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CONDUCTED BY

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BEING A CONTINUATION OF THE "ANNALS" COMBINED WITH  
MESSRS. LOUDON AND CHARLESWORTH'S "MAGAZINE OF NATURAL HISTORY."

WITH ONE PLATE.

Illustrative of Prof. M'Intosh's Notes from the Gatty Marine Laboratory,  
St. Andrews.

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that of the dry phase; nevertheless all intermediate examples are not absolutely constant, some showing more falcation of the primaries than others. The local variations are not constant enough to deserve names, but examples from Western China tend to have smoky secondaries; and an example which we have from the Celebes is of a smoky ochraceous tint over the whole upper surface; examples from Java are usually rather small, but not smaller than many other examples of the species. The characters upon which the var. *sumbæ* is separated are extremely variable: the upper ocellus of the primaries is sometimes almost lost in the black bar from costa, and the lower ocellus partly enclosed in a black patch in Indian examples; the lower ocellus in the secondaries is sometimes quite large, at others almost obliterated; the uppermost ocellus on the under surface of primaries is sometimes well-formed, with defined pupil, sometimes reduced to a fine point; the upper pair on the secondaries exhibits great variation as regards separation, and the lines on the under surface are frequently almost entirely red-brown instead of black; the pale bands on the under surface also vary in number, the wettest phase showing them most distinctly.

XXX.—*Notes from the Gatty Marine Laboratory, St. Andrews.*—No. XXI. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

[Plate I.]

1. On some Points in the Life-history of the Littoral Fishes.
2. On Japanese Annelids—*Nephtys* and *Eteone*.
3. On Norwegian Annelids collected by Canon Norman.
4. On Canadian *Phyllodoce* collected by Mr. Whiteaves.
5. On certain *Hesionidæ* from the 'Porcupine' Expedition of 1870.

1. *On some Points in the Life-history of the Littoral Fishes\**.

No group of marine fishes is better fitted for demonstrating the great mortality which ensues between the period of the deposition of the ova and the adult condition than the littoral fishes, such as the Shanny, Cottus, Gunnel, and Viviparous Blenny. This is especially true of such a form as the Shanny, the adults of which can, as a rule, be readily located on rocky shores in the pools between tide-marks.

\* Communicated to the Bradford Meeting of the British Association, 1900.



Not unfrequently only a single Shanny is encountered in a pool, its presence being disclosed by the noise as it leaps from the seaweeds on which it has been lying into the water. Yet the adult females deposit a considerable number of eggs in small rocky caverns, and the young abound in the rock-pools in August and September, when they are still more or less pelagic. As they increase in size they become fewer—not so much by spreading themselves in the ocean or by taking advantage of new sites amongst the rocks, but apparently by steady diminution from predatory neighbours. Thus it is that large adults are comparatively rare at St. Andrews.

The eggs of the Shanny would not seem to suffer so seriously from the attacks of birds, rats, and predatory fishes as those of the Short-spined Cottus and the Lump-sucker, nor are the adults much, if at all, molested by man, yet the drain on the young and adolescent forms suffices to restrict the numbers.

The Viviparous Blenny is by no means plentiful in its adult condition between tide-marks, even in winter, though it cannot be said to be rare. Its distribution at St. Andrews, for instance, is similar to what it was fifty years ago, and perhaps for a very much longer period; yet its young, so far as observed, do not leave the tidal region, though the adults may occasionally be seen following the flowing tide at low-water mark. It has also to be mentioned that in spring and summer the adults are rare between tide-marks, probably having gone to estuarine and laminarian regions to recruit. They are more frequently met with in the rock-pools from November to January. Yet the adults are to be found in the harbour throughout the summer; they appear to take to the rock-pools in connection with the discharge of their young. The viviparous habit affords a contrast both with those having demersal and those having pelagic eggs. The young, further, reach an advanced stage of growth (about two inches) before leaving the parent, and thus commence life under favourable auspices; yet the attacks made on them by pelagic and littoral fishes, and even by their own parents, suffice to keep the species in check, so that though an adult female may produce from 40 to 70 or more young in a form capable of taking care of themselves, and at once sheltering under stones, sticks, crabs, shells, and similar structures, yet the losses ere they reach the adult condition are great—and this without any interference in our country by man.

The Short-spined Cottus (*Cottus scorpius*) shows the same abundance of demersal eggs and even greater numbers of



pelagic young, yet the adults are by no means plentiful in rock-pools or in the laminarian region. The eggs are a favourite food of many fishes and some birds, so that destruction begins early in the life-history. The larval and post-larval forms are pelagic and may be caught at the surface in inshore water, for their range at this stage appears to be greater than that of the Shanny, just as the range of the adult extends beyond the tidal region into the neighbouring sea. Their gaudy coloration and protective spines, however, do not prevent a serious reduction in their numbers, so that the contrast between the crowds of young and the comparatively few adults is noteworthy.

The eggs of the Lump sucker, though the adult is not strictly a littoral fish, are perhaps the most conspicuous demersal eggs on our shores\*, both in regard to numbers and coloration, and they have the further interest in that they are faithfully guarded by the males. The newly hatched young are pelagic, and often swarm in the rock-pools and adjoining inshore areas, while the subsequent stages—to nearly 20 mm. in length—are also pelagic, though some of the larger are fixed by the sucker to floating pieces of seaweed (*Fuci*) and thus are captured in the tow-nets. They (the larger) can, however, swim rapidly from place to place on separation from the weeds. Their greenish tints—with remarkable touches of silvery white—and their peculiar papillæ do not seem to prevent a great reduction in numbers from this stage onwards, chiefly by the attacks of predatory fishes. The adults are certainly comparatively few in contrast with the masses of ova and the swarms of post-larval specimens, though from their frequenting the region beyond low-water mark there is less opportunity for observation than in the case of the Shanny. Besides, seals are fond of the adults and many of the males fall victims to their faithful guardianship of the eggs. While this species is in greater numbers than such as the Shanny, its habits and its size prove fatal, for it is caught in considerable masses in the salmon bag-nets off rocky coasts, and in former times was used to feed the pigs of the fishermen. The adults are also occasionally caught on hooks 20–30 miles from land.

The Gunnels deposit their eggs in masses about the size of a walnut between tide-marks, and the parents watch them during incubation. A large number of hardy larval fishes are produced, and during a considerable portion of their early growth (larval and post-larval) they are pelagic and often

\* They were produced to the Royal Commission on Trawling, in 1883, as the eggs of the haddock.



occur in great numbers at a distance from the tidal region. The adolescents, again, have been met with at considerable depths. The adults, on the other hand, are found under *Fuci* in tidal rivulets and under stones between tide-marks. Though common, they never form groups, but occur singly or in pairs, and their numbers (in contrast with those of the young) are insignificant. The large number and hardy nature of the latter indicate that a great increase would annually take place if their ranks were not seriously thinned during growth. The migration of the young seawards probably increases the chances of survival, though some might consider that such augments the danger. Much depends, however, upon the eagerness with which the early stages are pursued by littoral, laminarian, or pelagic fishes.

Fifteen-spined Sticklebacks are by no means numerous between tide-marks, though at the same time they are generally distributed. They occur in rock-pools (especially those approaching high-water mark), where they make their nests. Their eggs are not so numerous as in the foregoing forms, but they are thus specially protected. The young are plentiful in the rock-pools in June and present hundreds for every adult along the coast-line. As the young seem to keep to the rock-pools during growth, it is in the tidal region that the decrease in their numbers takes place, and it may be that great mortality ensues before the spines are fully developed, though much weight need not be attached to this feature. Both littoral and pelagic fishes, and, in their early stages, Mysidæ and other crustaceans, have them for prey. The result is that their ranks dwindle to a few adults here and there in the rock-pools of a region, their protective spines and hard surface having failed to do more for their preservation.

The next species, the Five-bearded Rockling, belongs to a different category, since its eggs are numerous and pelagic. The adults occur sparingly between tide-marks in rock-pools, and seldom seek the adjoining area seawards. The pelagic eggs tend to scatter the species widely, and the larval and post-larval stages follow the same pelagic habit. The young are familiar as silvery mackerel-midges in the surface tow-nets all round our shores. Thus the eggs and young may wander far from the place of their nativity and spread the species on new sites; yet neither the large number and transparency of the former nor the wide distribution of the latter enables the species to increase beyond a certain specified limit, and this though there is no interference by man. The contrast between the life-history of this form and



that of such members of the same family as the cod, haddock, whiting, and ling, is sufficiently pronounced, for in the one case the species is limited, even though the eggs are everywhere found in the tow-nets, whereas in the others the numbers are immense, and this notwithstanding all the efforts of man to destroy them.

A consideration of all the foregoing forms shows that the numbers of the adults do not, as a rule, vary much from period to period, and that the large number of eggs—whether demersal or pelagic—and of young are necessary to maintain the species, and this though there is no systematic capture of any of them either for food or for pleasure. Moreover, the incursions or migrations of the young into the neighbouring waters in their pelagic condition probably play an important part in the preservation of the species, yet there is considerable variety in the methods by which this is carried out.

Further, if such uniformity and persistence characterize littoral fishes everywhere within the easy access of man, it is not a great step to the view which holds that the marine food-fishes are in no great danger of extinction by the operations of man. These fishes have a vast area of water which is utilized not only for the migrations of the adults but for the spread of the pelagic eggs, larvæ, post-larval forms, and adolescents. Even were the inshore flat-fishes, for instance, to be reduced to such a degree that their capture would no longer be profitable, that fact would be their safeguard, for they would be left, amidst the most favourable surroundings, to augment their decimated ranks.

## 2. *On Japanese Annelids—Nephtys and Eteone.*

### *Nephtys Jeffreysii.*

A single example of a small *Nephtys* was dredged in 30 fathoms by Capt. St. John in the Japanese area  $33^{\circ} 58' N.$ ,  $130^{\circ} 27' E.$ , and sent to me in 1874 by Dr. Gwyn Jeffreys.

The head is proportionally smaller than in *N. longisetosa*, Örst., to which the species is allied, and forms a somewhat hexagonal lozenge, with a pair of small though very distinct black eyes at the posterior border, which, like the anterior, forms the narrow sides of the hexagon. The anterior tentacles are subulate and curve forward. The posterior pair, of a similar shape, follow closely. The proboscis is of considerable length, has somewhat longer papillæ than in *N. longisetosa*, in 22 rows (instead of 15 in the species mentioned) and 6 or 7 in each row. They increase in length from the proximal to the distal series and have a backward



curve. The usual series of bifid papillæ occur on the distal margin (in extrusion).

The body has the typical shape. The posterior region is absent. The bristles resemble those of *N. longisetosa* in their curvature and strength, but the two annelids are readily discriminated by the reduction of the dorsal lamella in the Japanese form.

In the typical foot the dorsal lamella has a stiff conical outline (Pl. I. fig. 1), standing nearly erect instead of having the backward slope of that in *N. longisetosa*, and it is directed outward and slightly upward. The dorsal cirrus is a slender subulate process with an enlarged base, and is connate with the base of the branchia. The latter is somewhat slender, and is curved inwards, as in *N. longisetosa*. The capillary dorsal bristles are pale, strong, and curved backward from a limited origin below and in front of the lamella. The spine is indistinct, but pierces a papilla between these bristles and the camerated anterior series. The line of origin of both sets of bristles is unusually limited. Unfortunately the bristles have lost their finer characters, but both the capillary and the camerated are stout, the segments in the latter being in many narrow.

The inferior division presents dorsally a curved, slightly tapered, branchial process, somewhat thicker than the dorsal cirrus. The tip of the lobe is bluntly conical and bevelled from above downward in lateral view—from the shape of the posterior lamella. The capillary and barred (camerated) bristles lie in front, the latter having no perceptible guard or fillet to their base anteriorly. The ventral cirrus is proportionally large, with a swollen base and tapering extremity.

In describing *Nephtys dibranchis* in the Annelids of the 'Challenger,' allusion was made to the species thus:—

"A similar species (*Nephtys Jeffreysii*) comes from Japan, lat. 33° 58' N., long. 130° 27' E., where it was dredged by Capt. St. John. The structure of the foot, however, shows a characteristic divergence. Instead of being rounded, the superior lamella has a nearly straight upper edge, the tip is pointed, and the external border convex. The superior lobe of the foot is less produced than in the foregoing, the cirrus at the base of the branchia is symmetrically dilated at the base, and thereafter forms a nearly cylindrical process. The branchial process is both shorter and more slender, and the enlargement a little beyond the base externally very prominent. The inferior lobe is very short, presenting superiorly a short, straight, branchial process which extends a little beyond the tip of the lamella beneath, which is some-



what conical. The ventral cirrus is broadly fusiform at the base, and slender distally."

*Eteone japonensis*, sp. n.

*Habitat.* Dredged in the Japan Sea by Capt. St. John in 1874 and sent by Dr. Gwyn Jeffreys.

It is a comparatively small species, apparently about an inch in length. The head forms a proportionally broad spatulate and truncate region, with two well-marked eyes situated towards the posterior region. The tentacles are of average size and subulate. The tentacular cirri are also subulate, but tapered to a fine point, and scarcely reach the diameter of the narrow body. The latter is linear elongate, very slightly tapered anteriorly, but more distinctly diminished posteriorly, where it terminates in two ovoid styles or cirri. The feet (Pl. I. fig. 2) lean to the type of *Eteone arctica*, Malmgren, but differ in the more elongated or broadly lanceolate dorsal lamellæ, which likewise have a longer pedicle. This difference is especially marked posteriorly. The setigerous process is somewhat pointed and bears a series (few in number) of slightly curved bristles that are stouter than those of *Eteone arctica*. The shortness of the dilated region at the end of the shaft and the shorter curved hooks at the tip on each side of the terminal blade are characteristic. The terminal blade is very finely tapered, and the edges so minutely denticulated that the teeth are invisible in ordinary views. The ventral lamella stands freely outward as a broadly lanceolate process, but its tip does not project beyond that of the setigerous division.

3. *On Norwegian Annelids collected by Canon Norman, D. C. L., LL. D.—Nephtydidæ, Phyllodocidæ, and Hesionidæ.*

No new species was met with in the groups under consideration, but *Nephtys hystericis*, M'I., var., was found to be common off Lervig, in Lervig Bay. In this variety the body is less firm than in *Nephtys ciliata*, O. F. M., with which species it agrees in the size of the papillæ of the proboscis, but the latter is smooth inferiorly (in extrusion) instead of being papillose. The anterior free flap of the foot is very small, and in some appears to be absent. The other forms were *Nephtys pansa*, Ehlers, *N. cirrosa*, Ehlers, *N. scolopendroides*, D. Ch. (young), *N. ciliata*, O. F. M. (the most abundant species), and a young example of *N. caeca*, Fabr.



*Nephtys pansa*, Ehlers\*, was originally described from Station 45 of the 'Porcupine' Expedition, 30th July, 1869, 51° 1' N., 11° 24' W., at a depth of 426-458 fathoms, and a bottom temperature of 8°·35 Celsius.

A specimen was procured by Canon Norman off Dröbak, Christiania Fjord, in 30-100 fathoms.

It is distinguished by its somewhat short proboscis, which has about four papillæ in each of the rows (22), and the structure of the feet. The latter present a narrow posterior lamella and a short conical dorsal cirrus, whilst the branchiæ in the anterior segments form short, flat, and broad lamellæ, but they diminish posteriorly to small processes, so that the feet approach those of *N. incisa*, Mgrn. The proboscis has no long median papilla as in *N. ciliata*. The capillary bristles are boldly curved and strongly serrated, and the barred or camerated bristles have the usual structure.

The Phyllodocidæ are represented by the generally distributed *Phyllodoce grænlandica*, Ærsted, *Eumida sanguinea*, Ærsted, by the less common *Notophyllum polynoides*, Ærsted, *Genetyllis lutea*, Malmgren, *Eteone fucata*, Sars (?), and the rarer *Mysta barbata*, Malmgren, and *Sige fusigera*, Malmgren, the last being, indeed, a characteristically northern form.

Only two of the Hesionidæ were obtained, viz. *Ophiodromus vittatus*, Sars, and *Castalia punctata*, O. F. M., both finely coloured species, especially the former.

#### 4. On Canadian Phyllodocidæ.

The specimens were dredged by Mr. Whiteaves, now of the Geological Survey of Canada, from 1871-1873.

Besides those subsequently noted, the ubiquitous *Phyllodoce grænlandica*, Ærsted, was most abundant, large specimens occurring 15 miles S.S.E. of Bonaventure Island and on Bradelle Bank. There were also a form near *Phyllodoce laminosa*, Savigny, and another species which differs both from this species and *P. grænlandica*. Three species of *Eteone* are present, viz. a form near *E. lentigera*, Malmgren, *Eteone spetsbergensis*, Mgrn., and another which approaches the *E. cinerea*, of Webster and Benedict. One specimen of *E. spetsbergensis*, from Bradelle Bank, had, about the 52nd foot on the left, an elongate-ovoid white crustacean parasite fixed firmly in the sulcus between two feet. The flask-shaped body is smooth, but dorsally (in regard to the annelid) a transversely elongated brownish area occurs, and internally

\* Zeitsch. f. w. Zool. Bd. xxv. p. 40, pl. iii. figs. 1 & 2.



opaque whitish granules extend distally from it. The thick end of the elongated pear-shaped parasite narrows to a chitinous proboscis, which is deeply inserted in the tissues of its host.

*Phyllodoce* sp.?

*Habitat.* Dredged in Gaspé Bay, Canada, 30 fathoms, 1873, by Mr. Whiteaves.

*Head* (in spirit) forming a blunt cone, with the four short subulate tentacles at the tip. The posterior margin of the head is cordate, with two lateral bosses. The eyes are of good size, though much smaller than those of *P. oculata*, Ehlers\*, and are situated about the posterior third of the head and have lateral as well as dorsal vision. The tentacular cirri are of average length, the anterior dorsal arising just outside the lateral boss.

*Body.* As only a fragment of the anterior region was procured, all that can be said is that the general structure is typical, the segments being boldly marked dorsally and ventrally, two transverse bars in each segment being present, and ventrally a median longitudinal groove.

The foot (Pl. I. fig. 3) is characterized dorsally by a broad and somewhat irregular lanceolate lamella, which probably is considerably altered posteriorly. The setigerous region is slightly bifid, and bears a series of pale bristles, with the usual curve distally below the dilated end of the shaft, which is spinous along the edge and more minutely so on the surface. The terminal blade is long, finely tapered at the tip, and rather boldly serrated on the edge.

The ventral lamella is irregularly lanceolate, with a pointed tip, which extends fully as far outward as the tip of the setigerous process.

This species differs from *Phyllodoce laminosa* in the shape of the dorsal lamellæ, for they are much less foliaceous anteriorly, and the ventral lamellæ do not project so much beyond the setigerous region.

The tips of the bristles are also longer and more tapered, and in this respect they also differ from the *P. fragilis* of Webster †.

It is no nearer *P. grænländica* or other form. It differs from the *P. oculata* of Ehlers, also from the American waters, which has a dorsal lamella of similar shape anteriorly and spinose dilated ends to the shafts of the bristles, by the broader and shorter ventral lamellæ.

\* Florida-Anneliden, p. 135, Taf. 40. ff. 4-6.

† Annelida Virgin. Coast, p. 14, pl. iii. figs. 32-37.



The proboscis seems to approach that of *P. grænländica*, having apparently (as the specimen is injured) 17 terminal papillæ, and similar rows of these organs at the base.

The exact relationships of the American Phyllodocidæ to the European forms have yet to be more rigidly determined. Further, more accurate figures of the bristles and other parts are required. I have been unable to follow the distinctive characters of such as *P. catenula*, Verrill, for instance, as certain parts have been omitted. It is possible that the present form comes close to the latter.

*Eteone lentigera*, Malmgren?

*Habitat.* Dredged at 30 fathoms in Gaspé Bay, St. Lawrence, Canada, 1873, by Mr. Whiteaves.

*Head* bluntly conical, the transverse exceeding the antero-posterior diameter, and with a short tentacle on each side of the rounded snout. The second tentacle is shorter, and is only visible in lateral and ventral views. A median triangular region of the head is cut off by a line from the constriction behind the dorsal tentacles to the centre of the posterior border of the head, a lateral area with a rounded external border being thus separated on each side. The tentacular cirri are short subulate organs, not more prominent than the feet. No eyes are present.

*Body*, to judge from the fragment, approaching three inches in length, very slightly tapered anteriorly, and having the usual shape. A prominent papilla guards each side of the mouth posteriorly. When the body is viewed laterally the setigerous process of the foot is anterior, the dorsal and ventral lamellæ sloping backward, except in the anterior segments.

The proboscis in extrusion is smooth at the base, clavate and rugose distally, while within the ring of smaller papillæ at the tip a much larger papilla projects from each side anteriorly, simulating teeth.

The rounded dorsal lamellæ are nearly vertical in front, but posteriorly somewhat overlap. The dorsal lamella forms a rounded fan anteriorly, then the edge becomes more prominent and the symmetry of the fan less perfect. The pedicle is also longer. The setigerous lobe is somewhat short and massive, blunt and bifid at the tip. The shafts of the bristles are slender; the dilatation at the tip has a distinct shoulder, is obliquely striated, and presents two short stout terminal hooks or spines, which, when the blade is viewed in profile, are lateral in position and next the serrated edge of the blade. Secondary small spines are visible on the



ridges in some examples. The terminal process is obliquely striated, of moderate length, serrated on the edge, and finely tapered.

The ventral lamella is bluntly rounded at the tip in front and broadly ovate. It projects considerably beyond the setigerous region both in the anterior and posterior feet, but it is narrower and more pointed externally.

A specimen had thrust itself into the tube of *Chaetopterus*.

Unfortunately Prof. Verrill does not mention the condition of the proboscis or the ventral lamellæ in his species\*. Accordingly his *Eteone robusta*, *E. limicola*, and *E. setosa* cannot be accurately identified.

#### *Eteone cinerea*, Webster & Benedict?

*Habitat.* Dredged by Mr. Whiteaves between Bradelle Bank and Miscou Island, in 45 fathoms, Gulf of St. Lawrence, Canada.

*Head* forming an obtuse cone, brownish, and without visible eyes. The tentacles are short. The subulate tentacular cirri are a little longer than the feet, and about four seem to be present on each side, thus differing from the typical *Eteone*.

Body incomplete, about three-quarters of an inch of the anterior region being present. It is tinted brownish in front, pale posteriorly. The aspect from the dorsum is peculiar, since the elongated dorsal lamellæ trend backwards as isolated processes.

The 30th foot (Pl. I. fig. 4) has dorsally a lobe which, at the 10th foot, is ovato-lanceolate, and although the pedicle is short it extends far outward and upward from the setigerous process. It increases in size posteriorly, and the pedicle becomes more distinct, the lamella forming an elongate ovoid, slightly narrowed at the tip, yet presenting a more or less clavate aspect in certain views. In form the dorsal lamella somewhat resembles that of Ehlers's *Eteone sculpta* † from South Georgia, but in this case it is considerably longer, and there are other differences in the structure of the feet. The setigerous process is short and bifid. The shafts of the pale slender bristles have an elongated or somewhat fusiform dilatation at the tip, and the spines at the end are delicate and translucent, but have a similar arrangement to that of *Eteone*. The dilatation is very minutely spinulose. The

\* Invertebr. of Vineyard Sound, &c., Rep. U.S. Comm. Fish & Fisheries, 1873, p. 588.

† Hamburger Magalhaens. Sammelreise, Polychæt. p. 33, Taf. 1. fig. 32 (1897).



terminal blade is translucent, tapers to an extremely fine point, and the serrations on the edge are minute. The entire bristle is perhaps one of the most delicate in the group.

The ventral lamella is ovoid and bluntly rounded in front, more pointed posteriorly. It projects considerably beyond the setigerous region.

The *Eteone limicola* of Verrill\*, is described as having "lateral appendages small on the anterior segments, becoming much more prominent farther back; anterior branchiæ very small, ovate, sessile; those farther back much longer, and narrow ovate"; but in the Canadian form the dorsal lamellæ extend prominently outward and upward, even so far forward as the tenth foot. The eyes also appear to differ, none being visible in the present species. The form approaches Webster and Benedict's *E. cinerea* †, though the ventral lamella in the Canadian species extends considerably beyond the setigerous region, whereas in the American author's figure it falls short of it.

#### 5. On certain Hesionidæ from the 'Porcupine' Expedition of 1870.

##### *Tyrrhena atlantica*, Roule ‡.

*Habitat.* Several specimens were dredged in the 'Porcupine' expedition of 1870 at Station 9, on the Channel Slope, lat. 48° 6' N., long. 9° 18' W., in 539 fathoms, on a bottom of grey mud. Bottom temperature 48°·0 Fahr., surface temperature 64°·0.

*Head* more or less quadrate, with the long diameter antero-posterior, and generally with a median depression and a somewhat cordate posterior border, so that the eyes occur on an elevated ridge on each side. The anterior pair of eyes are wide apart, large, rounded, and with a cuticular lens in the centre, the darkest part of the pigment-ring, in spirit, being the inner and posterior border. The posterior pair are rounded or oblique in the preparations. The two pairs lie in the middle of the head. From the outer and inferior angle of the head on each side the palpi project forward and downward, the segment at the tip being proportionally short, and, in his species, Claparède observes that it can be partly invaginated. The organ is of considerable thickness at the

\* Invert. Vineyard Sound, &c., Rep. U.S. Comm. Fish & Fisheries, 1873, p. 588.

† Annelids of Provincetown, Rep. U.S. Comm. Fish & Fisheries.

‡ "Campagne du 'Caudan,'" Ann. de Université de Lyon, Août-Sept., 1895, p. 455, pls. xxi., xxiv., xxv. figs. 9, 10, 24, 28, 29 (1896).



base, and tapers towards the tip. The tentacle, which is internal and superior to the former, is subulate and much more slender. It springs from the front of the head at the inner edge of the former and is longer. In the median line between the posterior pair of eyes is a comparatively short subulate median tentacle, which is easily overlooked, especially in an indifferent preparation. The edge of the proboscis projects in the preparations, and in the median line dorsally is a prominent papilla, which lies under the anterior border of the snout, and Claparède states that in life, in his form, it is surrounded by a circle of cilia. In these preparations the eyes are considerably larger than in examples of *T. Claparèdii* from Naples, and the tentacular cirri larger and longer.

*Body* about  $1\frac{1}{2}$  in. long, massive anteriorly, though in life it tapers a little towards the head, as Delle Chiaje and Claparède show in *T. Claparèdii*, and more distinctly towards the tail. It is rounded or convex dorsally, iridescent and minutely ringed, somewhat flattened ventrally, and with a deep median groove. The tail terminates in a free median vent, with a long cirrus at each side. The tentacular cirri are 8 in number on each side, and are long tapering organs springing from a massive basal segment, which is furnished internally with spines. The first four segments are fused, but, as Claparède showed in his species, they receive special nerve-twigs, and thus he thinks the view of De Quatrefages that all the cirri arise from the buccal segment is untenable. The proboscis *in situ* presents a somewhat thick, frilled, anterior edge, the blunt papilla alluded to projecting from the central fold of the dorsal arch. As Claparède pointed out in *T. Claparèdii*, chitinous jaws are situated in the present species at the anterior end of the organ *in situ* in the mid-dorsal and mid-ventral lines. The dorsal teeth at the free edge have the shape of a bifid fan, whilst the ventral resembles a conical tooth. The massive wall of the organ becomes more chitinous and of a brownish hue, and (extending backward quite a third of the length of the body) terminates at a prominent aperture (the gut) in the centre of its posterior wall. Two flattened lateral cæca, also with dark pigment, occur in this region. The inner surface of the proboscis has two thick pads behind the teeth in front, a transverse bar on each side in the middle, and the posterior half is subdivided by deep grooves. It seems to be an efficient prehensile and suctorial organ, and its great proportional size probably renders its function important.

The bristled feet (Pl. I. fig. 5) are 16 in number, long and



prominent, and their resplendent tufts of bristles make them still further conspicuous. The dorsal lobe presents just behind the ridge of the foot the basal segment of the dorsal cirrus, while the setigerous region in front is acutely conical, the long black spine passing to the apex. Each bears a tuft of simple and somewhat stiff bristles, which taper gently to a hair-like tip. The whole bristle is marked by transverse striæ or camerated till within a short distance of the tip. Moreover, the tip is furnished with a regular series of minute spikes. The latter are much more conspicuously developed in *T. Claparèdii* from Naples, the spikes in some being continued far downward, and forming a feature along each side of the bristle. It was the comparison between the dorsal bristles of the two forms that many years ago led to their separation. Claparède had overlooked the presence of these spikes in his species, as also has Roule in the present form. The ventral division is irregularly conical, with a prominent papilla for the powerful black spine or two. The upper slope of the region is downward and outward, the inferior (more abrupt) is downward and inward. In shape the foot thus differs from that of *T. Claparèdii* from Naples, which is longer, and the inferior setigerous region has an abrupt truncated extremity with, superiorly, a papilla for the spine. The base of the dorsal cirrus is carried erect in the specimens from the 'Porcupine,' whereas it is horizontal in *T. Claparèdii*, but this is not of much moment. The bristles (Pl. I. fig. 6) form a dense tuft. The shaft has a close series of longitudinal and transverse striæ, is slightly dilated at the distal end, and then bevelled—from the attachment of the terminal process to the point. The distal blades are longest towards the upper third of the tuft, shorter dorsally, and shortest ventrally. Each is flattened, slightly tapered, and curved distally, where it is bifid, with a secondary process beneath. Oblique striæ slope from the serrated edge of the blade downward and backward. The bevelled base of the blade is attached by a web to the shaft. These bristles, though pale, are finely iridescent, and in some are brownish in the posterior region of the body.

In comparing these bristles with those of *T. Claparèdii* from Naples the whole bristle is more slender, the tips longer and more delicate, and the bifid forked tip more minute (Pl. I. figs. 7 & 8). The boldly bifid nature of the tip in *T. Claparèdii* (fig. 7) and the more distinct secondary process are in contrast with fig. 8 (*T. atlantica*), the second or inferior spur being curved and the secondary process adpressed. The serrations on the edge of the blade are similar. The backward tilt of the tip of the bristle is seen in both, but



*T. atlantica* has also a tendency to a dorsal curve (*i. e.* a convexity towards the dorsal edge) throughout. It is the same type of bristle in both, but that from the abyssal species has been modified. The type of bristle is that of *Dalhousia atlantica* of the 'Challenger' \*.

The ventral cirrus is of considerable length, slender, subulate, and tapering. It extends a little beyond the fleshy part of the foot.

Claparède in his species found the male elements developing in winter.

The genus *Tyrrhena* was established by Claparède † for a species first discriminated under the name of *Costalia Claparèdii* in the manuscript of the fourth 'Annuaire du Musée Zoologique de Naples,' by Achille Costa. He characterized the genus (named after the sea it inhabited) as having few segments; the head-lobe provided with five antennæ (two palpi and three tentacles); dorsal division of the foot with capillary bristles, ventral with compound bristles; 8 tentacular cirri; and the proboscis with two maxillæ.

What relationship Claparède's or the present species has to the various forms described or alluded to by De Quatrefages ‡ is uncertain, for there is little that is definite or that can be relied on in his treatment of the Hesionidæ, as, indeed, Claparède long ago pointed out. In the number of the tentacular cirri *Tyrrhena* agrees with the genus *Fallacia* of De Quatrefages, but this is all that can be said with safety.

Though the species had long been discriminated in my collection, the publication of the Annelids of the 'Caudan' by Prof. Louis Roule gives his title priority. His single example was procured in the Atlantic at a depth of 1410 mètres. In his description no allusion is made to the cuticular lens of the anterior eye. He correctly points out the distinctions from *Tyrrhena Claparèdii* in regard to the tentacular cirri and the teeth. His account of the dorsal bristles, however, requires further elucidation, for he states that they are of two kinds, *viz.*, a rare form, which is simple and delicate, tapering to a curved point; the other the camerated bristle, which at its tip has a cap of granular matter, giving it the aspect of a racquet. In that from the 'Porcupine' not a few of the dorsal bristles had a granular parasitic mass near the tip, as, indeed, is liable to happen in spiked bristles. That the type of bristle should be so altered (as shown in Prof. Roule's right

\* Annelids of the 'Challenger,' p. 186, pl. xv. a. figs. 5-7.

† Ann. Chét. Nap. p. 227.

‡ Annelés, pp. 95-111.



figure in fig. 29, pl. xxv.) is remarkable. He has likewise omitted to record the presence of the spikes. His artist has, further, taken considerable liberties in his drawing of the ventral bristles (pl. xxv. fig. 28), but perhaps the style of plate adopted is unsuitable for the illustration of structures so delicate and yet so characteristic. The distal segment of the palpus is also overlooked in pl. xxi. fig. 10 and the sub-frontal papilla is tapered to a point, whereas that in the specimens from the 'Porcupine' was blunt.

*Dalhousiella Carpenteri*, sp. n.\*

*Habitat.* A single example was dredged in the 'Porcupine' expedition of 1870 at station 9, on the Channel Slope, lat. 48° 06' N., long. 9° 18' W., in 539 fathoms, on a bottom of grey mud. Bottom temperature 48°·0; surface temperature 64°·0 Fahr. This species accompanied *Tyrrhena atlantica*, which, like *Ophiodromus* and other Hesionidæ, has a fondness for mud—often of a most tenacious description.

*Head* (Pl. I. fig. 9) agrees with the type seen in *Dalhousia* and, though there is no median tentacle, in *Tyrrhena*. The tentacles appear to be about the length of the palpi, which have a short terminal segment. A deep median furrow separates the rounded lobes on which the large and closely approximated eyes are situated. The preparation shows less disproportion between the anterior and posterior eyes than usual, but it is not good. There are eight pairs of tentacular cirri, with spines, in the buccal and following segments, and they appear to have long and slightly moniliform tips as in allied forms.

*Body* of the typical form, about 1¼ in. long (in spirit), and with 17 bristled segments. The posterior end appears to be injured, though two short cirri occur beneath the vent. The papilla beneath the snout is small (or little elevated).

The proboscis has a firm wall and a glistening interior surface, but, though the parts are dense in the mid-dorsal line, no distinct teeth are present.

*Feet.* In the state of the preparation the shape of these is uncertain, but they are long and appear to diminish more towards the outer edge than in *Tyrrhena*. The dorsal cirrus arises somewhat behind the ridge of the foot, has two very

\* The genus thus provisionally established agrees with *Hesione* in its uniramous foot, but differs in the structure of the bristles and in the number of the tentacular cirri. It is named after the late Secretary for Scotland, who took so masterly a grasp of the Scottish Fisheries. The specific name is after the late Dr. B. W. Carpenter, who occupied so prominent a part in the 'Porcupine' expeditions.



small black spines at its base, and is long, tapering, and slightly moniliform. No dorsal bristles were visible in the preparation.

The setigerous region tapers towards the outer extremity, where a papilla occurs. The spine is black and powerful. The bristles (Pl. I. fig. 10) have comparatively short shafts, which are minutely striated longitudinally and transversely as in allied forms. When seen on edge the tips of the shafts are somewhat fusiform, from the dilatation below the bevelled region. In lateral view, though the diameter is greater, the dilatation is less pronounced and the striæ are now oblique. The terminal blade is comparatively short, has a web connecting its bevelled base with the shaft, is slightly curved, and tapers very little to the strongly forked (longitudinally split) terminal region. The dorsal limb of the fork, viz. that opposite the serrated edge, is the longer, but is frequently broken. It is proportionally longer in the upper bristles of the tuft. The edge of the blade is minutely spinous even up to the base of the fork. The ventral cirrus is slender and subulate, stretching beyond the fleshy tip of the setigerous process. The structure of this bristle would seem to be diagnostic, for though that of *Stephania flexuosa* of Delle Chiaje \*, as figured by Claparède †, is a step in its direction, yet not even uniform and continuous friction could make it resemble that of the present form, and this without referring to other distinctive characters of the species.

#### EXPLANATION OF PLATE I.

- Fig.* 1. Anterior foot of *Nephtys Jeffreysii*. × about 90 diam.  
*Fig.* 2. Anterior foot of *Eteone japonensis*. × 90 diam.  
*Fig.* 3. Anterior foot of *Phyllodoce* sp. ? from Gaspé Bay. × 79 diam.  
*Fig.* 4. Thirtieth foot of *Eteone cinerea*, Web. & Bened. × 250 diam.  
*Fig.* 5. Foot of *Tyrrhena atlantica*, Roule, viewed from the front. × 12 diam.  
*Fig.* 6. Bristle (with very short tip) of the foregoing. × about 100 diam.  
*Fig.* 7. Tip of a bristle of a specimen of *Tyrrhena Claparèdii* from Naples. × about 400 diam.  
*Fig.* 8. Tip of a bristle from *Tyrrhena atlantica* procured by the 'Porcupine.' × about 400 diam.  
*Fig.* 9. Head of *Dalhousiella Carpenteri*, enlarged under a lens. The specimen was indifferent.  
*Fig.* 10. Distal blade and tip of the shaft of a bristle of the foregoing. × about 400 diam.

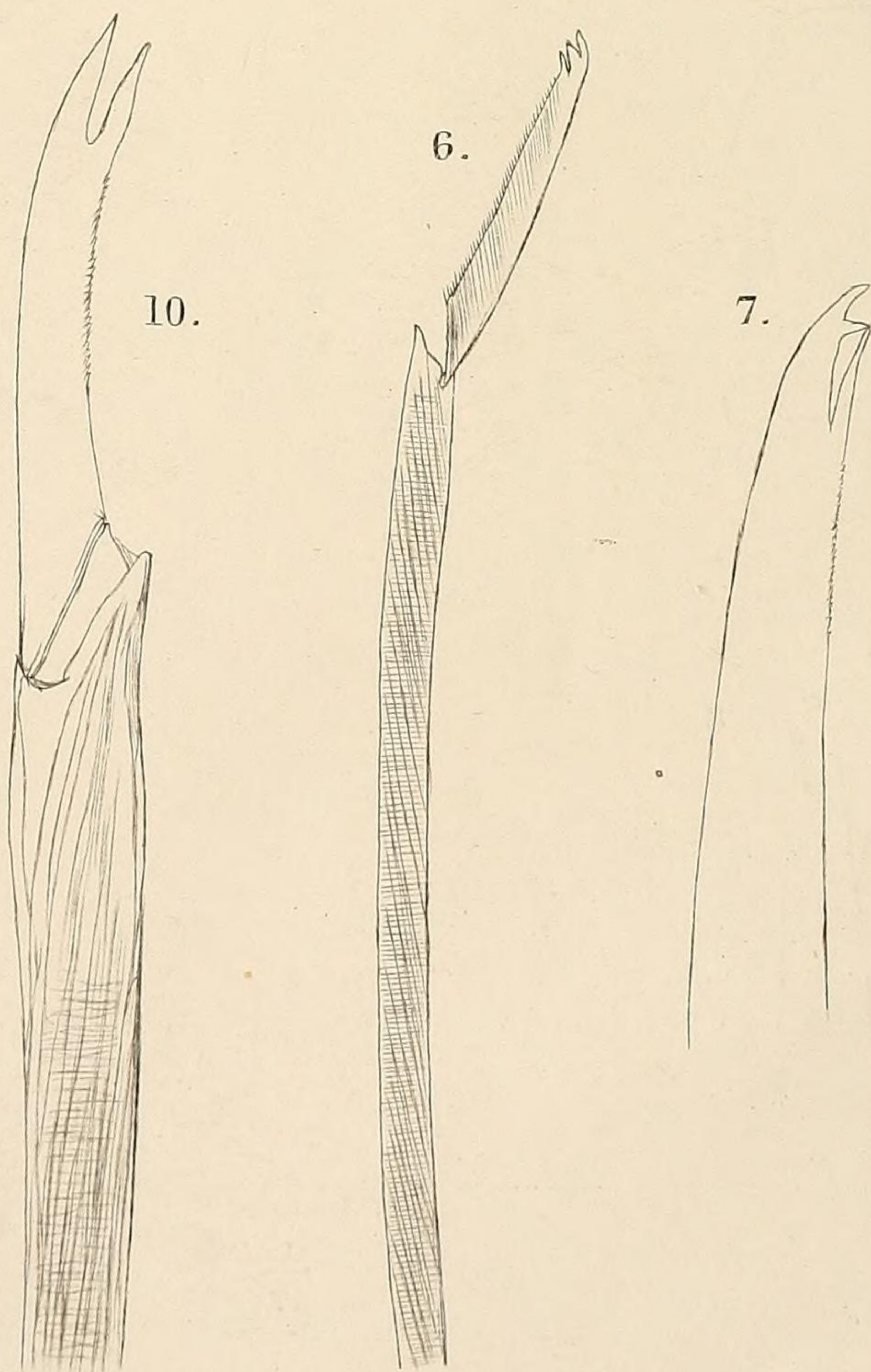
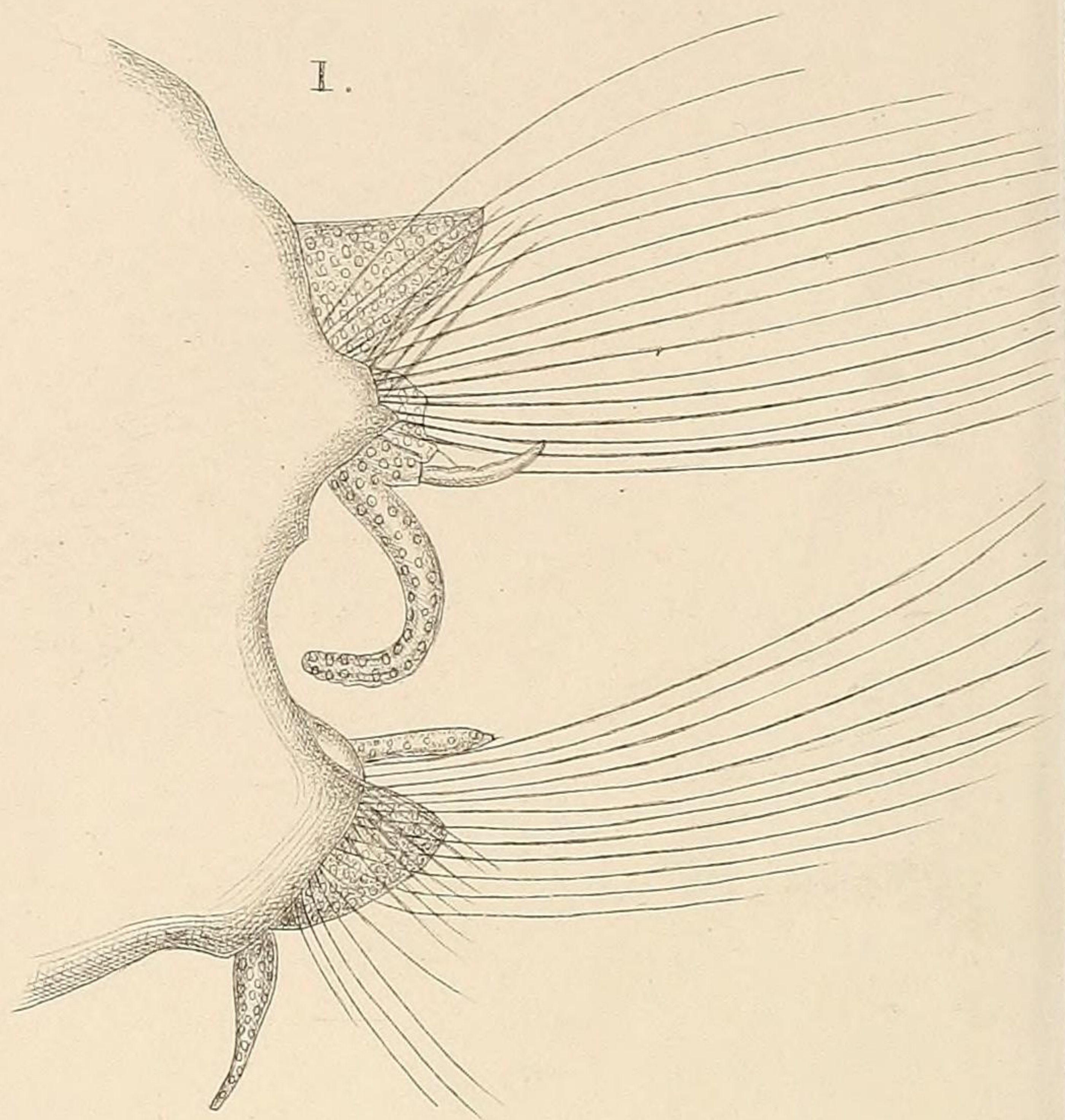
\* Mem. sugli Anim. senza Vert. ii. pp. 368, 401, & 424, tav. xix. fig. 8; Descrizione e Not. iii. p. 97, v. p. 103, tav. cxxix. fig. 8.

† Supplem. Ann. Nap. 1870, p. 118, pl. xii. fig. 1.



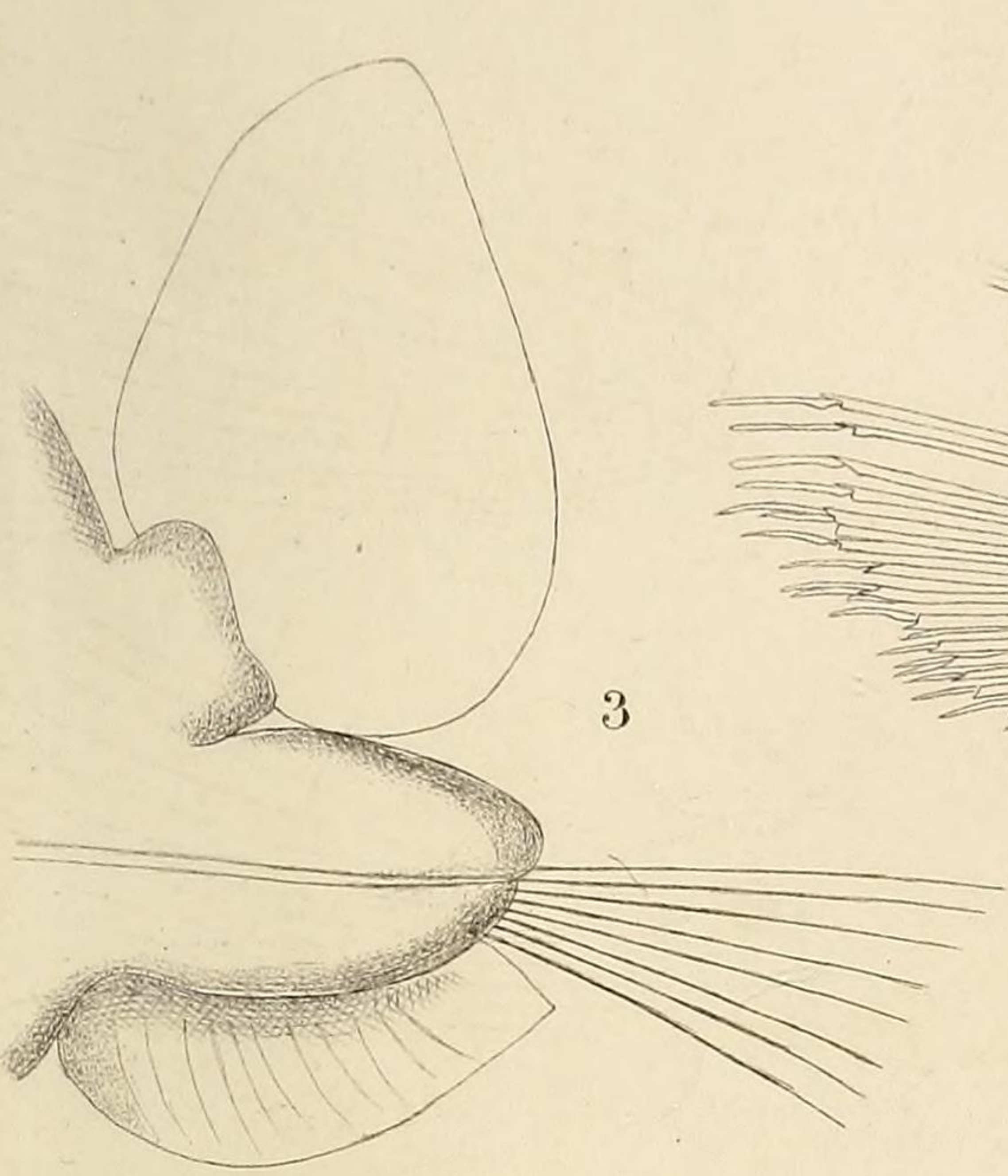




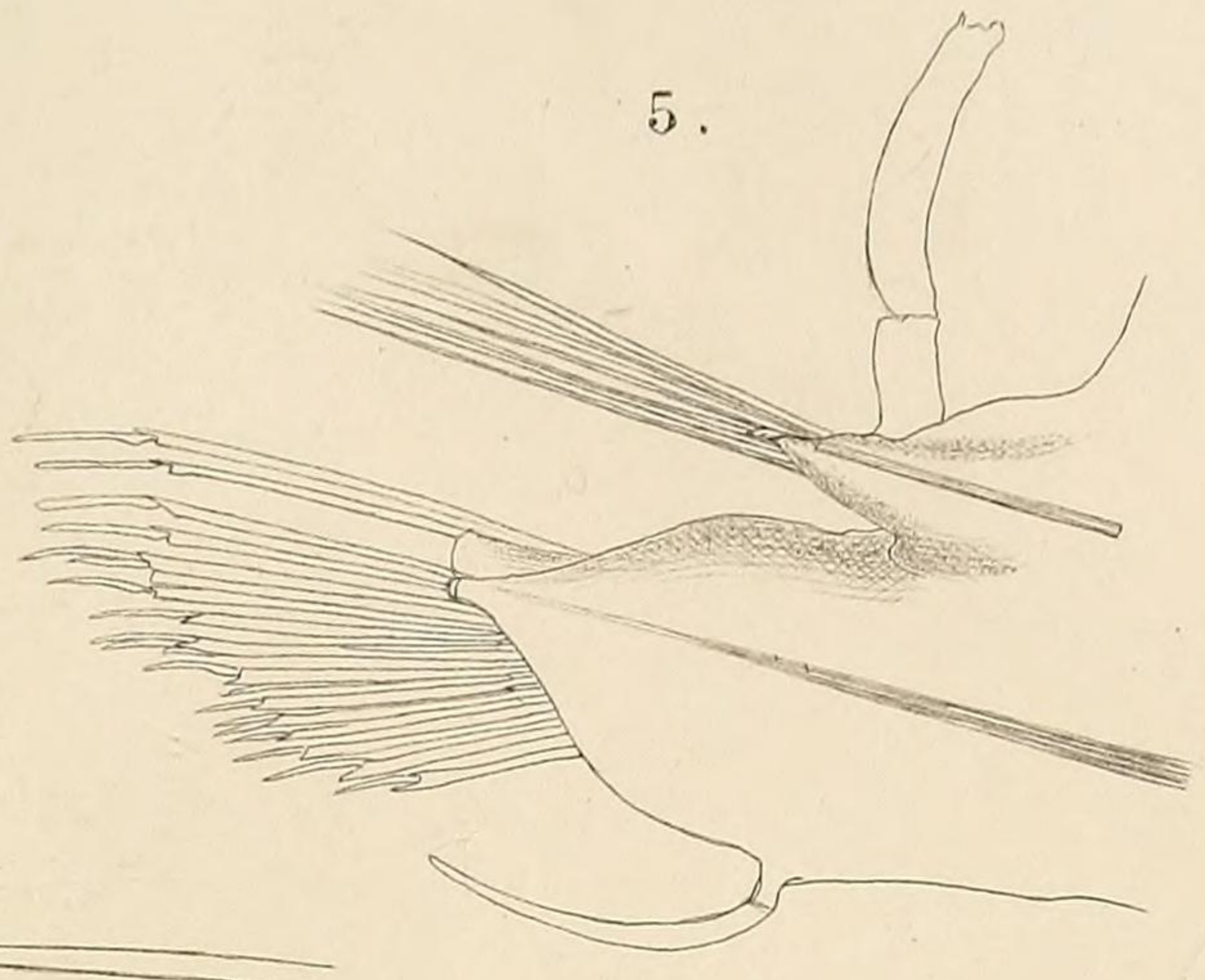


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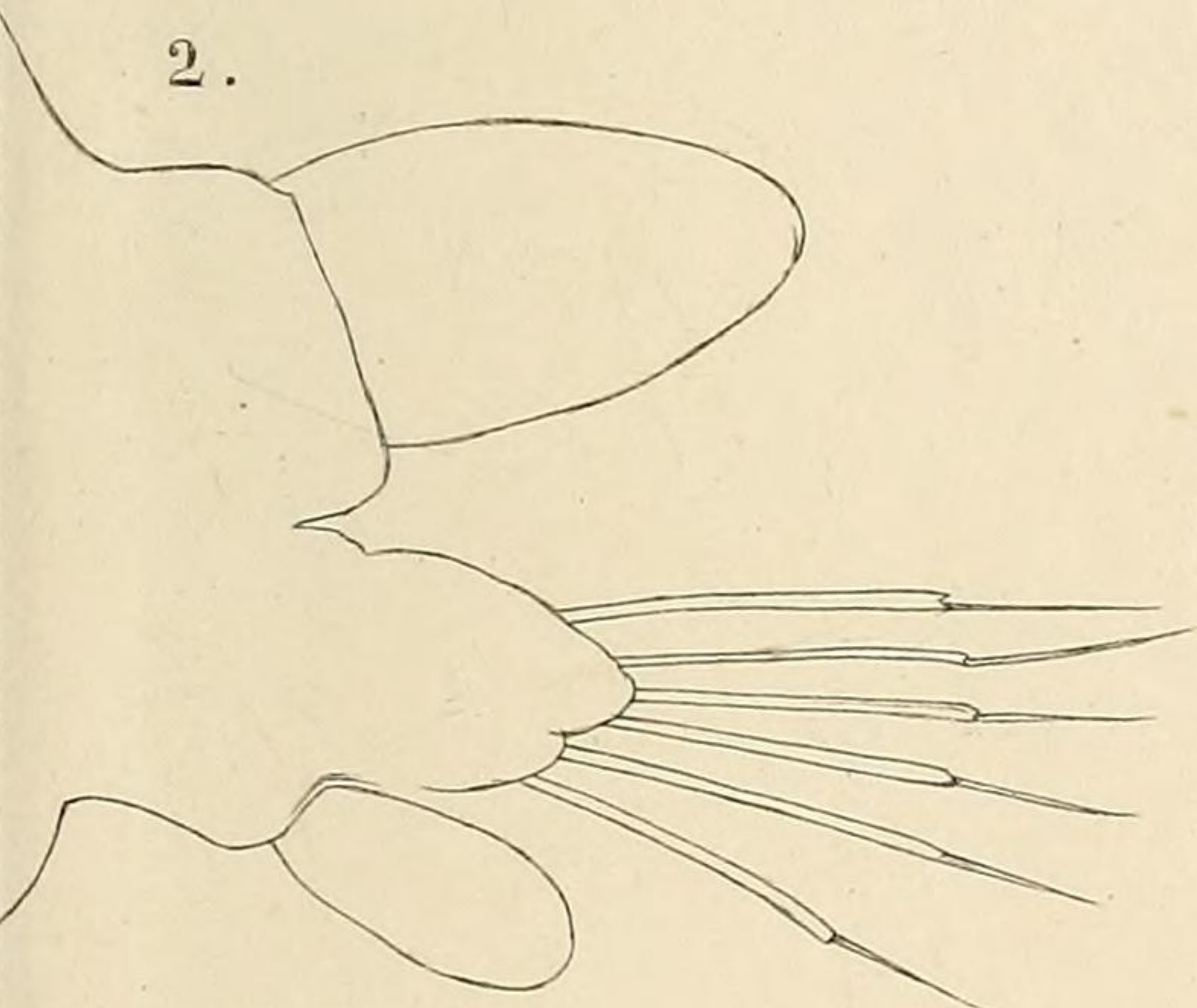




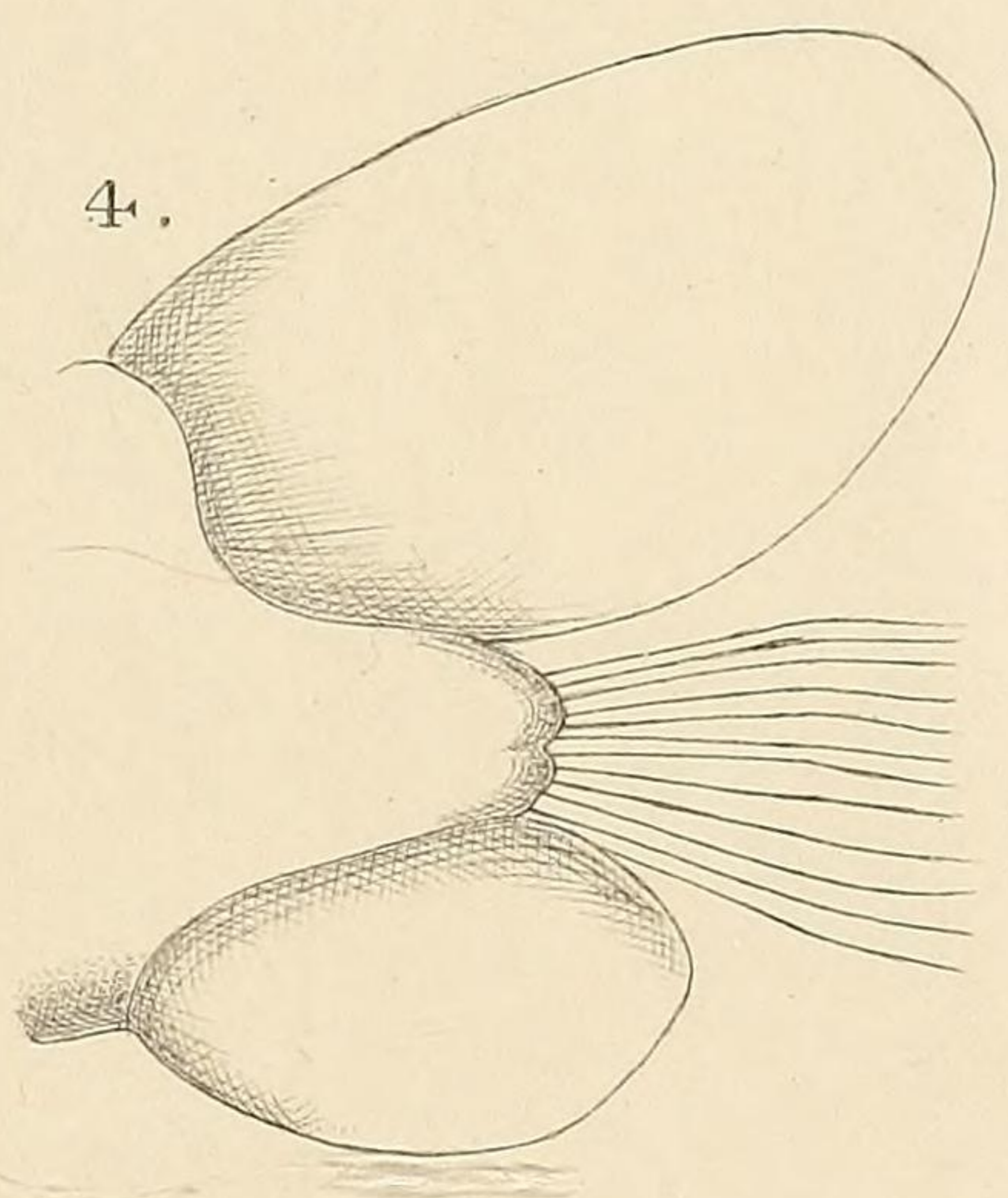
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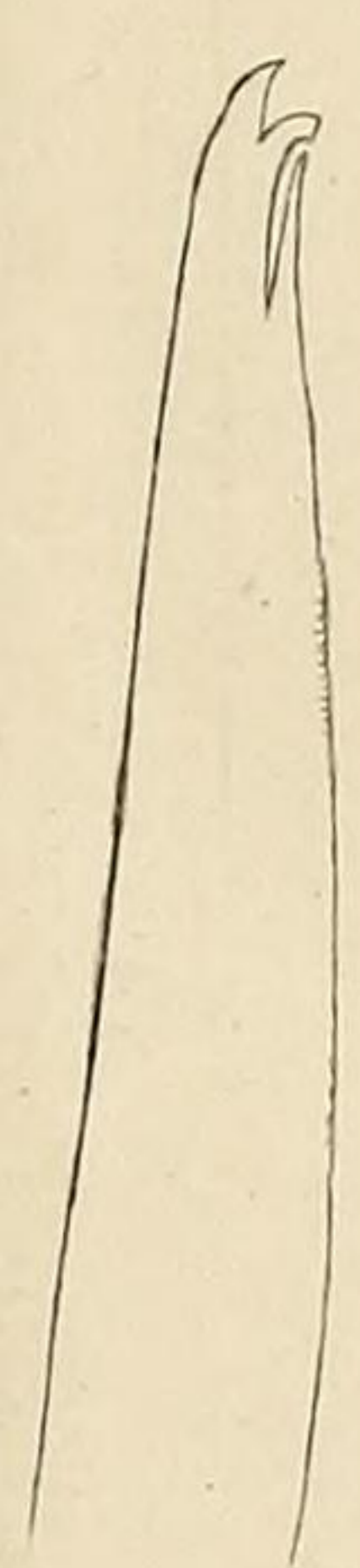
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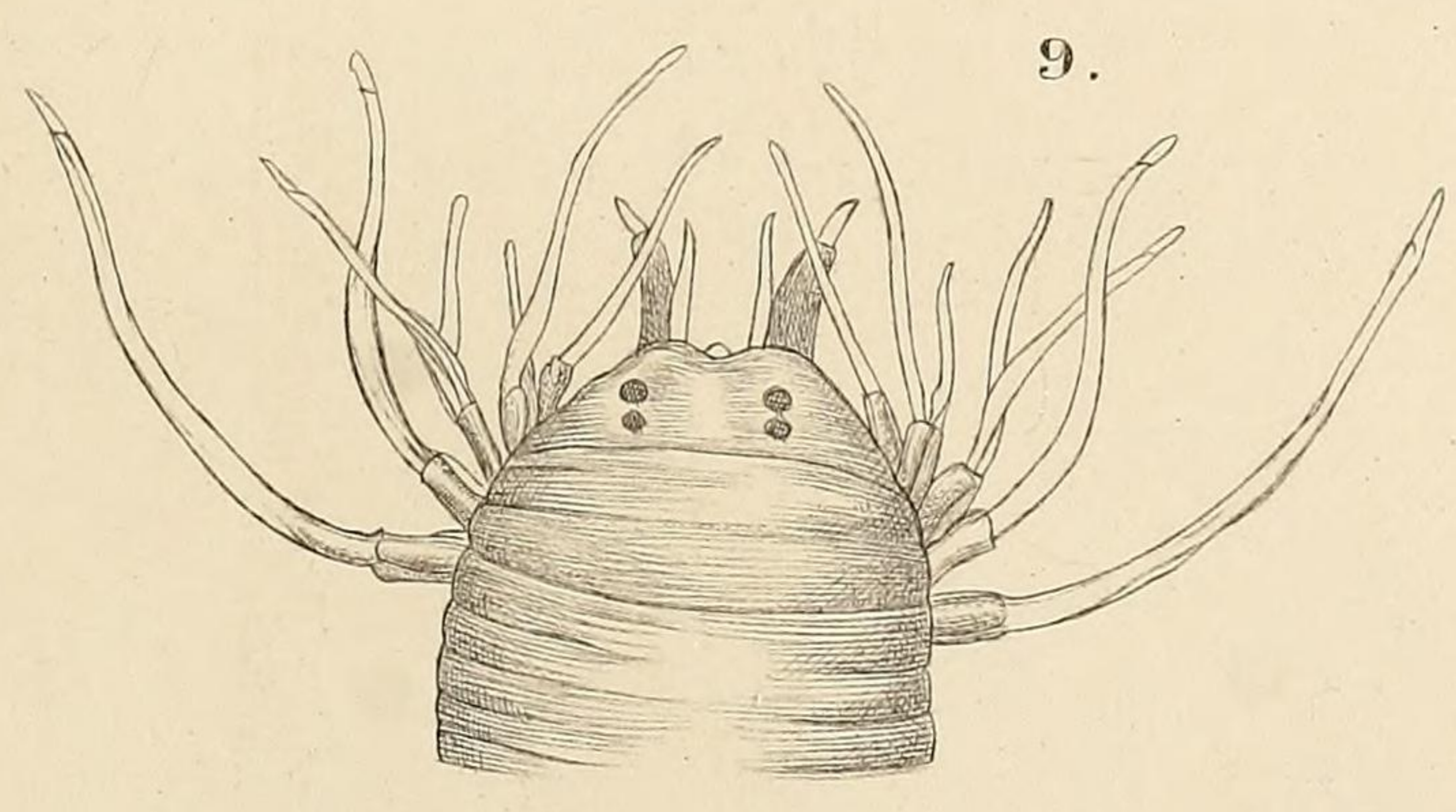
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