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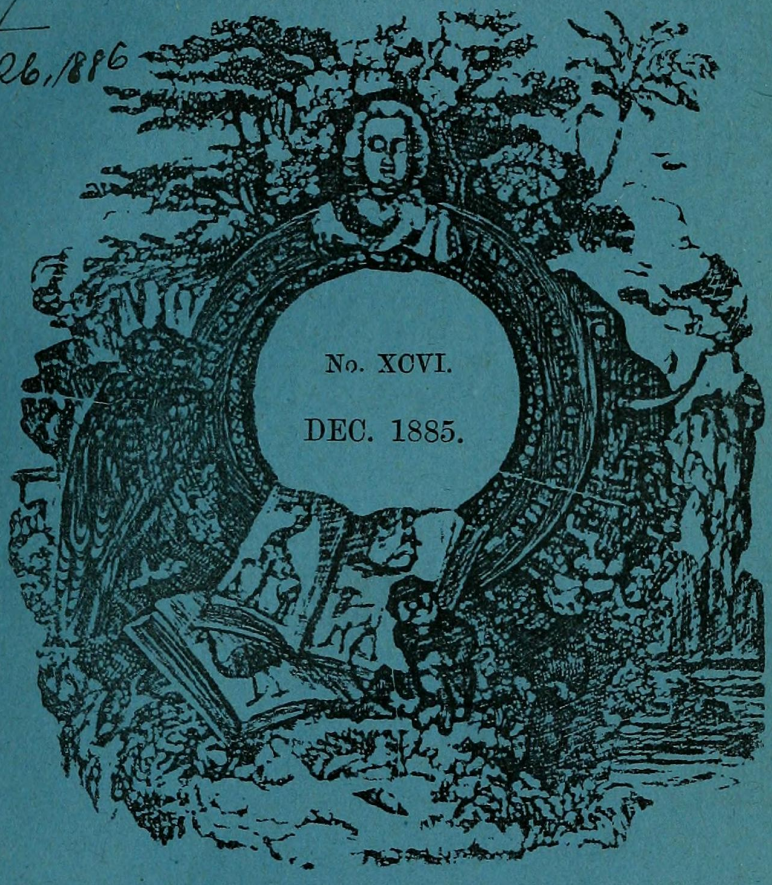

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BEING A CONTINUATION OF THE "ANNALS" COMBINED WITH
MESSRS. LOUDON AND CHARLESWORTH'S "MAGAZINE OF NATURAL HISTORY."

WITH SEVEN PLATES.

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XLVII.—*Notes from the St. Andrews Marine Laboratory (under the Fishery Board for Scotland)*. By Prof. M'Intosh, M.D., LL.D., F.R.S., &c.—No. III. *

[Plate XIII.]

1. On the Ova of *Callionymus lyra*, L.
2. On a new British *Staurocephalus*.
3. On certain Processes formed by *Cerapus* on *Tubularia indivisa*.
4. On Structures resembling Ova procured off the Forth.
5. On a Female Porpoise, with a note on its Milk.

1. On the Ova of *Callionymus lyra*, L.

So little was known about the breeding of this fish that the most recent work on British fishes, viz. that of Dr. Day †, contains nothing more than the following remark, the quotation of which will indicate how much remains to be done in this department:—"Dr. G. Johnston ‡ recorded having found a sordid dragonet containing milt or soft roe, it being a young male. The Rev. G. Harris § mentions having discovered hard roe in a gemmeous dragonet, which, provided the observations were correct, is interesting as seeming to show that the female might assume the colours of the male and still not be sterile. The observation does not seem to have been confirmed by any other naturalist." It will thus be observed that the author has nothing to advance in regard to the nature of the ova or spermatozoa, and nothing in regard to the period of spawning. Yet the skulpin is a very common fish on our eastern shores both in the trawl and on the lines of the fishermen, since it ranges from a few to 40 fathoms and upwards on sandy or muddy ground. It is perhaps less frequently brought on shore than other kinds of unsaleable fishes by either liners or trawlers, since the spinous rosette at the angle of the preoperculum causes general detestation; indeed, like the glutinous hag (*Myxine*), it is often jerked from the line into the sea by the fishermen or scooped overboard on a shovel by a trawler. In and near St. Andrews Bay they are frequently caught on the hooks of the liners (baited with mussels) when fishing for plaice and dabs as well as for haddocks; and I have to thank certain of the fishermen for this and similar opportunities of examining marine specimens.

* Communicated by the Author, having been read at the Aberdeen Meeting of the British Association (Section D), 1885.

† 'Fishes of Great Britain,' i. p. 176.

‡ Zool. Journ. iii. p. 336.

§ Zool. pp. 2999 and 3118.

A careful watch had been kept on the species throughout the spring; but it was not till the 12th of June that Mr. Prince, in my absence, procured a female with the ovaries so advanced as to give reliable data with regard to the eggs. Other females in a more or less developed condition were procured in July. In these the total bulk of the ovaries is by no means noteworthy, even at the breeding-season. They form a somewhat cordate mass, bifid in front, but connate posteriorly, and, like the spermaries, have a coating of the silvery peritoneal lining on the surface. Some of the ova were transparent, and thus, though small (·025 to ·03 inch in diameter), appeared to be mature. In their very early condition in the stroma of the ovaries these ova present a characteristic appearance (Pl. XIII. fig. 3), for shortly after passing from the stage of a mere nucleated cell the egg appears to have a double capsule (Pl. XIII. fig. 4), viz. an inner clear coat probably homologous with the *zona radiata* of other Teleosteans, and an outer one of beautifully-arranged hexagonal cells. The two divisions just mentioned, however, belong to one layer, as shown in sections made by Mr. Prince.

About a week later (8th August) a female with more fully-developed eggs was procured; indeed, the specimen seemed to have deposited part of its ova, some of which lay externally around the reproductive aperture. From the pellucid appearance of the eggs in various specimens it formerly appeared probable that they were pelagic, and the condition in this example cleared up any doubts. The translucent ova are very small, nearly approaching those of the common dab in this respect, and thus a very large number are held even by the small ovaries. When mature each ovum (Pl. XIII. fig. 1) has a very fine hyaline *zona radiata*, with a series for the most part of hexagonal reticulations like those of a honeycomb. These spaces are not quite uniform in size, but many are. Some again have four, six, and seven sides. When the edge of the sphere is examined the septa bounding the reticulations stand out very distinctly, and their edges show minute striæ (Pl. XIII. fig. 2). In transverse section of the partially developed egg in the ovary (Pl. XIII. fig. 4) the thickness of the *zona radiata* is in marked contrast with that in the fully mature ova. The external reticulations are imperfectly seen in preparations, as they form a confused layer from collapse. The exact function of this arrangement is unknown, but it enables the egg to be distinguished at once amongst its congeners.

So far as observed, a considerable number of ova, propor-

tionally to the size of the ovaries, seem to arrive at maturity simultaneously.

The mussels used as bait were found in the stomachs of several, while in the intestine *Trophon*, hermit-crabs, and fragments of bivalve mollusks occurred.

2. *On a new British* Staurocephalus (Staurocephalus Siberti).

When at Whitstable, in June 1884, I noticed in a small aquarium belonging to Mr. Sibert Saunders a minute annelid in considerable numbers, and, as its form seemed unfamiliar, I got Mr. Saunders to forward some to the St. Andrews Laboratory, where they now are. The marine specimens in the aquarium had been procured from the Whitstable oyster-beds, in which Mr. Saunders has for many years taken a prominent interest, so that, in all probability, the species about to be described haunts the algæ and other growths attached to the shells of the oyster. It is very hardy in confinement, not only living but multiplying in a small aquarium, and bearing long journeys without loss.

This form (Pl. XIII. fig. 5), which measures about 8 or 9 millim. in length and about 1 millim. in breadth, including the bristles, is comparatively pale and semitranslucent, the internal organs, such as the blackish dental apparatus and the straw-coloured or greenish alimentary canal, being visible from the exterior. There are about thirty segments in the body, exclusive of those devoid of bristles, viz. the cephalic, buccal, first body-segment, and caudal. The tail is terminated by two long slender styles provided with palpocils.

The head is horseshoe-shaped, and marked along the anterior edge by a series of palpocils, which are of considerable proportional length. These organs are broad at the base, taper to a fine point, and apparently are of great tactile sensibility. Their motion along the anterior arch of the snout is so lively that the surface seems to be ciliated. On the dorsum of the præstomium in front of each anterior eye is a small tentacle of two segments, the basal shorter than the distal, which is bluntly rounded and furnished with palpocils similar to those on the anterior arch. A pair of tentacles having the same structure occupy a corresponding position on the ventral surface of the snout, but they are more external in position, so that they project distinctly on each side.

The number of eyes is variable; two are situated externally, each occupying a dimple behind the dorsal tentacle. They are simple pigment-spots, blackish by reflected and pale

brownish by transmitted light. The snout often shows a slight furrow nearly opposite each eye. On the summit of the præstomium, just in front of the nuchal fold, are a smaller pair of eyes placed near each other. Occasionally a pigment speck or two exist in front of these.

The armature of the proboscis (Pl. XIII. fig. 6) consists of a pair of dark brown or blackish, strongly curved, and sharp-pointed maxillæ, behind which an acute posterior process projects. Six denticles, which probably represent the dental plates of allied forms, occur beneath and in front of these, each having a somewhat hoof-shaped outline, the free edge anteriorly being finely denticulated. They diminish in size from before backward, the last having a long and slender process which reaches the posterior border of the maxillæ. The younger examples, as in the figure, have a smaller number of denticles. The mandibles have a process or tooth on the inner edge anteriorly, and the external region or spur is minutely crenate in front. The shafts are gently curved, like the letter *f*, and have a wing-like appendage immediately behind the anterior region.

Dorsally each foot presents a short cirrus, and ventrally a somewhat larger one. A long and conspicuous setigerous process occurs between these just above the ventral cirrus. The dorsal bristles (Pl. XIII. fig. 7) consist of two or three long and slightly curved simple bristles, the tips of which are somewhat flattened and slightly hooked. The ventral series are compound, the terminal pieces being apparently simple and slightly hooked (Pl. XIII. fig. 8). A strong spine supports the fleshy part of the foot.

At first sight it was supposed that the species just described corresponded with a form discovered by Prof. Langerhans in Madeira, and which he has termed *Staurocephalus minimus* *. The latter, however, appears to differ in the greater length (antero-posterior diameter) of the head and in the minute structure of the jaws and bristles. Thus the maxillæ in the foreign species wholly differ (if the figures of Langerhans are to be trusted) in appearance, and none of the pectinate processes he shows are to be found in the dental apparatus of *Staurocephalus Siberti*. So far as could be made out also the tips of both dorsal and ventral bristles are simply hooked and not bifid, as in the species from Madeira. Langerhans mentions that the *Lacydonia miranda* of Marion and Bobretzky †, from the Gulf of Lyons, presents certain resemblances to his

* Zeitschr. f. wiss. Zool. Bd. xl. p. 257, pl. xv. fig. 16.
† Ann. des Sc. Nat. 6e sér. ii. p. 57, pl. vii. fig. 17, &c

Staurocephalus minimus, though he observes that the armature of the proboscis in the latter at once distinguishes them. It appears to me, however, that these resemblances are quite superficial and probably have been suggested by the shape of the head. The position of the short cephalic tentacles, the structure of the proboscis, the form of the feet and the bristles, the structure of the segments following the head, and other particulars widely diverge, as indeed might be expected in a form approaching the Hesionidæ.

3. *On certain Processes formed by* Cerapus *on* Tubularia indivisa.

The members of the domicolous subdivision of the Amphipodous Crustacea are characterized by the very general habit of forming tubes of various kinds, which constitute dwellings as well as nests for the young, as in the common *Amphithoë* and in the *Podoceri*. Others, again, excavate tunnels in tough clay or mud, like *Corophium*, so abundant in the mussel-beds of the Eden, or perforate wood like *Chelura*. The subject of the present remarks, apparently a species of *Cerapus*, closely allied to *Cerapus difformis*, Milne-Edwards, and very prettily barred with red on the antennæ, constructs groups of flexible tubes (Pl. XIII. fig. 9, *a*, *a*), which vary in diameter according to the size of the occupant, on stems of *Tubularia indivisa*, very much as Stimpson describes in his *Cerapus rubricornis* on the shores of Grand Manan. Instead of being formed, however, as Stimpson says, of "fine mud and some animal cement," those of the British species have in addition grains of sand, bristles and spines of annelids, hairs of sea-mice, and many fine horny fibres, apparently derived from the byssi of horse-mussels.

On the same stems of *Tubularia* supporting the nests or tubes are certain remarkable processes (Pl. XIII. fig. 9, *b*, *b*) which project from the cœnœcium like branches, and, indeed, it was the unusual appearance and somewhat symmetrical arrangement of these that first attracted notice. These filamentous branches are of a dull greyish hue (that of the mud), and are very slightly tapered distally. The basal region, however, is distinctly larger, especially where fixed to the zoophyte. Their length varies from 3 to 4 inches, and all seemed incomplete. They are smoothly rounded and resemble the fine muddy tubes formed by certain annelids; but they are quite solid and composed of the same constituents as the tubes formerly mentioned, though, perhaps, the foreign bodies, such as bristles and spines, are more conspicuous. These, moreover, are neatly arranged with their long axis parallel to

that of the process, and especially abound towards the base of the filament, which thus is more rigid and tougher than the distal region, into the composition of which mud, sand, and the secretion chiefly enter. In consequence of this structure the distal region slightly curves downward in the ordinary position in the water, while the proximal stands stiffly outward. These processes are generally fixed to the main stem of the *Tubularia*, though occasionally they spring from the tip of a young example attached to the former, or stretch from the extremity of a parasitic Sertularian.

These filamentous processes are usually at some distance from the nests or tubes of the Crustaceans, which climb actively on them. Whether they thus give them a larger area for the capture of prey in security or afford a more extensive surface for the temporary arrest of minute larval or other forms on which they feed is unknown. It is probable, however, that processes so elaborate subserve some useful purpose to the species, and are not the result of mere purposeless formation by way of exercise.

Spinous processes of an equally peculiar kind are not uncommon on the tubes of annelids, such as those of *Nothria Willemoesii* and certain Terebellidæ discovered by the 'Challenger.' Most of these, however, have a protective function, whereas the foregoing processes cannot have this use assigned them.

4. *On certain Structures resembling Ova procured off the Forth.*

When carrying out the work for H.M. Commission on Trawling an old willow basket came up in the net on the 15th August, 1884, 15 miles S.E. of the island of May, which, besides other interesting marine forms, had attached to it certain peculiar dull yellowish structures resembling ova, and about $\frac{1}{8}$ inch in diameter (Pl. XIII. fig. 10). They adhered to each other, forming a group in a single layer along the bark of the twig. They are nearly circular, with a short, slightly curved distal process. The capsule is yielding, but tolerably tough, and the contents consist of a structureless soft and cohesive gelatinous substance of a pale colour. They were kept for a considerable time in the marine laboratory of St. Andrews, but no change ensued until decomposition set in.

5. *Note on a Female Porpoise and its Milk.*

Amongst the porpoises examined during the year at the marine laboratory was a fine adult female abounding in milk. For some days before its capture, in August, a solitary adult

individual had been noticed disporting itself in circles close to the commencement of the East Rocks, and it is possible that this was the specimen (5 feet 2 inches in length) captured in the salmon-nets. It had evidently been suckling, and a small quantity of its milk was preserved for examination. The mammæ were very prominent on capture, projecting beyond the sulcus in each case, but in ten or twelve hours after death they had shrunk very considerably. The milk is of a dull yellowish colour and of the consistency of thick cream, so that it passed with difficulty through the neck of a bottle. In John Hunter's "Observations on the Structure of Whales"*, it is stated of this species that "the milk is very rich; for in that caught near Berkeley with its young one, the milk, which was tasted by Mr. Jenner and Mr. Ludlow, surgeon, at Sudbury, was rich, like cow's milk to which cream had been added." I have to thank my colleague, Prof. Purdie, for making the subjoined "Note on the Chemical Composition of the Milk of the Porpoise" from a small quantity collected chiefly from the reservoirs during the dissection †.

The specimen appeared to have been delivered at a comparatively recent period, so that the remarks in the last edition of 'Bell's British Quadrupeds' may be supplemented. It is stated that a female was found pregnant towards the end of the year; and again, that Mr. Jenyns found a female in May with a fully-formed young one. They probably produce their young chiefly in summer. In the stomach of the ex-

* I am indebted to Prof. Flower for drawing my attention to this paper. 'Works of John Hunter' (J. F. Palmer), vol. iv. p. 392, edited by Sir Richard Owen.

† "Prof. M'Intosh having kindly placed at my disposal a specimen of milk which he extracted from the mammæ of a porpoise, I have made an analysis of it, thinking that the results are not without interest.

	In 100 parts by weight.
Water	41·11
Fat	45·80
Caseine	11·19
Milk-sugar (?)	1·33
Mineral salts	0·57
	100·00

"The most remarkable point about the composition of the milk is the large percentage of fat it contains, a constituent of food which, I presume, the cetacean, from its mode of life, would require in larger proportion than ordinary mammals do. The milk was not of an inviting appearance, being of a yellow colour and thick consistency, and possessing a '*fishy*' smell. The specific gravity of the milk, in spite of its solid contents, differed little from that of water."

(Vide *Chemical News*, 2nd Oct. 1885.)

ample caught at St. Andrews was a mass consisting of a number of herrings, "small" whitings, and haddocks.

EXPLANATION OF PLATE XIII.

Fig. 1. Mature ovum of *Callionymus lyra*, L., somewhat darkly shaded, and slightly altered (from keeping) inferiorly. Magnified.
Fig. 2. Honeycomb-like arrangement of the surface of the same. More highly magnified.
Fig. 3. Immature egg of the same from the ovary. Magnified.
Fig. 4. Section of an immature ovum in the ovary. The areolated superficial layer of the zona radiata presents a confused appearance externally, from collapse in mounting.
Fig. 5. Young example of *Staurocephalus Siberti*, n. sp. The eyes are absent in this example. Enlarged.
Fig. 6. Dental apparatus of the foregoing. × 90 diam.
Fig. 7. Dorsal bristle of the same. × 350 diam.
Fig. 8. Ventral bristle. × 350 diam.
Fig. 9. Stem of *Tubularia indivisa* with crustacean nests (*a*,*a*) and filamentous processes (*b*, *b*) attached to the chitinous periderm. About natural size.
Fig. 10. Structures resembling ova attached to a fragment of willow. Slightly enlarged.

XLVIII.—*On the Nest and Development of* Gastrosteus spinachia *at the St. Andrews Marine Laboratory*. By Edward E. Prince.

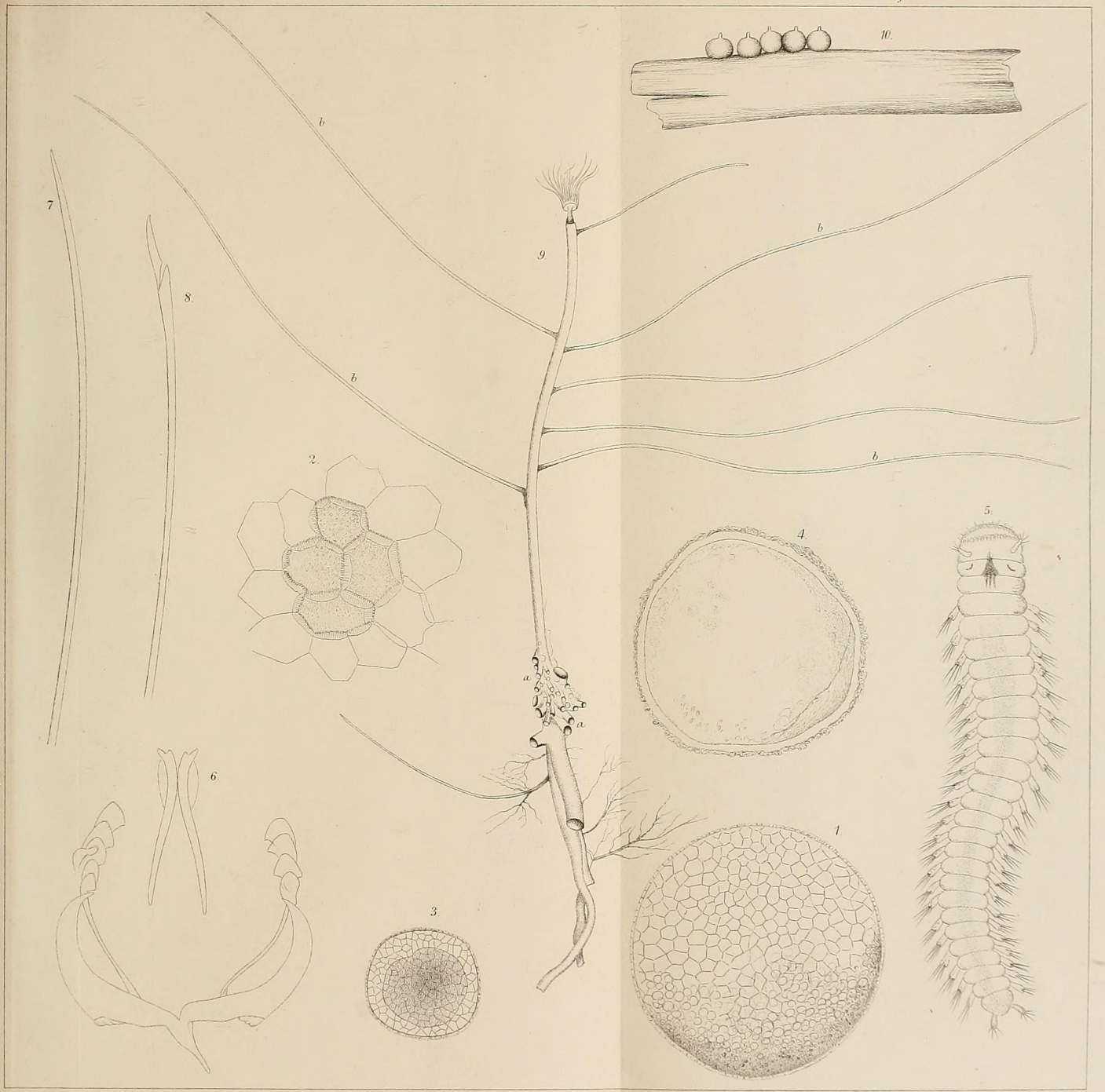
[Plate XIV.]

A communication to the Biological Section of the British Association at its recent meeting embodied certain observations made during the past summer at the St. Andrews Marine Laboratory, and of this the present paper is an amplification. *Gastrosteus spinachia*, amongst the smaller Teleosteans occurring upon our coasts, is a very common though a highly interesting form. Various authors, Kupfer, Ransom, Möbius, and others, have treated of this or the allied freshwater species; but the notices of the nidification, development, &c. of the marine form are very fragmentary and incomplete.

During the summer of 1885 a large number of the nests of the fifteen-spined stickleback have been examined in the St. Andrews laboratory; the process of building has been watched and the early stages of development studied.

Towards the latter end of April and during the months of May and June these nests may be found in sheltered rock-pools, between tide-limits, and generally some distance from low-water mark, so that, as Dr. Day observes, "they may be left uncovered for two or three hours at a time."* They

* Hist. of Brit. Fishes, p. 248.



Figs 1–5. E. Prince. Figs. 6–10. W. C. M. del.