, to show the position of the diverticula in the endoderm lamella. The figure is a little idealized. — "Tjalfe" stat. 173. — × 50.

Figures 5—7 *Sarsia tubulosa* (M. Sars).

5—7. Tentacles. Fig. 5 front-view, fig. 6 side-view, fig. 7 hind-view. — Observe that the endodermal part of the tentacular bulb is vaulted upwards into the jelly of the umbrella, and that the radial canal issues from the abaxial side of the bulb (compare *Sarsia princeps*, Plate I, fig. 1). — Greenland, "Tjalfe" stat. 519.

Figure 8 *Euphysa tentaculata* Linko.

8. Female specimen from the Great Belt, Denmark. — × 10.

Figure 9 *Hybocodon prolifer* A. Agassiz.

9. Medusa seen from below, manubrium left out. Showing the nettle-ribs and their basal dilatations. Observe also the outlines of the subumbrella and the endoderm lamella, both seen in optical section. — Specimen from the Great Belt, Denmark. — × 12.

Figures 10—11 *Euphysa aurata* Forbes.

10. The tentacular bulb, lateral view. — Specimen from Hellebæk, Denmark.

11. The rudimentary marginal bulb opposite the tentaculiferous bulb. — Same specimen.

Figures 12—14 *Euphysa flammea* (Linko).

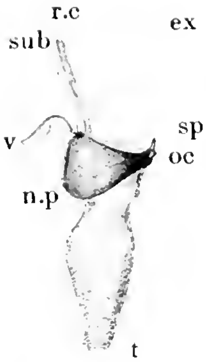
12. Specimen from Vardö, Norway. — × 6.

13—14. Tentacle. — Fig. 13 front view, fig. 14 lateral view. — Observe the vaulted internal part of the bulb, the radial canal issuing from the adaxial side of the bulb, and the broad nettle-ring not interrupted in front.

Figures 15—17 *Tiaranna affinis* Hartlaub.

15—16. Two sections of the bell margin with secondary (rudimentary) tentacles. In fig. 15 the tentacle is reduced to a small, conical knob; in fig. 16 it has still retained a short, tapering, filiform part. — Observe in both figures the ectodermal, abaxial outgrowth from the base of the reduced tentacular bulb. — Specimen from the North Atlantic, "Thor" stat. 165 (05).

17. Part of the bell margin, seen from the abaxial side, with 4 primary tentacles (one of which is broken off) and 4 secondary, rudimentary tentacles. — Same specimen as the preceding figures.



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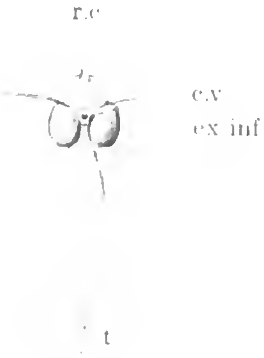

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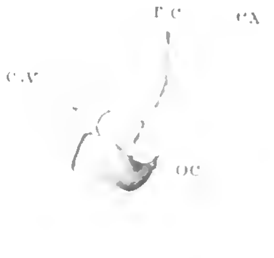

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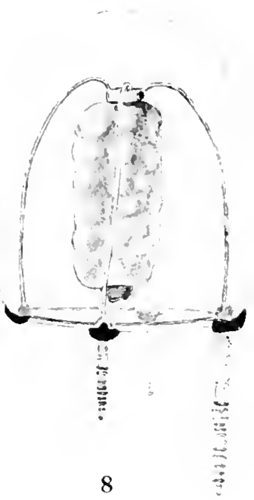

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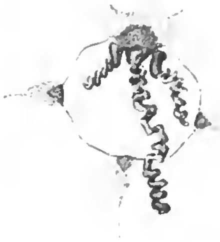

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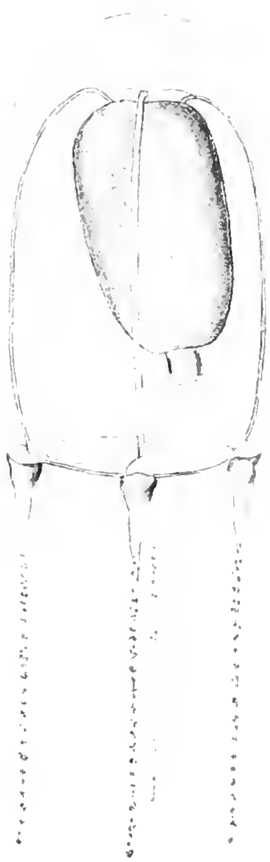

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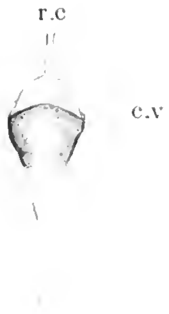

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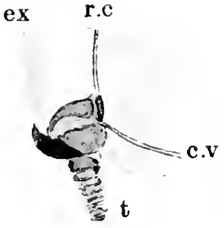

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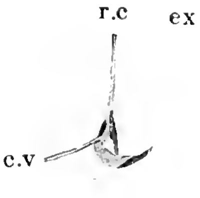

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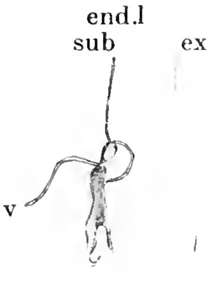

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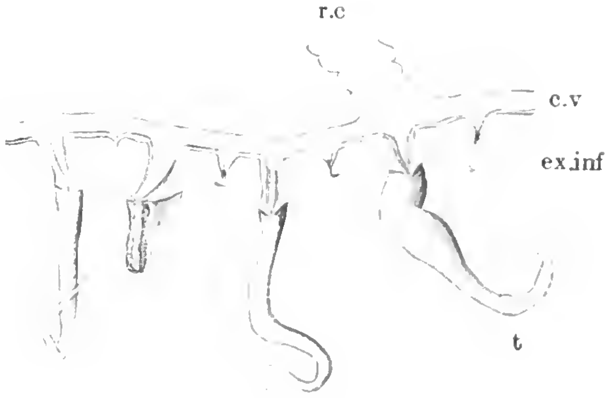

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P. L. Kramp del.

Plate II.

Plate II.

Figures 1—3 *Halitholus pauper* Hartlaub.

Figure 1. Medusa seen from the top. Observe the outlines of the area of attachment of the stomach to the subumbrella; this area appears lighter than the stomach walls outside the outlines of the attached area. — Specimen from West-Greenland, "Tjalfe" stat. 502 (loc. 5). — × 6.

2. Perradial tentacle and section of bell margin. Observe the bulbous dilatation of the lower end of the radial canal, and the flattened upper side of the tentacular bulb. — Specimen from Greenland.

3. Piece of tentacle. Observe the deep transversal grooves on the adaxial side. — Specimen from Dyrefjord, Iceland, (loc. 8). — × 65.

Figure 4 *Halitholus cirratus* Hartlaub.

4. Specimen from Nyborg at the Great Belt, Denmark. — × 4.

Figures 5—7 *Leuckartiara octona* (Fleming).

— 5. Basal part of a fully extended tentacle, seen from the adaxial side. Observe the adaxial keel. — Specimen from Bergen. — × 35.

— 6. Piece of contracted tentacle, in the second coil, showing the transversal wrinkles, containing the nematocysts, much more close together on the convex (adaxial) than on the concave (abaxial) side. — × 110.

— 7. Middle part of a fully extended tentacle, showing the unilateral spiral line of protuberances containing nematocysts. — Specimen from Bergen. — × 65.

Figure 8 *Leuckartiara brevicornis* (Murbach & Shearer).

8. Tentacle. Observe the deep transversal grooves on the *ab*axial side. — Specimen from "Armauer Hansen" stat. 17 (loc. 8). — × 10.

Figure 9 *Leuckartiara nobilis* Hartlaub.

9. Tentacle. Observe the transversal grooves on the *ad*axial side. — Specimen from "Armauer Hansen" stat. 17. — × 10.

Figures 10—11 *Catablema vesicarium* (A. Agassiz).

10. Tentacle. — Specimen from Greenland, "Tjalfe" stat. 583 (loc. 15). — × 10.

11. Middle part of the same tentacle. — × 50.

Figure 12 *Catablema multicirrata* Kishinouye.

12. Manubrium, seen obliquely from the top, showing the broad area of attachment to the subumbrella. Observe also the vertical foldings of the gonads, and the tongue-shaped diverticula on the radial canals. — Specimen from "Tjalfe" stat. 583. — × 5.

Figures 13—14 *Neoturris pileata* (Forskal).

13. Tentacle, spirally coiled. — × 10.

14. Piece of tentacle, near the distal end, showing the triangular cross-section and the transversal grooves on the adaxial side. — × 50.

Figure 15 *Pandea rubra* Bigelow.

15. Tentacular bulb, showing the big abaxial spur, the extreme point of which is colourless and embedded in the jelly of the umbrella. — Specimen from the North Atlantic.

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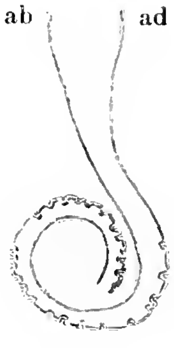

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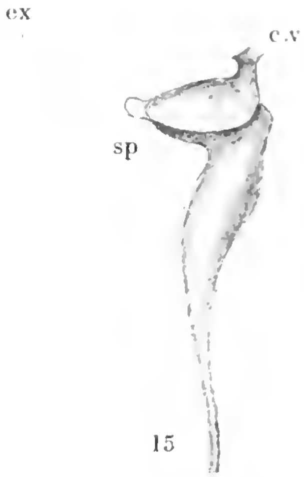

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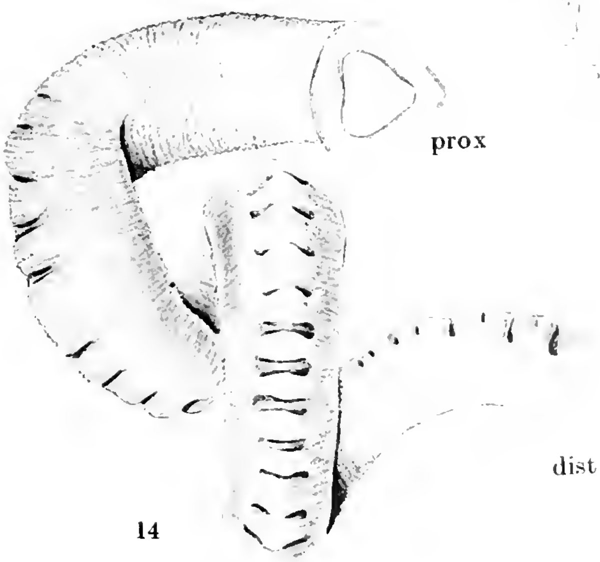

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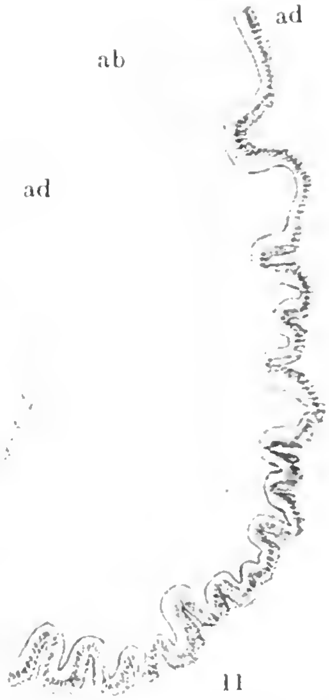

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P. L. Kramp del.

THE INGOLF-EXPEDITION

1895—1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°0	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	—0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr.	Lat. N.	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
65	62° 06′	22° 30′	843	3°4	92	64° 44′	32° 52′	976	1°4	118	68° 27′	8° 20′	1060	—1°0
69	62° 40′	22° 17′	589	3°9	93	64° 24′	35° 14′	767	1°46	119	67° 53′	10° 19′	1010	—1°0
70	63° 09	22° 05′	134	7°0	94	64° 56′	36° 19′	204	4°1	120	67° 29′	11° 32′	885	—1°0
71	63° 46′	22° 03′	46			65° 31′	30° 45′	213		121	66° 59′	13° 11′	529	—0°7
72	63° 12′	23° 04′	197	6°7	95	65° 14′	30° 39′	752	2°1	122	66° 42′	14° 44′	115	1°8
73	62° 58′	23° 28′	486	5°5	96	65° 24′	29° 00′	735	1°2	123	66° 52′	15° 40′	145	2°0
74	62° 17′	24° 36′	695	4°2	97	65° 28′	27° 39′	450	5°5	124	67° 40′	15° 40′	495	—0°6
	61° 57′	25° 35′	761		98	65° 38′	26° 27′	138	5°9	125	68° 08′	16° 02′	729	—0°8
	61° 28′	25° 06′	829		99	66° 13′	25° 53′	187	6°1	126	67° 19′	15° 52′	293	—0°5
75	61° 28′	26° 25′	780	4°3	100	66° 23′	14° 02′	59	0°4	127	66° 33′	20° 05′	44	5°6
76	60° 50′	26° 50′	806	4°1	101	66° 23′	12° 05′	537	—0°7	128	66° 50′	20° 02′	194	0°6
77	60° 16′	26° 59′	951	3°6	102	66° 23′	10° 26′	750	—0°9	129	66° 35′	23° 47′	117	6°5
78	60° 37′	27° 52′	799	4°5	103	66° 23′	8° 52′	579	—0°6	130	63° 00′	20° 40′	338	6°55
79	60° 52′	28° 58′	653	4°4	104	66° 23′	7° 25′	957	—1°1	131	63° 00′	19° 09′	698	4°7
80	61° 02′	29° 32′	935	4°0	105	65° 34′	7° 31′	762	—0°8	132	63° 00′	17° 04′	747	4°6
81	61° 44′	27° 06′	485	6°1	106	65° 34′	8° 54′	447	0°6	133	63° 14′	11° 24′	230	2°2
82	61° 55′	27° 28′	824	4°1		65° 29′	8° 40′	466		134	62° 34′	10° 26′	299	4°1
83	62° 25′	28° 30′	912	3°5	107	65° 33′	10° 28′	492	—0°3	135	62° 48′	9° 48′	270	0°4
	62° 36′	26° 01′	472		108	65° 30′	12° 00′	97	1°1	136	63° 01′	9° 11′	256	4°8
	62° 36′	25° 30′	401		109	65° 29′	13° 25′	38	1°5	137	63° 14′	8° 31′	297	—0°6
84	62° 58′	25° 24′	633	4°8	110	66° 44′	11° 33′	781	—0°8	138	63° 26′	7° 56′	471	—0°6
85	63° 21′	25° 21′	170		111	67° 14′	8° 48′	866	—0°9	139	63° 36′	7° 30′	702	—0°6
86	65° 03′½	23° 47′½	76		112	67° 57′	6° 44′	1267	—1°1	140	63° 29′	6° 57′	780	—0°9
87	65° 02′½	23° 56′½	110		113	69° 31′	7° 06′	1309	—1°0	141	63° 22′	6° 58′	679	—0°6
88	64° 55′	24° 25′	76	6°9	114	70° 36′	7° 29′	773	1°0	142	63° 07′	7° 05′	587	—0°6
89	64° 45′	27° 20′	310	8°4	115	70° 50′	8° 29′	86	0°1	143	62° 58′	7° 09′	388	—0°4
90	64° 45′	29° 06′	568	4°1	116	70° 05′	8° 26′	371	0°4	144	62° 49′	7° 12′	276	1°6
91	64° 44′	31° 00′	1236	3°1	117	69° 13′	8° 23′	1003	1°0					

THE DANISH INGOLF-EXPEDITION

VOLUME V.

11.

ANTHOMASTUS.

BY

HECTOR F. E. JUNGERSEN.

(WITH 1 PLATE, 3 FIGURES AND 1 MAP IN THE TEXT,
AND A LIST OF STATIONS.

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Preface.

Among the unpublished papers of the late professor dr. Hector F. E. Jungersen an almost completed study of our north Atlantic *Anthomastus* was present, of which study the late professor already in the summer 1916 had given a short review at the Scandinavian naturalists meeting in Kristiania, and a preliminary note in the Danish language is found inserted the report of that meeting. — During my visit in Copenhagen in the spring of 1922 professor dr. Ad. S. Jensen entrusted me with the honourable task to look through the alcyonarian manuscripts for the purpose of eventual publication. Luckily the study of *Anthomastus* was so nearly finished that it could be published only with some small additions[1] and alterations of subordinate significance. The paper here published is well apt to give a good picture of the accurate and extraordinarily prominent alcyonarian investigator, the late professor dr. Hector F. E. Jungersen.

p. t. Copenhagen in May 1922.

Hjalmar Broch.

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[1] Inserted within brackets ([-]).

Anthomastus grandiflorus Verrill.

Anthomastus grandiflorus, Verrill (1878), Notice of recent add. marine fauna east-coast of N. America. Amer. Journ. Sc. (3), Vol. XVI.

Sarcophytum purpureum, Koren og Danielssen (1883), Nye Alcyonider, Gorgonider og Pennatulider. Bergen.

Anthomastus grandiflorus, Verrill (1883), Rep. Res. "Blake" 1880. Bull. Mus. Comp. Zoöl. Vol. XI, pl. I, fig. 7—10.

— — Verrill (1885), Res. Expl. "Albatross" in 1883. U. S. Comm. Fish and Fisheries 1883, pl. II, fig. 12.

— *purpureus* + *A. canariensis*, Wright and Studer (1889), Rep. Alcyon. "Challenger" Zool. Vol. XXXI, pl. XXXVII fig. 4, pl. XLI fig. 7.

— *agaricus*, Studer (1901), Alcyon. Camp. Hirondelle. Vol. XX, pl. I figs. 6—8.

nec — *grandiflorus*, Hickson (1904), Alcyon. Cape of Good Hope. Part II. Mar. Invest. in South Africa, Vol. III, pl. VII fig. 2.

— *grandiflorus* + *purpureus* + *canariensis* + *agaricus*, Kükenthal (1906), Alcyonaria. Wiss. Ergebn. d. D. Tiefsee-Exp. ("Valdivia"), Bd. XIII.

— *grandiflorus* + *purpureus* + *canariensis* + *agaricus*, Kükenthal (1910), Zur Kenntnis d. Gatt. Anthomastus. Beitr. Naturg. Ostasiens, Abh. K. Bayer. Ak. Wiss. I. Suppl. Bd.

— *agaricus*, Jane Stephens (1909), Alcyon. and Madrep. Corals of the Irish Coast. Fisheries Ireland. Scient. Invest. 1907.

— *purpureus*, Broch (1912, 1913), Alcyon. d. Trondhjemsfjordes. I and III. K. Norske Vidensk. Selsk. Skr. 1911 and 1912.

— (*Sarcophyton*) *purpureus*, Grieg (1914), Bidrag til kundskapen om Hardangerfjordens fauna. Berg. Mus. Aarb. 1913.

— *grandiflorus*, Jungersen (1915), Alcyonaria, Antipatharia og Madreporaria. Conspectus Faunæ Groenlandicæ. Meddel. om Grönland XXIII.

The "Ingolf" took this species on the following localities in the "warm area" of the North Atlantic:

In the Davis Strait: St. 28: 65°14′ N., 55°42′ W., 420 Fthms., 3°,5 C. (about 500 specimens, quite young as well as larger colonies with up to 8 polyps).

- 27: 64°54′ N., 55°10′ W., 393 Fthms., 3°,8 C. (1 young colony with only 2 polyps).
- 25: 63°30′ N., 54°25′ W., 582 Fthms., 3°,3 C. (one small colony, and a large one of "puff-ball" shape with ca. 20 polyps; quite pink, almost white).

In the Danmark Strait: St. 97: 65°28′ N., 27°39′ W., 450 Fthms., 5°,5 C. (2 young colonies; solitary polyps with zooids).

- 10: 64°24′ N., 28°50′ W., 788 Fthms., 3°.5 C. (1 well grown "fringed" colony).

S. W. and S. of Iceland: St. 83: 62°25′ N., 28°30′ W., 912 Fthms., 3°.5 C. (1 well sized colony with fringe[1]), figured pl. I fig. 9, and textfig. 3.

- 81: 61°44′ N., 27°00′ W., 485 Fthms., 6°,1 C. (2 specimens).
- 75: 61°28′ N., 26°25′ W., 780 Fthms., 4°,3 C. (3 colonies, the largest one figured in textfig. 4, another in pl. I fig. 10).
- 40: 62°00′ N., 21°36′ W., 845 Fthms., 3°,3 C. (7 colonies, all with richly branched "roots"; in one — viz. the largest specimen — one root is about twice as long as the colony, terminating in several branchlets; two specimens consist only of the primary polyp and a number of zooids. The bottom of this locality is a "dark grey mud with numerous shells of Foraminifera and Spirialis".)
- 64: 62°06′ N., 19°00′ W., 1041 Fthms., 3°,1 C. (13 specimens, mostly of puff-ball shape, by means of basal membranes attached to blocks of hard clay; one is fringed, and one only a solitary polyp with zooids).
- 65: 61°33′ N., 19°00′ W., 1089 Fthms., 3°,0 C. (2 specimens of puff-ball shape; zooids hardly visible, polyps completely withdrawn; the larger specimen with a membraneous base, embracing mud, the small one attached to a stone).
- 47: 61°32′ N., 13°40′ W., 950 Fthms., 3°,23 C. (1 specimen of puff-ball shape, with polyps completely retracted and zooids not visible).
- 46: 61°32′ N., 11°36′ W., 720 Fthms., 2°,4 C. (18 specimens, mostly attached to stones; some of puff-ball shape [one with retracted polyps figured pl. I fig. 8], some with polyps expanded, and 13 specimens more or less pronouncedly fringed; among the latter are 3 solitary polyps with zooids.)

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[1] As this specimen, and some others with the "fringe" especially prominent were hosts of a Polynoid worm, I suspected the fringe to be in some way or other connected with the presence of such worms. But as the greater part of the fringed specimens did not carry any worms, and especially as quite young specimens (primary polyps with a few zooids) were found with commencing fringes, I think my first suspicion must be abandoned as not supported sufficiently by facts.

To this may be added 1 specimen from the coast of Norway (off Röberg on the Trondhjemsfjord, about 300 Fthms.) dredged by Dr. Th. Mortensen in july 1911.

The geographical distribution evidently is very wide, extending over a large part of the North Atlantic, excluding however the "cold area" of the latter. In the western part of the North Atlantic it reaches from near the Polar circle, in the Davis Strait, to about 12° Lat. N. in the Caribbean Sea (off Grenada, 576 Fthms; Verrill); in the eastern part from off the south coast of Iceland, to off south western Ireland, and to south of the Canaries (ca. 27° Lat. N. "Challenger" St. 3, "*A. canariensis*", 1525 Fthms.); further in the western fjords of Norway from Hardangerfjord to Trondhjemsfjord, localities cut off from the rest of the area of distribution by the cold abyssal deep of the Norwegian Sea.

The bathymetrical range of the species is likewise very extensive, from 75 to 1525 Fathoms. The lesser depths comprise some of the fishing banks off the east coast of North America, and the Norwegian fjords, while the greatest depths recorded are from localities along the American east coast (1395 Fthms.), and south of the Canaries (1525 Fthms.).

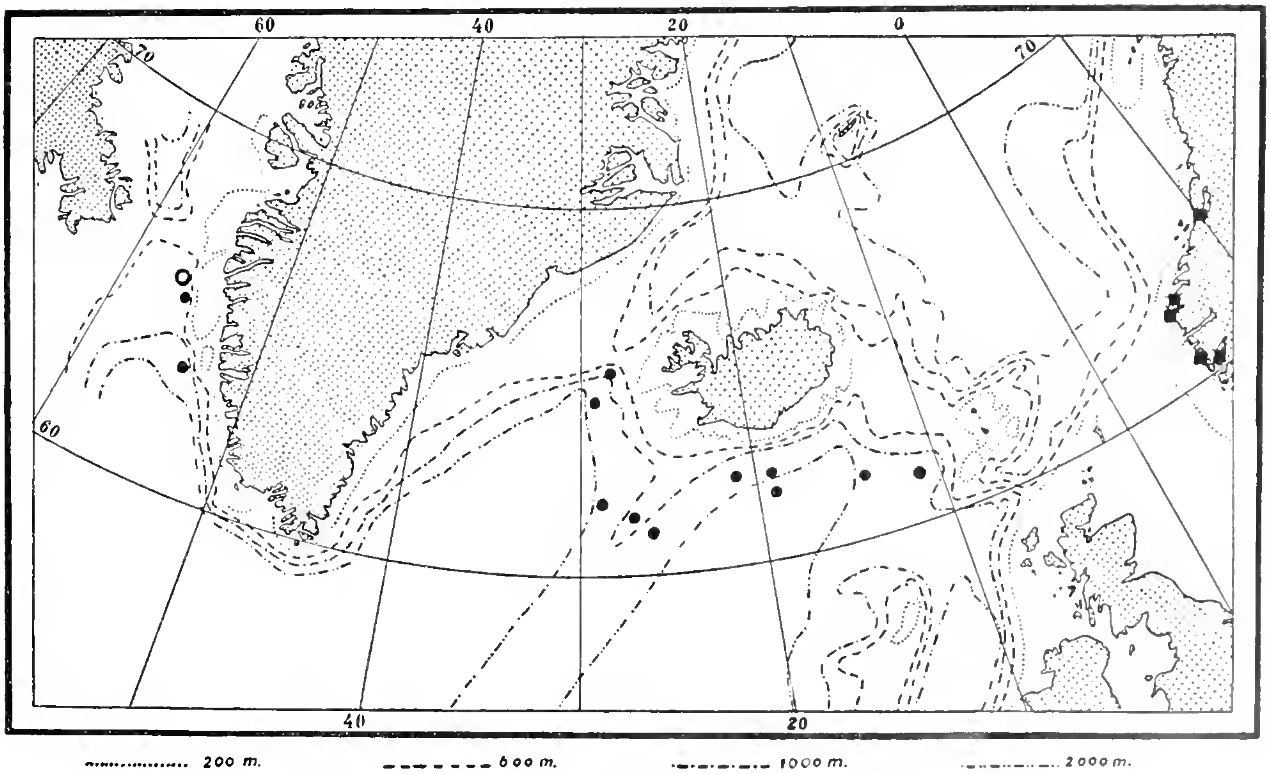

Fig. 1. Finding places of *Anthomastus grandiflorus* in the North Atlantic.
● Ingolf-localities where the species was found.
○ St. 28 of Ingolf, where the main part of the material was captured.
■ Finding places recorded from the Norwegian coastal waters.

[The geographical distribution of *Anthomastus grandiflorus* in the North Atlantic (comp. textfig. 1) gives a typical picture of a more southern or lusitanic species of the intermediate depths. In no place it surpasses the 600 meter line along the northern border of its main distributional area viz. the waters south of the submarine ridges, but has its home in deeper waters, although it does not endure temperatures below ca. 2°.4 C. In no place it has been observed within the cold area, and even those parts of the Norwegian Sea, where the bottom is covered by the warmer waters of the Atlantic current, seem to be devoid of the species, probably because the depth is here less than 600 metres. On the other hand the species flourishes in several Norwegian fjords from the Hardangerfjord to the Trondhjemsfjord, and in some of them it is rather common in lesser depths up to 200 metres, sometimes even occurring in 150 metres; on the other hand it here never goes down to 600 metres. This phenomenon probably indicates a relict species: in the western Atlantic the bathymetrical distribution is continuous from great depths and up till about 150 metres, and here no submarine barriers may be parallelized to the ridges of the northeastern Atlantic. Now we must remember that the coastal lines of Scandinavia show that the bottom of these parts of the ocean has risen to its present level during later postglacial times, and that in earlier postglacial times the temperature must have been higher than at present. The immigration of the species into Norwegian waters must be dated back to early postglacial time, and the distribution has at that time evidently been continuous from the Faeroe channel to Norway. During later postglacial times the connection has been cut off, the species not being able to exist under the altered biophysical conditions of the Norwegian Sea; but on the other hand, some lots of individuals have been able to find suitable conditions, and to propagate behind the thresholds of the western Norwegian fjords, and thus now constitute a lusitanic relict in these localities. A recent immigration owing to larval transport seems in this case to be absolutely precluded, in spite of the fact that individuals may gather, and propagate in astonishing numbers near the border of the Atlantic habitat as f. inst. on the "Ingolf" St. 28 far up in the Davis Strait. This find moreover points at a very short freeswimming larval period, the young ones settling down close to their parent colonies.]

The examination of an extensive series of *Anthomastus* — from St. 28 nearly 500 of which preserved and now present 488 — dredged by the "Ingolf" in different stations within a large area of the North Atlantic makes it quite certain, for the first that they all belong to one species, and that this is identical with *Anthomastus grandiflorus* Verrill, and secondly that several species previously established have to be included in the same species being only growth variants of *Anthomastus grandiflorus*. As is the case with most Alcyonarians the shape of the colony of this *Anthomastus* varies a good deal, not only according to age and development, but also according to environment and other conditions of which nothing definitely is known as yet. Already in the excellent description given by Verrill (1883, p. 41) is pointed out that the peduncle may be rather narrow, expanding upwards to the broad convex or flattened summit, that it may be short or remarkably elongated, at the base terminating in several, often numerous lobulate branches, irregular in form and size, but mostly with constricted bases so that they are easily broken off; or, on the other hand, specimens both large and small may be found attached to stones by a broad incrusting base; in large specimens the peduncle becomes short, and the upper or polypiferous part large, round and convex, or capitate, sometimes with a marked tendency of the polyps to form one or more rows along the border, and to leave the central area bare, sometimes with the polyps scattered all over the surface.

Quite the same is shown by the "Ingolf" material; and I may add that sometimes there is no distinct peduncle at all, the lower part evenly widening into the upper polypiferous part; sometimes this upper part is expanded on the top of a stalk somewhat in the manner of a fullgrown mushroom. In short, almost all shapes may be observed, which are represented by a mushroom during its development from the rounded stage resembling a puff-ball (young boviste) to the fully expanded "toadstool". In some cases the margin of the polypiferous part is not only sharply defined from the surface of the stalk, but even formed like a fringe, more or less produced into irregular lobes (textfig. 3, pl. I fig. 9) the latter generally terminating with young polyps or zooids. This fringe may be found in quite young specimens, beginning on one (the dorsal) side of the single primary polyp, from which the colony originates (comp. below).

The "rootlets", the irregular lobulate branches from the lower end of the colony, signalized by Verrill, evidently mostly occur in specimens living on soft bottom, mud or clay; sometimes they are extremely numerous, short, and richly branched, sometimes only few, in some cases very long, much longer even than the rest of the colony. When attached to stones, corals, worm tubes etc. the foot is expanded; this basal expansion may be short, broad, and stout, or widely spread, thin, and clumsily lobated at the margin. In some specimens from soft bottom, however, no rootlets were developed but a basal expansion grasping a lump of clay or mud to anchor the colony safely.

A few "double specimens" or "twins" are found, two colonies originating from a common root or basal expansion.

The largest colony found by the "Ingolf" is of the expanded mushroom shape with a narrow stalk ca. 30 mm high, 4—5 mm in diameter; the flat polypiferous disc is 26.5 mm in diameter with 8 fully developed polyps and one bud arranged round the margin, the large central part only being provided with thickly set, wartlike zooids, like the rest of the disc. The greatest number of polyps observed in any colony of my material is 20, found in a slightly pink (now bleached to almost white by the alcohol) colony of puff-ball shape from St. 25, where the polyps are scattered over the whole rounded surface as is mostly the case with colonies of this shape. The largest polyps measured are about 12 mm long with tentacles of 6 to 7 mm length (all the measurements given are from alcoholic specimens). Thus the dimensions of the colonies, and of the polyps are nearer to those given by the authors for *Anthomastus purpureus*, and far behind those mentioned by Verrill for "a well grown specimen, but not the largest examined" of *Anthomastus grandiflorus* (1883, p.42): "across the polypiferous part, 82 mm.; diameter of peduncle, 50 mm.; height of peduncle, 30 mm.; of polypiferous mass, 30 mm.; length of polyps as expanded in alcohol, 36 mm.; diameter of body, 7—9 mm.; breadth across expanded tentacles, 25 to 30 mm.". But if we compare younger specimens and the smaller colonies present in large quantities in the "Ingolf"-material, we find the polyps diminishing in size with the diminishing size of the whole colony, and as all the specimens of different sizes without the least doubt belong to one and the same species, and as no other real difference can be pointed out, which might separate *Anthomastus grandiflorus* from *Anthomastus purpureus*, I do not hesitate to follow Verrill in regarding the latter only as a synonym.[1]

The polyps are completely retractile; when completely retracted no calicles are to be seen as already stated by Verrill; in fact, only a star-like figure shows the position of the retracted polyp [illegible] quite as in

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[1] Verrill (1885 p. 513): "More recently it has been redescribed from the Norwegian coast under the name of *Sarcophyton purpureum* Kor. & Dan."

Alcyonium digitatum. Kükenthal in his last diagnosis of the genus *Anthomastus* says (1910, p. 3): "Die Autozooide sind vollkommen in Kelche zurückziehbar"; this is not quite correct, neither quite reconcilable with the diagnosis of the species *grandiflorus*; in the species diagnosis of *Anthomastus grandiflorus* (1910, p. 4) he more correctly says that the polyps are "gänzlich zurückziehbar". Broch (1912, p. 31) while simply repeating Kükenthal's diagnosis (as to this point) in the diagnosis of the species *purpureus* says: "Der Polypenkelch ist rudimentär", adding on p. 33 "bisweilen fast völlig verschwunden"; thus if we only take the little word "fast" away, Broch would be quite right. — The zooids may be more or less prominent, as warts, but in some cases they may be extremely difficult to see, the whole surface of the disc between the polyps appearing quite smooth (comp. textfig. 4) giving the impression of complete absence of zooids; zooids are nevertheless always present in large numbers, and they are the only carriers of the reproductive organs; the fully formed polyps are always sterile. Whether a zooid after having participated in the production of sperma or eggs — the colonies of *Anthomastus* are, as usually in Octactiniarians, dioecious — may grow sterile, and afterwards develop into a polyp, I have not ascertained; only of the fact that the first rudiment of a polyp is not to be discerned from a zooid I have become fully convinced (comp. below).

Figs. 2–4 *Anthomastus grandiflorus.* 2 A young colony from St. 28, with four well developed polypes, and a fifth developed in the middle of the zooid carrying "disc"; seen from above. × 3. 3 Colony from St. 83, with well developed fringe, and beneath this a Polynoid worm surrounding the upper part of the "stalk". (Comp. Pl. I, 9.) × 2. 4 The largest colony from St. 75, seen from above. × 2.

The general characters of the spicules, and their arrangement has been sufficiently well worked out by previous authors, lately by Broch (1912). Only the following addition may be made:

In specimens from St. 28 with well preserved tentacles the numbers of pinnulæ in each lateral row are 17 to 19, mostly 18; at the base small ones are developing. The long, transversely arranged spindles from the stem of the tentacle measured from 0.192 to 0.272 mm., most of them 0.256 mm. (Broch has measured somewhat larger spicules of the stem of the tentacle, mostly about 0.3 mm.); the flat forms also found in the pinnulæ are 0.096 to 0.128, while the more spindle-like of the pinnulæ measure from 0.144 to 0.228. Very few "doublestars" are found in the stem of the tentacle, measuring 0.048.

As only very little is known hitherto regarding the development of the colony in most Alcyonacea, the following observations may prove to be of some interest.

On some of the "Ingolf" stations several quite young colonies were found; but especially on st. 28 in the Davis Strait an immense number of colonies of almost every degree of development was taken in one haul by the trawl. The youngest stage is represented by a single polyp, and 2 or 3 very small zooids (pl. I fig. 1, *a* and *b*). That this polyp is the primary one into which the "planula"-larva is transformed, I think may be taken for granted. It is in height about 6 mm., including the one or several rootlets, into which its basal part is drawn out. The shape of its upper part is like that of the body of the polyp protruding from the disc or head of the fully formed colony, possessing mouth, and long tentacles etc. The colour is the same bright red, due to the coloration of the spicules, as in the larger colonies; it gradually loses its intensity downwards, and fades away on the root or rootlets serving for anchorage in the bottom. At a certain distance below the tentacles a group of 2 or 3 zooids are to be seen more or less conspicuously, always only on one side of the polyp, the dorsal or asulcar side as shown by sections, i. e. the side containing the gastral chambers opposite the siphonoglyphe of the stomodæum. In most cases the part of the polyp above these zooids is a little bent ventrally so that the longitudinal axis of the tentaculiferous part forms an open angle with that of the lower part. With the group of 2 or 3 zooids the formation of the disc is indicated. Consequently the part above the zooids, measuring 1.3 mm. (the tentacles included), corresponds to the polyps protruding from the disc in the fully formed colony (measuring about 12 mm.), while the part below the zooids represents the stalk. One specimen with only two zooids visible externally was cut in sections, and one developing (third) zooid was revealed in the median line just above the two.

A large number of specimens furnish together an unbroken series of the further development. In stages next to that described the number of zooids is augmented step by step without any conspicuous increasing in size of the primary polyp. Judging from the size of the zooids in the specimens, the first new ones may be added below the first three, or laterally of the one or the other of them. But as the number further rapidly increases, I have not been able to follow the exact sequence of the newcomers; my impression is, however, that no definite law is followed, new ones being intercalated more or less irregularly between those at first found. By and by a semilunar ridge or low cushion is formed, containing a considerable number of zooids of different age (comp. pl. I figs. 2—4). All the zooids of this assemblage have like those first appearing their dorsal sides directed towards the dorsal side of the primary polyp, their siphonoglyphs pointing outwards. The primary polyp of this stage is somewhat larger than before.

Now one of the zooids of the median line of the ridge cushion slightly enlarges, and when a certain amount of prominence is reached, rudiments of tentacles may be observed: i. e. the second polyp puts in its appearance and is developing. As the polyp gradually grows, and new zooids are added, by and by the size of the primary polyp is reached, and we have a stage with a small disc and two polyps of equal size. The third polyp appears on one side of the now considerably enlarged disc between the two first, showing the same stages of development as did the second; sometimes the fourth may be visible at the same time on the opposite side, but at least most often it appears after the third has reached a certain size. Next comes the fifth, then the sixth opposite the fifth; but with increasing numbers the regularity found so far seems to be given up. — The regular sequence described seems only to hold good in cases where the polypiferous part keeps the shape of a rounded or flattened disc with a bare central part; in colonies of puff-ball shape with the polyps irregularly scattered I have not been able to settle the order of budding, as no developmental series of this type is found in my material.

A very incomplete series of stages of the fringed form was found on St. 46, among them a rather large single, primary polyp with a group of some few zooids arranged on the margin of a short but distinctly prominent rudiment of fringe. On the fully developed colony figured in textfig. 3 and pl. I, fig. 9, the lobulated fringe will be seen to carry zooids, the larger lobes showing on their tips developing polyps of different sizes. — Also a primary polyp attached to stones by means of a basal membrane has been found in St. 64. It is a good deal larger than most of those found in St. 28, but the main features are the same; some few zooids only are to be seen.

Sections through the youngest stages show that the gastral cavity of the primary polyp with its mesenteries reaches almost to the root (or roots); here it narrows, loses the mesenteries and is continued into an irregular system of canals traversing the root or roots. In the mesogloea of the polyp body are found similar canals frequently opening into the radial chambers. The gastral cavity of the zooids are short, and by means of canals always connected with the dorsal chamber of the primary polyp, and besides also with the dorsolateral. With increasing number of zooids, the gastral cavities appear to be connected principally with the nearest chamber of the primary polyp. In specimens just showing an enlarging zooid, i. e. on the way to form a second polyp, the gastral cavity of this zooid seems also to enlarge; by and by it acquires the shape of a narrow straight canal, parallel to the gastral cavity of the primary polyp, and the mesenteries are gradually lengthened along the walls of this canal. If the stem of a more developed colony, say with four polyps, is cut across, it will be seen to contain four wide gastral cavities reaching almost to the base, one for each polyp; and in the same way all the gastral cavities of the fully developed polyps in any colony will be found continued through the stem to near the base.

In pl. I fig. 6 and 7 are represented two somewhat remarkable young specimens from St. 28. At first sight they look simply like fragments of rootlets detached from a colony; but closer examination shows that a young polyp is present at one end, and also two or three zooids could be detected. I think, however, that these specimens really are detached rootlets, and that rootlets may possess, or under certain conditions acquire the power of reproducing a new polyp. The growth, and further development into a colony of a polyp produced in this way presumably follows the laws described for the primary polyp produced from an egg. These suppositions are moreover strengthened by the above mentioned occurrence of twin colonies; they give evidence that the faculty of polyp budding is normally present in the rootlets and the basal expansions, although not directly observable in most preserved colonies. This faculty will of course more often be demonstrated by detached rootlets than by the basal expansions or rootlets of intact colonies.]

The specific identity of Verrill's *Anthomastus grandiflorus* with Koren and Danielssen's *Anthomastus* (*Sarcophytum*) *purpureus* can hardly be doubted. I have compared specimens of the "*purpureus*" from the Trondhjemsfjord with my material from the "Ingolf", and in the latter I find specimens which in every respect agree with the Norwegian specimens as to shape and size of the colony, and of the polyps, and as to the spicules. A certain amount of individual variation in the spiculation may be found; in some specimens "double-stars" are much more abundant than in others; but the different types of spicules in every specimen examined are invariably alike, with only slight individual variations as to size and development of warts. The *Anthomastus agaricus* Studer I have not had the opportunity to examine; but from my material I can easily pick out specimens completely like every one of Studer's figures (1901, pl. 1, figs. 6—8), and in every point agreing with his description. Furthermore the locality — New Foundland — is one from which Verrill has examined a good many specimens of his *Anthomastus grandiflorus*. I therefore without the least hesitation regard *Anthomastus agaricus* as identical with *Anthomastus grandiflorus*. Also the *Anthomastus canariensis* Wright and Studer in almost all features agrees with *Anthomastus grandiflorus*, the only difference as far as I am aware being that some of the spicules, viz. the spindleshaped ones attain a considerably greater length. Bearing in mind that characters of this kind have often been found to be of no specific value I am greatly inclined to abolish the specific name *canariensis*.

On the other hand I am convinced that Hickson's *Anthomastus grandiflorus* from off the Cape Recifs (1904) is quite a different species. The figure (1904, pl. VII, fig. 2) of the only specimen captured does not resemble any specimen in my material, nor any of the species of *Anthomastus* hitherto figured; in fact the description as well as the figure make it extremely doubtful to me whether Hickson's form really belongs to the genus *Anthomastus* at all. Also Kükenthal (1910, p. 4) greatly doubts that this form rightly has been referred to *Anthomastus grandiflorus*. At the same time I might point out that among the new species of *Anthomastus* which Kükenthal has described (1906 and 1910), one, the *Anthomastus elegans* certainly has to be eliminated from the genus *Anthomastus*. The two specimens captured at first sight are very different in shape from any true *Anthomastus*, and Kükenthal (1906 p. 64) says alluding to the specimen figured pl. I, fig. 6: "Siphonozooide liessen sich an dieser warhscheinlich noch jungen Form äusserlich nicht mit Sicherheit nachweisen", and p. 65 regarding the other undoubtedly quite young specimen with seven polyps: "Von Siphonozooiden liess sich bei diesem wie beim vorigen äusserlich nichts wahrnehmen, dennoch ist anzunehmen, dass sie vorhanden sind." Now if we remember the development of *Anthomastus grandiflorus*, set forth above, we should certainly expect to find the siphonozooids distinctly visible in the youngest specimen if such really were present at all; I therefore venture to say that no siphonozooids occur in the "*Anthomastus elegans*", and consequently this species cannot be admitted into the genus *Anthomastus*.

As to the colour Verrill seems to be the only investigator who has observed some variation; whereas all others give dark red as the only colour, he (1883, p. 42) says "varying from bright cherry-red to dark red". — We have to bear in mind that the colour generally is bound to the spicula alone, and the latter are mostly of a dark, blood-red colour; the colour of the colonies, or of the different parts of a colony accordingly somewhat varies in intensity in accordance with the more or less crowded position of the spicules. Some of the colonies may exhibit a delicate blueish hue like that figured in pl. I fig. 10. On the other hand the colonies from St. 25 showed a light pink colour, which faded away rather soon after their preservation in alcohol. These colonies recall the "white" colonies of *Paragorgia arborea* Linné: in common, dark red specimens with yellowish white polyps also here the red colour is bound to the spicula alone; but in the less numerous "white" colonies the spicula are colourless, the colour being here on the contrary bound to the soft tissues so that the living specimens are pinkish white with intensively, and rather darkly pink polyps; in this case the colour is rapidly done away with by the alcohol after preservation, in the former case the colour will on the other hand not, or almost not fade in alcohol. According to the "Ingolf"-material *Anthomastus grandiflorus* thus seems to exhibit quite similar features as to the colour. As yet, however, nothing can be said about the physiological conditions which determine, whether the colour is bound to the spicula or to the soft tissues].

Plate I.

Plate I.

Fig. 1. *a* and *b*: *Anthomastus grandiflorus;* primary polyp with only two externally visible zooids; from St. 28. ($^7/_1$.)

— 2. *a* and *b*: primary polyp somewhat more developed with three well developed, externally visible zooids; from St. 28. ($^7/_1$.)

— 3. Primary polyp with 7 zooids visible externally; from St. 28. ($^7/_1$.)

— 4. Great primary polyp with zooids building a ridge or cushion as commencing "disc" of the colony; St. 28. ($^7/_1$.)

— 5. *a* and *b*: a small colony from St. 28, with two well developed polyps, and with the third and fourth polyps appearing as enlarged zooids at the border of the zooid-carrying "disc". ($^3/_1$.)

— 6. Detached rootlet with developing polyp at one end; from St. 28. ($^7/_1$.)

— 7. Detached rootlet with developing polyp, and zooids; from St. 28. ($^7/_1$.)

— 8. Puff-ball shaped colony from St. 46, with completely retracted polyps, and externally invisible zooids. ($^1/_1$.)

— 9. Colony from St. 83 with well developed fringe, same specimen as the one represented in textfigure 3. The Polynoid worm surrounding the upper part of the "stalk" in fig. 3 has been removed here. ($^2/_1$.)

— 10. Colony with numerous lobate rootlets; from St. 75. ($^2/_1$.)

1 a.

1 b.

2 a.

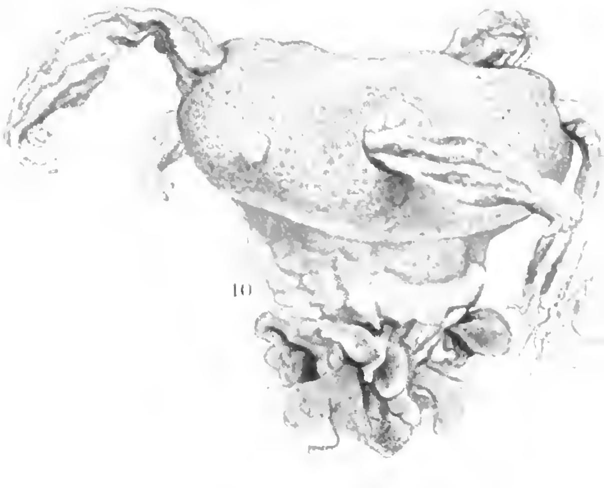
2 b.

5 a.

4

5

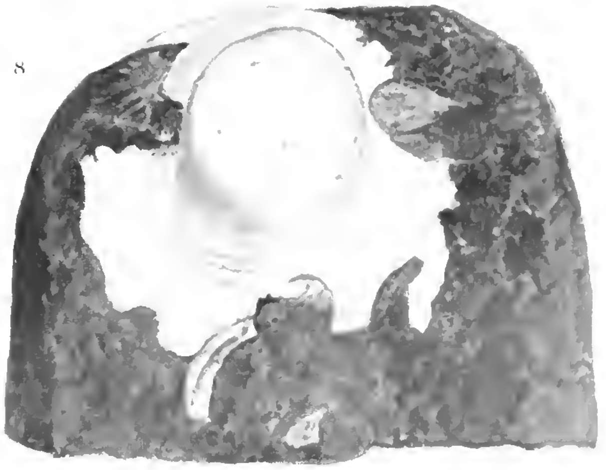
5 b.



10

6

9



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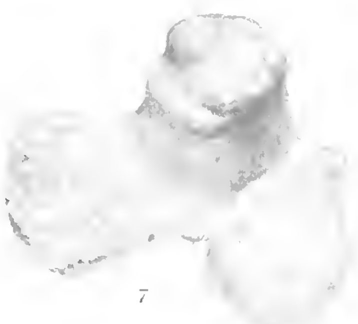

7

THE INGOLF-EXPEDITION

1895—1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N	Long. W	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°6	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	—0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
68	62° 06′	22° 30′	843	3°4	92	64° 44′	32° 52′	976	1°4	118	68° 27′	8° 20′	1060	—1°0
69	62° 40′	22° 17′	589	3°9	93	64° 24′	35° 14′	767	1°46	119	67° 53′	10° 19′	1010	—1°0
70	63° 09′	22° 05′	134	7°0	94	64° 56′	36° 19′	204	4°1	120	67° 29′	11° 32′	885	—1°0
71	63° 46′	22° 03′	46			65° 31′	30° 45′	213		121	66° 59′	13° 11′	529	—0°7
72	63° 12′	23° 04′	197	6°7	95	65° 14′	30° 39′	752	2°1	122	66° 42′	14° 44′	115	1°8
73	62° 58′	23° 28′	486	5°5	96	65° 24′	29° 00′	735	1°2	123	66° 52′	15° 40′	145	2°0
74	62° 17′	24° 30′	695	4°2	97	65° 28′	27° 39′	450	5°5	124	67° 40′	15° 40′	495	—0°6
	61° 57′	25° 35′	761		98	65° 38′	26° 27′	138	5°9	125	68° 08′	16° 02′	729	—0°8
	61° 28′	25° 06′	820		99	66° 13′	25° 53′	187	6°1	126	67° 19′	15° 52′	293	—0°5
75	61° 28′	26° 25′	780	4°3	100	66° 23′	14° 02′	59	0°4	127	66° 33′	20° 05′	44	5°6
76	60° 50′	26° 50′	806	4°1	101	66° 23′	12° 05′	537	—0°7	128	66° 50′	20° 02′	194	0°6
77	60° 10′	26° 59′	951	3°6	102	66° 23′	10° 26′	750	—0°9	129	66° 35′	23° 47′	117	6°5
78	60° 37′	27° 52′	799	4°5	103	66° 23′	8° 52′	579	—0°6	130	63° 00′	20° 40′	338	6°55
79	60° 52′	28° 58′	653	4°4	104	66° 23′	7° 25′	957	— 1°1	131	63° 00′	19° 09′	698	4°7
80	61° 02′	29° 32′	935	4°0	105	65° 34′	7° 31′	762	—0°8	132	63° 00′	17° 04′	747	4°6
81	61° 44′	27° 06′	485	6°1	106	65° 34′	8° 54′	447	0°6	133	63° 14′	11° 24′	230	2°2
82	61° 55′	27° 25′	824	4°1		65° 29′	8° 40′	466		134	62° 34′	10° 26′	299	4°1
83	62° 25′	28° 30′	912	3°5	107	65° 33′	10° 28′	492	—0°3	135	62° 48′	6° 48′	270	0°4
	62° 36′	26° 01′	472		108	65° 30′	12° 00′	97	1°1	136	63° 01′	9° 11′	256	4°8
	62° 36′	25° 30′	401		109	65° 29′	13° 25′	38	1°5	137	63° 14′	8° 31′	297	—0°6
84	62° 58′	25° 24′	633	4°8	110	66° 44′	11° 33′	781	—0°8	138	63° 26′	7° 56′	471	—0°6
85	63° 21′	25° 21′	170		111	67° 14′	8° 48′	860	—0°9	139	63° 36′	7° 30′	702	—0°6
86	65° 03½′	23° 47½′	76		112	67° 57′	6° 44′	1267	—1°1	140	63° 29′	6° 57′	780	—0°9
87	65° 02½′	24° 56½′	110		113	69° 31′	7° 00′	1309	—1°0	141	63° 22′	6° 58′	679	—0°6
88	64° 58′	24° 25′	76	6°9	114	70° 36′	7° 29′	773	1°0	142	63° 07′	7° 05′	587	—0°6
89	64° 45′	27° 26′	310	8°4	115	70° 50′	8° 29′	86	0°1	143	62° 58′	7° 09′	388	—0°4
90	64° 15′	29° 06′	568	4°4	116	70° 05′	8° 26′	371	0°4	144	62° 49′	7° 12′	276	1°6
91	64° 44′	31° 06′	1236	3°1	117	69° 13′	8° 23′	1003	—1°0					