THE ROTIFERA

OR

WHEEL-ANIMALCULES

THE ROTIFERA.

VOLUME II.

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THE ROTIFERA;

OR

WHEEL-ANIMALCULES

BOTH BRITISH AND FOREIGN.

BY

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ASSISTED BY

P. H. GOSSE, F.R.S.

IN TWO VOLUMES, WITH SUPPLEMENT.

VOLUME II.

WITH ILLUSTRATIONS.

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1889.

Those viewless beings,
Whose mansion is the smallest particle
Of the impassive atmosphere,
Enjoy and live like man:
And the minutest throb,
That through their frame diffuses
The slightest, faintest motion,
Is fixed, and indispensable,
As the majestic laws
That rule yon rolling orbs.

SHELLEY.

Qui curiosus postulat totum suæ
Patere menti, ferre qui non sufficit
Mediocritatis conscientiam suæ,
Judex iniquus, æstimator est malus
Suique naturæque; nam rerum parens,
Libanda tantum quæ venit mortalibus,
Nos scire pauca, multa mirari jubet.

GROTIUS.

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CHAPTER IX.

PLOÏMA

IL-LORICATA—continued.)

Les actions des bêtes sont peut-être un des plus profonds abîmes su. quoi notre raison se puisse exercer; et je suis surpris que si peu de gens s'en aperçoivent. - BAYLE.

Their good is good entire, unmixed, unmarred;
They find a paradise in every field,
On boughs forbidden where no curses hang:
Their ill, no more than strikes the sense, unstretched
By previous dread, or murmur in the rear;
When the worst comes, it comes unfeared; one stroke
Begins and ends their woe. - YOUNG.

CHAPTER IX.

Family VIII. TRIARTHRADÆ.

Body *furnished with skipping appendages;* **corona** *transverse;* **ciliary wreath** *single, marginal;* **foot** *absent.*

The four genera which form this family resemble each other in one striking particular. Each bears spines, or moveable appendages, by means of which the creature can leap through the water. These spines have no connection with the body-cavity, though they are moved indirectly by the usual longitudinal muscles; which, in sharply withdrawing the head, throw the spines forward. In one genus, *Pteroessa*, which is known only by its lorica, the spines are very numerous, and are of two distinct patterns; in another, *Polyarthra*, they are clusters of blades borne upon the shoulders; in the remaining two, *Triarthra* and *Pedetes*, there is only one simple spine on each shoulder, but *Triarthra* carries also a similar spine on the posterior ventral surface. All the genera are more or less loricated. In *Pedetes* the skin bears hard knobs for the attachment of the spines, while *Triarthra* has it stiffened chiefly round the edge below the neck. *Polyarthra* is semi-loricated; the dorsal surface is very tough and there is a still harder shield on each side between the dorsal and ventral surfaces. The ventral surface, however, is soft and membranous. In all, the longitudinal muscles are highly developed, and coarsely striated.

The genera differ in their trophi. *Triarthra* has the malleo-ramate trophi of *Melicerta ringens*; in *Pedetes* the trophi have not been clearly defined; while *Polyarthra*, widely unlike either, has a mastax and trophi closely resembling those of *Synchæta*. *Polyarthra*, moreover, is still further separated from *Pedetes* and *Triarthra* by having one occipital eye, instead of two frontal.

Genus POLYARTHRA, *Ehrenberg*.

GEN. CH. **Spines** *in clusters on the shoulders;* **eye** *single, occipital;* **mastax** *very large and pear-shaped;* **trophi** *forcipate.*

It is not easy to decide in which family the genus *Polyarthra* should be placed. Its mastax and trophi are almost exactly those of *Synchæta*; its corona bears styligerous prominences similar to those of *S. pectinata*; its ciliary wreath is marginal and single, though not broken up into curves; and, like *Synchæta*, it possesses but one occipital eye. On the other hand its skipping spines naturally place it with *Triarthra* and *Pedetes*, which genera it further resembles by its lack of foot, by its habit of carrying its eggs, and by the partial stiffening of its skin into an imperfect lorica.

P. PLATYPTERA, *Ehrenberg*.

(Pl. XIII. fig. 5.)

Polyarthra platyptera[1]	. .	Ehrenberg, *Die Infus.* 1838, p. 441, Taf. liv. fig. 3.
,, ,,	. .	Leydig, *Ueb. d. Bau d. Räderth.* 1854, p. 42, Taf. i. fig. 10.
,, ,,	. .	Gosse, *Phil. Trans.* 1856, p. 435, pl. xvii. figs. 44–49.
,, ,,	. .	,, ,, ,, 1857, p. 320, pl. xv. figs. 27–29.
,, ,,	. .	Plate, *Jenaisch. Zeits. f. Natur.* 1885, p. 16, Taf. i. fig. 4.

[1] Ehrenberg's *P. trigla* is possibly *P. platyptera* with the blades seen edgewise.

SP. CH. **Spines** *twelve broad blades with serrate edges.*

When gliding along under the action of its ciliary wreath *Polyarthra* seems to have a triangular outline; for the **body**, though itself truncated both in front and rear, carries four clusters of serrated blades fastened to the shoulders; and these trail behind so as nearly to meet in a point, at some distance from the animal's body. Every now and then the blades are jerked vigorously forward, and the creature is tossed out of its path, several times its own length. The **trunk** is partially loricated. There is a kind of chitinous shield running down each side of the body, pointed at its hinder end, and bent at the sides so as to encroach a little on the tough dorsal and membranous ventral surfaces. The edge of the dorsal lorica (if it may be so termed) is plainly visible running across from one cluster of blades to the other. A pair of powerful striated **muscles**, forming a letter V, is fastened to the lower pointed end of the shield, and to the inner surface of the soft tissues, to which, at the upper end on each side, six of the blades are attached. The contraction of these V-shaped muscles drags the soft tissues sharply down over the hard edge of the shield, and makes the blades fly out with great swiftness. The **blades** are curiously like a bird's feather in general outline (fig. 5*d*), having a midrib (fig. 5*e*) and being distinctly serrated on both edges. The **corona** is slightly convex and bears, towards the dorsal surface, two **prominences** like those of *Synchæta pectinata*, each carrying a brush of styles. There are also two long styles facing these, and springing from the corona towards the ventral surface. Mr. Gosse has, moreover, noticed, besides these tactile organs, a small occipital pimple armed with bristles. The very large mastax points obliquely downward to the ventral surface. Both it, and its trophi, closely resemble those of *Synchæta pectinata*. The contractile vesicle can be easily seen, but neither lateral canal nor vibratile tags have been recorded. Nothing else in its internal structure requires notice.[1] The animal carries the great female egg singly, and transversely, between the points of the two side shields; but the small male eggs in clusters of half-a-dozen or more at a time (fig. 5*b*). The male was discovered by Mr. Gosse in 1850, and described and figured by him in the "Phil. Trans." for 1856. [Its length is only $\frac{1}{3\,8\,0}$ inch. The head is very large (fig. 5*h*) and the body tapers quickly to the posterior part, but both extremities are truncate. The front bears two warts between which the rotatory cilia are placed, but the cilia are longer (perhaps setæ) on the warts. The hinder part is bifid, the smaller division being the caudal extremity or toe-less foot, and the latter a protrusile truncate penis ciliated at the tip. No internal organization was discoverable.—P.H.G.] Dr. Plate's figure (*loc. cit.*) shows the sperm-sac.

Length. Female's body, $\frac{1}{2\,0\,0}$ inch. **Habitat.** Pools and ponds: common.

Genus PTEROESSA, *Gosse.*

[GEN. CH. **Lorica** *entire, save for a large oval opening behind; beset with articulate pinnate* **styles**, *and simple* **setæ**: **foot** *wanting.*

P. SURDA, *Gosse*, sp. nov.

(Pl. XIII. fig. 9.)

SP. CH. *The only known species. Horny yellow;* **pinnæ** *twenty-four, in six longitudinal rows.*

The form of this remarkable species is that of an ancient amphora; a long oval tapering to an obtuse point, with no foot, forming a constricted neck, in front, and thence

[1] An observation of Mr. Gosse's leads him to think that the rectum is turned far forward as in the *Rhizota*; and that it is capable of considerable protrusion, though ordinarily invisible.

expanding to a broad truncate margin. Behind there is a great ovate opening, as if a slice had been cut off the entire breadth from the middle to the extreme point. Doubtless this, in life, is covered with membrane, and its edge is thickened. From the upper margin rise two short **setæ**, jointed to knobs; while from the breast, exactly opposite, there issues another, similarly jointed but of great length, descending far behind the extremity of the body.

But the chief peculiarity of the creature is that four-and-twenty **styles**, regularly arranged, are affixed to the lorica, giving a most unique aspect to it. For every one is a feather in appearance; the shaft, moderately long and stout, being beset, on its two opposite sides, with regular pinnules like those of a fern (*Polypodium*, for instance), in considerable number, length, and regularity (fig. 9*c*). These pinnæ are arranged in six longitudinal rows, three on each side, on the ventral aspect, the middle pair of rows consisting of six each, the next pair four, and the outmost two, each. The shaft of each is evidently articulated on a knob of chitine, which is itself a tubercle on a somewhat larger round knob, set in a commensurate orifice in the lorica,—apparently moving freely in it, a true "ball and socket" joint, worked doubtless by proper muscles within. Thus, adding the three simple styles, which are similarly based, we have here a wonderful array of exterior articulate members, which well illustrate the claim of the ROTIFERA to a place among the ARTHROPODA. The pinnules vary much in their number, their length, and the angle of their expansion. The body ends in a blunt point, with no foot, nor other appendage. The anterior extremity, beyond the marked neck, is short, somewhat inclined toward the back, truncate, with an orifice as wide as the widest part of the trunk. Through this, of course, the head is protruded during life; but of this, and of the whole internal organization, I can give no information. The specimen which came under my observation was an empty lorica, in good preservation, as if recently dead, which I was enabled to revolve under the microscope, and so to examine in several aspects. The whole lorica was of a dark yellow-brown hue, with a dull translucency like that of a smoky horn lantern: but whether this is specific, or only accidental, I cannot tell.

This most curious form occurred in the sediment of a bottle of water, examined on October 20, 1885, but which had been standing on my table since September 23, when I had received it from Mr. Hood with a colony of *Scaridium cudactylotum*. From the condition of the lorica I have little doubt that it had come to me alive; but being occupied with the new *Scaridium* I did not search closely.—P.H.G.]

Length. Of lorica, $\frac{1}{110}$ inch; to tips of pinnæ, $\frac{1}{53}$ inch; from brow of lorica to tip of ventral seta, $\frac{1}{74}$ inch. **Habitat.** Loch near Dundee (P.H.G.).

Genus TRIARTHRA, *Ehrenberg*.

GEN. CH. **Spines** *single, two lateral, one ventral;* **eyes** *two frontal;* **mastax** *of moderate size;* **trophi** *malleo-ramate.*

There are three known species of this genus, and they resemble each other very closely; the main points of difference being the length of the leaping-spines, the distance between the eyes, and the length of the œsophagus. The first of these characters is one that cannot be much relied on except in the case of *T. breviseta*; for the length of the spines varies very much in the same species. Ehrenberg makes a further point of difference, in the presence or absence of any well marked separation between the stomach and intestine, asserting that *T. longiseta* possesses this separation and that *T. mystacina* lacks it. This, however, is a character of small value, for the same animal will show at one time an undivided alimentary canal; and, at another, one sharply divided into intestine and stomach.

T. LONGISETA, *Ehrenberg.*

(Pl. XIII. fig. 6.)

Triarthra longiseta	. . .	Ehrenberg, *Die Infus.* 1838, p. 447, Taf. lv. fig. 7.
„ „	. . .	Hudson, *Mon. Micr. J.* vol. i. 1869, p. 176, pl. vi.
„ „	. . .	Grenacher, *Sieb. u. Köll. Zeits.* Bd. xix. 1869, p. 491, Taf. xxxvii. fig. 3.

SP. CH. **Body** *oval;* **buccal orifice** *prominent but not beaked, cup-shaped;* **spines** *more than twice the length of the body;* **eyes** *wide apart;* **œsophagus** *long.*

The habit of this interesting creature is to swim slowly forward while turning round its longer axis, and every now and then to dart out of its course by jerking forwards the three long spines which usually trail behind it. The **corona** is oval, and bears in its centre one broad, low prominence, with a smaller one on either side of it; and just within each of these latter is placed a red eye. The buccal orifice is cup-shaped and has its inner surface lined with cilia. The **buccal funnel** slopes backwards and upwards towards the dorsal surface to meet the mastax, whose trophi are almost identical with those of *Melicerta ringens*. The œsophagus is long and narrow, and the stomach and intestine are usually separated by a deep constriction. The **gastric glands** (fig. 6*a*) are curiously shaped, and frequently studded with what appear to be oil-globules. The **vascular system** is delicately transparent, and difficult to be seen. I have traced the lateral canals on each side, for some distance down the trunk, from a plexus of tubes in the neck, and have detected just there a vibratile tag. I failed to discover the contractile vesicle, but Dr. Grenacher (*loc. cit.*) has seen it, in its usual position, close to the cloaca. There is a large **ovary**; and the newly laid eggs remain attached to the parent by a thread for some time after their exclusion. The ephippial eggs (fig. 6*f*) are as curious in shape as the gastric glands, and are protected by a thick layer of yellowish transparent cells. By bringing into focus the central inner portion of the head, seen sidewise, a bluish and roughly rhomboidal mass may be observed; this is the **nervous ganglion**, and above it are the eyes, and from it threads extend to a setigerous fossa in the neck, as well as to rocket-headed antennæ, one on each side (fig. 6*e*) just under the surface. Each **eye** (fig. 6*b*) is a clear, colourless, refracting sphere $\frac{1}{8000}$ inch in diameter, resting on, and partly imbedded in, a flat plate of red pigment. The longitudinal **muscles** are very powerful, and are strongly striated; the striæ not being straight transverse lines, but irregular obliquely transverse curves (fig. 6*c*). Indeed they appeared to me to alter both in direction and in size as I looked at them, giving me the impression that I was looking at illusory striæ, produced possibly by looking through separated sheets of striated fibre, lying over each other. There is an unusually powerful muscular collar running round the neck. The **spines** are stiff quill-like appendages, broadest at their attached bases, and tapering at their free ends. The bases (fig. 6*d*) are like quills that have been obliquely cut across, and it is by these cut surfaces that they are attached, one on each side of the corona, just above the neck; and one on the ventral surface, at the spot from which the foot springs, in those Rotifera that possess one. The spines are notched here and there (fig. 6*d*), and finely imbricated towards their tips. On looking at fig. 6, it will be evident that if the muscular collar round the neck be suddenly contracted, and the head withdrawn, the spines will be first dragged across the stiff edge of the trunk, below the collar, and then jerked forward by the downward pull of the head.

How the third spine is moved is not so clear. Dr. Grenacher suggests that it is dragged forward by the other two, which are often crossed beneath it; but adds that this is a forced explanation. It is probable, I think, that this spine is driven forward by the sudden jerk downwards on its base, when the longitudinal muscles sharply compress the stiff ventral cuticle. Fine muscular fibres surround the trunk at regular

intervals, and unite with the broad band round the neck in driving out the retracted head, and restoring the spines to their usual position.

Length. Without the spines, $\frac{1}{150}$ inch. **Habitat.** Fresh-water ponds and ditches: common.

T. MYSTACINA, *Ehrenberg.*

(Pl. XIII. fig. 8.)

Triarthra mystacina . . . Ehrenberg, *Die Infus.* 1838, p. 447, Taf. lv. fig. 8.

[SP. CH. **Body** *oval;* **buccal orifice** *taking the form of a beak projecting from the face;* **spines** *not twice the length of the body;* **eyes** *approximate;* **œsophagus** *invisible.*

In July 1849, from the ditch at Dalston Causeway, near London, I took several of the Whiskered Three-beard. The moderate length of the leaping spines, the approximate eyes, and the absence of any manifest œsophagus—the stomach coming into contact with the mastax—marked the species as Ehrenberg's *mystacina*. The absence of the œsophagus is doubtless only apparent, this duct, as is the case with *Polyarthra* (see Pl. XIII. 5*c*) and many other Rotifera, issuing from behind the mastax, near its summit. One adult had an egg attached to the hind extremity, which somewhat retarded its motions, as compared with those of its fellows. After a while the spontaneous movement of the embryo became more and more vigorous, and the ciliary rotation energetic; and a clear globule, as of air, was seen within, while yet the egg remained adherent.

The front is formed of a ring of six or seven sub-globose masses, in mutual contact, each of which is crowned by a cluster of divergent cilia. The **chin** descends in a prominent hook, like a parrot's beak, which appears stiff, and projects between the bases of the two pectoral spines. The two **eyes** are nearly frontal, small, bright red, and approximate. The **mastax** appears formed on the plan seen in the Bdelloida. The stomach is large and saccate, and is supplemented by a distinct intestine. The animals are very subject to be infested by two species of *Colacium*, which are seen in fig. 8. They cling to its spines as well as its trunk, and appear to give it uneasiness. I have counted sixty-five of these parasites on one individual, and nearly fifty on another.

The animal seems to have no power of affixing itself, or of resting. It swims constantly; interrupted only by its spasmodic jerks or leaps, performed by the sudden throwing out of the elastic spines, chiefly, I think, the pectoral pair. These are articulated to shelly knobs, which imply a solidifying of the integument around their bases, to supply the necessary resistance. In the act of springing, these two are often shot forward so forcibly as to be projected in front, reminding us of the anal bristles in *Podura*. This is done with a rapidity that the eye cannot follow; and this, through so dense a fluid as water, requires the exertion of great muscular power.—P.H.G.]

Length. To tips of setæ, $\frac{1}{50}$ inch. **Habitat.** Around London: ditches and ornamental waters (P.H.G.).

T. BREVISETA, *Gosse.*

Triarthra breviseta . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 200.

[SP. CH. **Body** *cylindrical;* **breast** *projecting, but not beaked;* **spines** *not one-fourth as long as the body.*

This species is more regularly cylindrical than the others; it is diminished toward the front, which is truncate; the hinder end is ventricose, and extends much beyond the base of its spine; the belly is deeply sulcate, with thick collops of the skin between; the breast forms a great rounded projection, but not a beak. Just beneath this is a constriction, where the very short spines are set, each not more than half the body's width in length, very slender. The whole head can be retracted as far as this, by which involution of the skin the spines point straight forward, reverting to their normal direc-

tion as the head emerges. The animal has no power of springing by means of the spines, or of using them in any appreciable manner. The hind spine is similar, and similarly set in a deep sulcus of the lower belly. All are dilated at their bases.

At the very front are two minute but distinct red **eyes**, side by side, seated on a small brain-mass, which tapers into a thread that passes to the occiput, probably to an antenna, not detected. The **mastax** was obscure, but seemed of the Bdelloid pattern. A very slender but long **œsophagus** leads to a vast sacculate alimentary canal, and this to a cloaca at the very point of the body, behind the spine; which hence, Herr Grenacher's judgment notwithstanding, I conclude to represent the foot. A momentary action, like that of a **contractile vesicle**, I perceived, but could not define one; and lateral canals run down each side. Several **muscles** are discernible.

The animal is vivacious, swimming freely and swiftly; I did not see it attempt to spring, nor to crawl; the foot-spine was not whisked about. I first met with the species in a pond in Holly Walk, Leamington, in July 1850; and again lately in water from Keeper's Pool, Birmingham, sent me by Mr. Bolton.—P.H.G.]

Length, $\frac{1}{162}$ to $\frac{1}{185}$ inch. **Habitat.** Warwickshire pools: rare (P.H.G.).

Genus PEDETES, *Gosse*.

[GEN. CH. **Body** *ovate, tailed;* **toes** *absent;* **eyes** *two frontal; two leaping* **styles** *articulated to the breast.*

P. SALTATOR, *Gosse*, sp. nov.

(Pl. XIII. fig. 10.)

SP. CH. *Leaping* **styles** *thrice the length of the body.*

This genus has a very close relation to *Triarthra*. It may, indeed, be described as a *Triarthra* with the posterior style wanting. The **body**, though apparently soft and flexible, must be considered as enveloped in a lorica, since the knobs to which the styles are articulated, are hard, immoveable, and doubtless chitinous. Its form, viewed dorsally, is ovate, obtusely pointed behind and broadly truncate in front. Viewed laterally (fig. 10*a*), it is flat on the ventral, and strongly arched on the dorsal surface. The dorsum rises to a marked conical elevation which is a true tail, for the cloaca opens between it and the **foot**. The latter (or what represents it) is a small ovate terminal member, within which, close to the tip, is a minute vesicle, possibly the contractile bladder. The rotatory cilia are seated on a number of small projecting eminences, with which the front is beset. On each side of what for convenience sake we call the breast, but rather high up, is a large round shelly knob, apparently hard and immoveable. Dr. Hudson ("M. M. J.") long ago explained the action of the pectoral **styles** in the parallel case of *Triarthra* (see *T. longiseta*, p. 6). We may conclude the mechanism to be the same in both cases; but I am inclined certainly to see more than mere mechanical action in these shelly knobs, viz. special muscles for the forcible and definite motion of the styles, by means of a true (perhaps *ball* and *socket*) joint. Each style is a highly elastic rod, thick at its origin and for a considerable distance, then gradually tapering to a great attenuation, about thrice as long as the body. On the tips of these, which must therefore possess remarkable firmness, the animal, now and then, suddenly jerks itself away, as on a leaping-pole, with great force; so that they are in an instant seen stretching out at a right angle, or even more, forward. These leaping-poles are composed of transparent refractive material (chitine), resembling glass in appearance. The **brain** has not been defined; but two **eyes**, of a translucent red hue, near together, are conspicuous at the very front. The **mastax**, far down in the body, with vigorously working malleï, was visible near the middle; and below this a great globose, sac-like alimentary canal, without visible division. The only specimen I have seen occurred in

a tube, rich in Rotifera, sent me by Mr. Bolton in the autumn of 1884. It had become, in the live-box, accidentally entangled in a small mass of tenacious mucus, which evidently annoyed it, and from which it made vigorous but ineffectual efforts to become free. I have never met with the form since.—P.H.G.]

Length of body (without styles), about $\frac{1}{170}$ inch. **Habitat.** A pool near Birmingham (P.H.G.).

Family IX. HYDATINADÆ.

Corona *truncate with styligerous prominences;* **ciliary wreath** *two parallel curves, the one marginal fringing the corona and buccal orifice, and the other lying within the first, the styligerous prominences being between the two;* **trophi** *malleate;* **foot** *furcate.*

Ehrenberg's very extensive family of the *Hydatinæa*, under the name of *Hydatinadæ*, is here restricted to three genera, viz. *Hydatina*, *Notops*, and *Rhinops*. They are all alike in their corona, ciliary wreaths, and trophi, but differ from each other in their shape, eyes, and foot.

The **head** is truncate with a deep cup-like cavity as it were scooped out of it. This cavity lies more towards the ventral surface than the dorsal, so that a transverse slice would be horseshoe-shaped, the bend of the horseshoe being to the dorsal surface. The **principal wreath** fringes the outer edge of the cup's wall, and the secondary wreath borders the inner; both wreaths are continued down into the buccal orifice, which lies just within a deep notch in the wall of the cup on the ventral surface.

Styligerous prominences rise in the space between the two wreaths, except in the case of *Rhinops*; and in this genus the dorsal side of the corona bears a thick proboscis, around the edges of which the principal wreath is continued.

In their habits they in the main resemble each other; for all but *Rhinops* tolerate even very dirty water, provided that it contains an abundance of the minute organisms on which they feed.

Genus HYDATINA, *Ehrenberg.*

GEN. CH. **Body** *conical, tapering towards the foot;* **foot** *short, and confluent with the trunk;* **eye** *absent.*

H. SENTA, *Ehrenberg.*

(Pl. XIV. fig. 1.)

Hydatina senta	Ehrenberg, *Die Infus.* 1838, p. 413, Taf. xlvii. fig. 2.
„ „	Cohn, *Sieb. u. Köll. Zeits.* Bd. vii. 1856, p. 436, Taf. xxiii.
„ „	Leydig, *Müller's Archiv*, 1857, p. 404, Taf. xvi.
„ „	Hudson, *Mon. Micr. J.* vol. ii. 1869, p. 22, pl. xix.

H. senta is one of the largest of the Rotifera, and its flashing styles, ruddy teeth, and yellow stomach, often stuffed with brilliantly green *Euglenæ*, make it a charming object for dark-field illumination. Its **shape** is conical, the corona being the base, and the toes the apex. When seen, however, from the side (fig. 1*b*), especially if a little arched, the separation of the head and foot from the trunk is distinctly visible. The **styligerous prominences** are semi-globular cushions crowned with long and rapidly vibrating styles, set fan-fashion. It is difficult to say how many cushions there are, owing to *Hydatina's* incessant restlessness; but there are probably ten or eleven. Two are on the median line; one on the dorsal edge, and one between the first and the cavity of the head. The rest are arranged round the cavity in a sort of quincunx fashion; mainly on the dorsal half of the corona. The great hollow in the corona is not only ciliated on its edge but

also on its whole surface, and may fairly be considered to be the buccal funnel. At its base, close to the ventral surface, lies the **mastax**, containing malleate reddish trophi with unci of four arrow-like teeth (fig. 1*e*). I have often seen these hand-like unci protruded into the funnel to grasp some desired morsel. The thick cellular walls of the **stomach** are well seen in the young specimen (fig. 1*a*), in which a thin line of green food marks the hollow of the nearly empty stomach. The **secreting** and **vascular** systems are obvious and normal. A rectangular **nervous ganglion** (fig. 1) below the corona, and just under the dorsal surface, sends off a pair of nerve-threads at each corner. The upper pairs possibly ramify to the styligerous prominences which are very sensitive; and which Mr. Gosse has seen individually depressed below their usual position by muscular threads rising up to them from the depth of the head. One of the lower pairs supplies the two lateral **antennæ** (fig. 1*a*, 1*b*), and the other two nerve-threads pass to the dorsal antenna (fig. 1*b*). The **ovary** in the half-grown animal (fig. 1*a*) is very transparent, and the oviduct is then conspicuous; as are also the fibres that tie the ovary to the body-walls.

The **male** was described by Ehrenberg under the name *Enteroplœa hydatina*, as he was not aware of its sex. It is often to be met with among the swarms of females that haunt dirty farmyard ponds and neglected water-butts. Its general appearance is that of a young female, but it can be recognised at a glance by the absence of the mastax. Its internal structure is precisely like that of the male of *Asplanchna priodonta*, and is sufficiently shown in fig. 1*n*.

Disease.—I once found a few specimens of *H. senta* (fig. 1*m*) with what appeared to be the mycelium of a fungus growing in the perivisceral fluid, and loosely surrounding the various organs. The infected creatures, however, seemed as vigorous as the healthy ones. *H. senta*, too, suffers from an internal parasite. It is of a narrow oval form, about $\frac{1}{300}$ inch in length, and swims up and down its host's stomach by jerking the contents of its body constantly backwards and forwards (figs. 1*h*, 1*k*). There are curious bodies inside the parasite itself something like the globe of a lamp in shape (fig. 1*l*).

Length. From $\frac{1}{400}$ inch to $\frac{1}{300}$ inch. **Habitat.** In water swarming with *Euglenæ*, &c.: common.

Genus RHINOPS, *Hudson.*

GEN. CH. **Body** *conical, tapering to the foot; a long dorsal* **proboscis** *on the corona;* **foot** *short, and confluent with the trunk, with two minute* **toes** *closely pressed together;* **eyes** *two, at the end of the proboscis.*

R. VITREA, *Hudson.*

(Pl. XIV. fig. 2.)

Rhinops vitrea . . . . . Hudson, *Ann. Nat. Hist.* 4 Ser. vol. iii. 1869, p. 27, pl. ii.
„ „ . . . . . Plate, *Jenaisch. Zeits. f. Natur.* Bd. xix. 1885, p. 46.

Rhinops vitrea appears to have escaped notice till 1869, when I found it in a pond in Losely Park, near Guildford; so I suppose it must be rare: and yet I have often taken it in the neighbourhood of Clifton, and at times even in abundance. Though not a large Rotiferon, it is easily recognized with a hand-lens by its slow, deliberate way of swimming; a peculiarity which first attracted my attention to it. Its **shape** is striking. It is a *Hydatina* without any styligerous lobes on the **corona**; but bearing, in lieu of them, a unique prolongation of the dorsal surface into a sort of proboscis. Two splendid ruby **eyes** are placed on the extremity of this proboscis, and its under surface is furred with cilia like the prone face of *Adineta*. The outer **ciliary wreath** is carried up each side of the proboscis; but the tip between the eyes is free from cilia, and seems to act

as an organ of touch. The inner ciliary wreath consists of larger cilia which are sometimes held erect. The **œsophagus** is long and narrow, and the **gastric glands** so irregularly conical, that they generally appear unlike; probably owing to their being seldom presented to the eye from similar points of view. The **nervous ganglion** has an unusual position. It lies near the end of the proboscis, and gives off, above, four parallel nerve-threads; the two outer of which pass to the eyes, and the two inner to the sensitive bare spot on the tip of the proboscis (fig. 2*c*). The rest of the internal structure is both obvious and normal. The **young animal** quits the egg while yet in the body of the parent, and may often be seen filling up a large portion of the body-cavity. The **ephippial eggs** closely resemble those of *Conochilus volvox*.

Rhinops vitrea usually swims at a moderate pace, rolling gently round its longer axis as it goes, and every now and then bending back its proboscis, or turning somersaults as *Synchæta pectinata* does, only in a much more leisurely manner. Occasionally it darts forward; and, at each time that it has done so, I fancied I could see the atom which it wished to secure. Then it glides over the stems of *Algæ*, using its long proboscis just as *Adineta vaga* does its ciliated face; and, when a larger atom than usual has been drawn into the coronal cavity, it compresses the broad flaps of the corona, and rounds the whole front of the body into a long ciliated tube.[1]

Length, $\frac{1}{80}$ inch. **Habitat.** Clifton (C.T.H.): not common.

Genus NOTOPS, *Hudson*.

GEN. CH. **Body** *not conical;* **foot** *long and symmetrically placed with respect to the trunk, or short and wholly retractile within the ventral surface;* **eye** *single, occipital.*

Of the three remarkable species contained in this genus, two, *N. Brachionus* and *N. clavulatus*, are strikingly alike each other, especially in the head and its ciliated protuberances, and also in the trophi. They are, however, curiously unlike in their outline, and in the relative length of the foot. The third species, *N. hyptopus*, resembles *N. clavulatus* in the short foot, and in the odd position in which it is placed; but differs widely from all the *Hydatinadæ* in the corona and trophi. Feeble, however, as are its affinities with the two other species of the genus, they are stronger than those it has with any other; so it has been placed here as the best makeshift that could be devised.

N. BRACHIONUS, *Ehrenberg*.

(Pl. XV. fig. 1.)

Notommata brachionus . . .	Ehrenberg, *Die Infus.* 1838, p. 433, Taf. l. fig. 3.
,, ,, . . .	Leydig, *Ueb. d. Bau d. Räderth.*, 1854, p. 99.
,, ,, . . .	Hudson, *Mon. Micr. J.* vol. xiii. 1875, p. 46, pl. xci. figs. 1–4.

SP. CH. **Trunk** *square;* **foot** *one-third of total length, placed in continuation of the body's longer axis, not wholly retractile;* **trophi** *malleate.*

I found this handsome creature in a small rain-pool in Leigh woods. The summer heat frequently dried the pool up, but a heavy shower or two soon filled it again; and, two or three days after the downfall, I always found *N. brachionus* there in abundance: no doubt hatched out from eggs deposited on the rotting leaves which formed the bottom of the pool. These strange habitats of the Rotifera are probably due to their eggs being wafted by winds, or carried by birds; so that it is no wonder that this species should have been captured by Schmarda in a spring near the top of Adam's Peak in

[1] Dr. Plate (*loc. cit.*) says that *R. vitrea* has but one toe. I thought so myself, till I saw the creature, of its own accord, separate the apparently single toe, into two.

Ceylon. It is a remarkable Rotiferon, surpassing almost every other in the number and variety of its styles, setæ, and cilia. In general shape it is something like a *Brachionus*, but its head is that of a *Hydatina*. There are only three styligerous prominences in the **corona** between the two usual wreaths, and these bear styles arranged fan-fashion and thickened at the base, as if each style passed through a short sheath; a form of style strikingly visible in the young animal, when the styles are short. The whole of the cavity leading to the buccal funnel is ciliated, and at its base is a ring of large curved styles, pointing upwards. On each side of the wedge-shaped opening, at the entrance to the buccal funnel, are large setæ set horizontally above one another in short sheaths, and fringed at their bases with minute vertical setæ (fig. 1*c*). The **trophi** are malleate, and Mr. Gosse says that they are the exact repetition of those of *N. clavulatus* (*Notommata clavulata*) as figured by him in "Phil. Trans." 1856, Pl. xvi. fig. 23. The rest of the **nutritive system**, as well as of the **secreting** and **vascular systems**, is obvious and normal. The **ovary** is horseshoe-shaped, with its germs set in a single line. There is a **nervous ganglion** just below the dorsal surface of the head, somewhat rectangular in outline like that of *Hydatina senta*; and, like it, giving off nerve-threads at its corners, two of which doubtless pass to the large dorso-lateral **antennæ** shown at the lower corners of the trunk in fig. 1. Mr. Gosse, in a side view, has seen that the nervous ganglion is a truncated pyramid, bearing the **red eye** on its summit.

The **Male.**—*N. brachionus* carries its egg for some time after exclusion, so that it is possible to identify the male with certainty. The male is very unlike its mother in shape and size, and a side view (fig. 1*b*) shows that the head slopes back to a hump, on the apex of which is a bunch of **tactile setæ**. A nerve-thread from the **nervous ganglion** passes to these, and lies between two fine muscular fibres. A moderately sized **spermsac** ends in a ciliated **penis** just above the foot, which contains two large club-shaped **glands**. Close to the sac is a small **contractile vesicle**, the lateral canals of which can be readily traced on either side of the ventral surface.[1]

Length, $\frac{1}{60}$ inch. **Habitat.** Ponds and pools; Clifton (C.T.H.); Kingswood (P.H.G., T.B.): not common.

N. CLAVULATUS, *Ehrenberg.*

(Pl. XV. fig. 3.)

Notommata clavulata . . . Ehrenberg, *Die Infus.* 1838, p. 432, Taf. l. fig. 5.

SP. CH. **Body** *sac-shaped;* **foot** *one-ninth of total length, wholly retractile within the ventral surface;* **trophi** *malleate.*

At the first glance one would say that this animal was an *Asplanchna*, which genus it greatly resembles in general shape, in brilliant transparency, and in the comparative emptiness of the trunk. But a little examination shows that the two are widely unlike in corona, trophi, and alimentary canal. On comparing, however, the apparently dissimilar creatures *N. brachionus* and *N. clavulatus*, it will be found that they are, in many important points of their structure, exact counterparts of each other. The **coronæ**, for instance, are closely alike, although *N. clavulatus* has a greater number of styligerous lobes, and lacks the ring of curved styles that lie round the base of the cavity of the corona in *N. brachionus* (fig. 1). The **trophi** are identical. The **muscular** and **vascular systems** are much alike; the latter, indeed, curiously so, for the sharp bend at right angles in the lateral canals, which is rendered necessary by the shape of *N. brachionus*, is repeated (needlessly, as it were) by *N. clavulatus*. The **contractile vesicle** in the latter, however, has much thicker walls, and is sluggish in action. The **eye** is seated on the

[1] Ehrenberg found a female with a cluster of male eggs; and, misled by their size and number, supposed that the issuing young were those of a *Notommata* which he named *N. granularis*, and which he credited with laying its eggs on the backs of *Brachionus pala* and *Notops brachionus*. Leydig explained the error (*loc. cit.*).

ventral side of the nervous ganglion in *N. clavulatus*, and on the dorsal side in *N. brachionus*; but in other respects the **nervous systems** are alike; the side view (fig. 3*a*) of the female of the former showing precisely the same nerve-threads to a dorsal antenna which are exhibited by the male of the latter (fig. 1*b*). The **ovaries** in both species are flat horseshoe-shaped ribbons bearing a single row of germs. The chief points in which *N. clavulatus* differs from *N. brachionus*, besides those of the general shape, and of the size and position of the foot, are as follows. The **gastric glands** are long and cylindrical, and below them there are two pairs of short cæca attached to the dorsal surface of the stomach. The **stomach** often appears as a long conical tube tapering to a cloaca above the foot, colourless when empty, or tinged above with a faint yellow tint when filling with food. Frequently, however, there is a deep constriction above its lower portion, thus forming an **intestine**; and on one occasion I saw this constriction suddenly disappear, and the contents of the intestine at the same time drawn up into the stomach. Mr. Gosse noticed that the body had its surface marked with minute oblong points, which were scarcely visible except at the edge. He observed also that the discharged **egg** was carried behind the cloaca, and that its development was extremely slow; no sensible maturation having appeared even several days after its exclusion. The **male** is unknown.

Length, $\frac{1}{55}$ inch. **Habitat.** Hampstead (P.H.G.); Clifton (C.T.H.): not common.

N. HYPTOPUS, *Ehrenberg*.

(Pl. XV. fig. 2.)

Notommata hyptopus . . . Ehrenberg, *Die Infus.* 1838, p. 426, Taf. l. fig. 6.

SP. CH. **Corona** *without setigerous prominences;* **ciliary wreath** *single;* **foot** *about one-fifth of the total length, arising from the ventral surface and capable of being wholly withdrawn within it;* **trophi** *forcipate. Partially loricated.*

This must be a rare animal; for, since Ehrenberg found two specimens in 1835, no one but Dujardin and Perty records having seen it. I have myself only seen it twice; but on one of these occasions I fortunately had many specimens, and so I was able to add something to Ehrenberg's rather meagre details. The first thing that strikes the observer is the creature's odd, wabbling way of swimming. This is due, no doubt, to its unusual shape; for it is greatly compressed, having a narrow dorsal surface, but a broad lateral one. The skin can hardly be termed a **lorica**, yet there are several places where it is much stiffened. The two curved edges down the dorsal surface (figs. 2, 2*a*), the undulating edge of the trunk beneath the neck, and the rim of the aperture into which the foot can be withdrawn, are all thick and unyielding. The **corona** is truncate, but bulges forward towards the centre. The marginal **ciliary wreath** is interrupted on each side by a long vibratile style. A grape-shaped **mastax**, with feeble forcipate trophi, lies close to the buccal orifice. Ehrenberg says that there is neither **œsophagus** nor intestine; and if his two specimens had their alimentary canals much distended with food, these organs would have appeared to be wanting. But in front of the true stomach, with thick cellular walls, there is a very thin transparent chamber (fig. 2*a*) often empty, and constantly puffed in and out, in ever-varying shapes.

This, I think, is an œsophagus similar to those in *Asplanchna* and *Synchæta*; and, like them, capable of being distended with food, so as to be confluent with the stomach, or of collapsing to form a narrow tube. The apparent absence of intestine is also a temporary condition of the alimentary canal: my specimens had all a most well-marked intestine. The **gastric glands** are large and plainly nucleated; and the walls of the **stomach** are studded with unusually large oil-globules. The **contractile vesicle** is high on the ventral surface owing to the whole animal being tucked up, as it were, towards that surface. The lateral canals are unusually large and distinct; and lie, with their floccose ribbons, close to the skin: they are well shown in fig. 2*b*. The same figure

shows the chief longitudinal **muscles.** The **ovary** (fig. 2*a*) is very large, and has large germs: a maturing ovum is visible in fig. 2. A large **nervous ganglion** of Notommatan type stretches back from the corona to the dorsal surface and bears a large red **eye.** I failed to find any **antennæ.** The **male** is unknown.

Length, $\frac{1}{70}$ inch. **Habitat.** Near Birmingham (T.B.): rare.

Family X. NOTOMMATADÆ.

[**Corona** *obliquely transverse;* **ciliary wreath** *of interrupted curves and clusters, usually with a marginal wreath surrounding the buccal orifice;* **trophi** *forcipate;* **foot** *furcate.*

The Rotifera associated in this family may be considered the most typical representatives of the whole class. They are permanently free, never affixed to other objects, never to each other in clusters. Their bodies are not inclosed in tubes; their integument is more or less flexible, never hardened into a shelly mail. The body is generally cylindrical, with a length twice or thrice the diameter: the front does not expand into a flower-like disk, but is usually convex, often with a flat versatile face, inclined downwards (supposing the animal to be crawling), beset with strong vibrating cilia, so arranged that their combined action produces two vortices, one on each side of the head. The posterior extremity bears a foot of several diminishing joints, capable, in a slight degree, of telescopic inversion; and the last of these bears two diverging toes, chitinous in structure, used for support and locomotion.

The trophi are well developed, all the seven constituent elements—the *labrum*, the two *mallei*, the two *incus-rami*, the *fulcrum* and the *labium*—corresponding homologically to the *labrum*, the *mandibles*, the *maxillæ* and the *labium*, of insects,[1] being present, in relative proportions. The mastax is so placed that the jaws can be freely protruded from the buccal orifice, as has been seen in most of the genera, and used, forceps-like, to slit the cells of Algæ, to nibble the flocculent matter which grows on vegetable stems, or to seize, retain, and devour active animalcules.

Some of the genera possess a singular apparatus for suddenly augmenting locomotion, in the form of a pair of organs (*auricles*), ordinarily concealed, which can be thrust out in an instant, by eversion of the skin. The surface which is then external is clothed with cilia, dense, vigorous, and capable of producing ample vortices in the water.

The *Notommatadæ* are the most highly organised of all Rotifera; the most sudden, varied, and energetic in their motions; most highly endowed with external sense-organs; most predatory; most nearly approaching to the Articulate classes, not only in their manducatory organs, but also in their skin usually firm, elastic, capable of being thrown into transverse folds, or sub-articulations, more or less permanent. If not the most beautiful, they may claim to be the most interesting; best repaying investigation, while they present the greatest difficulties to the student. As this must be considered the central or typical family, without adopting all the fancies of the Circular theories, we may suggest that the relation between the genus *Furcularia* and the *Loricata*, through *Diaschiza*, is very close: that *Proales*, with its long prone face, leads to the *Bdelloida* through *Adineta*: that the skipping species of *Furcularia*, as *longiseta* and *æqualis*, look towards the *Scirtopoda*: and that in the mucous investiture common in the genus *Copeus*, we perceive a reflection of the excreted tubes of the *Rhizota*.—P.H.G.]

[1] See my mem. "On Mand. Organs," *Phil. Trans.* 1855 p. 449.

Genus ALBERTIA, *Dujardin*.

[GEN. CH. **Body** *vermiform, lengthened; ciliated* **face** *sub-prone;* **eyes** *wanting;* **jaws** *minute, forcipate;* **foot** *small, one-toed. Entozoically parasitic in Annellida.*—P.H.G.]

A. INTRUSOR, *Gosse*, sp. nov.

(Pl. XVII. fig. 13.)

[SP. CH. **Body** *greatly lengthened, nearly cylindric, but swollen behind;* **foot** *of one joint, besides the toe, which is a small cone;* **viscera** *divided by annular constrictions, within the straight (unconstricted) integument.*

This species seems distinct from the *A. vermiculus* of M. Dujardin, if I may judge from his figures (Infus. Pl. 22. 1 A, B). The general form of *that* is uniformly cylindrical, slightly tapering to a great conical foot; of *this*, cylindrical, gradually swelling to the ventricose hind parts, where a very minute conical toe terminates a small one-jointed foot. The mastax and jaws of *that* species are moderately large; of *this*, excessively minute. *That* species is parasitic within earthworms and slugs; *this*, within water-worms (*Naïs*). The discovery of the following species makes it almost certain that these differences are specific.

The **body** is greatly elongated, slender in front, thickening behind the middle, so that the diameter of the hind part is just double that of the fore. As, however, a great ovate egg was mature in the ovary, at the very extremity of the visceral cavity, of the specimen figured, the body may have been more than usually swollen. The **ciliated face** is broad and oblique; the **mastax** minute, displaying a forcipate incus, with broad blades, resembling those of *Diglena*, to which are attached slender simple mallei, with long straight arms inflexed at their extremities. All the trophi are frequently protruded fully half-way from the ciliated front, and vigorously snapped. A very slender **œsophagus** leads to a long alimentary canal, which is constricted at short intervals throughout, but appears to be simple. No **gastric**, or biliary (?) glands were seen. The **ovary** is long, and occupies the greater part of the abdomen. In all the specimens that I examined, there were seven or eight amorphous nuclei, and one large well-matured ovum filling up the posterior end; its substance minutely granular, with a vitelline globule near the anterior end. Between this ovum and the intestine was a small **contractile vesicle**. A minute point projects from the front, which may possibly be a sense-organ, but I perceived no setæ on it. A long pointed **occipital sac** descends far below the mastax, but is destitute of any eye-speck. The whole animal is slightly tinged with yellow; and this is the only trace of colour in it, as the abdomen contains no coloured food, owing to its peculiar economy. For the animal lives as a parasite in the visceral cavity of *Naïs proboscidea*. I was examining a specimen of this aquatic worm (in October 1854), when a slight pressure of the compressorium caused it to separate into two parts. I had looked over it with a lens, but had no suspicion that my *Naïs* was any other than a single integer, and unfortunately it was not in focus when the separation took place, so that I did not actually watch the process. The next moment, however, I found that I had two perfect *Naïdes*; the one which had been the tail differing only by being a little smaller, but with a head, eyes, and proboscis, as perfect as the other. The one which must be called the parent had the hind extremity less distinct than the daughter, and there was a slight trace of jaggedness visible. But my attention was arrested by a vermiform animal shooting swiftly through the water; and presently another. They were evidently Rotiferous, and as I was sure that they had not been in the live-box before, I conjectured that they had been discharged from the body of the *Naïs*, at the moment of division. This was immediately confirmed: for, on examining the *Naïs*, I found, within the alimentary canal of the parent, near the dividing point, three or more of the parasites snugly nestled, and actively writhing about. All the

specimens agreed accurately with each other, as described above. In the open water they swam swiftly; and it was difficult to confine them even with the compressor; for they soon managed, by contraction and elongation, to wriggle themselves out of the field of view. The *Naïs* was from a pool at Walthamstow. Examining another *Naïs* from the same phial, I found a single *Albertia* in the intestine; in another, an egg of the parasite was within the intestine, attached to a pellet of fæcal matter, which pushed it along. The opacity of the bowel prevented my seeing whether any matured parasites were present or not in this case.—P.H.G.]

Length, $\frac{1}{100}$ inch; diameter, $\frac{1}{500}$ to $\frac{1}{1000}$ inch. **Habitat.** Walthamstow (P.H.G.): entozoic.

A. NAÏDIS, *Bousfield*, sp. nov.

(Pl. XVII. fig. 14.)

[SP. CH. **Body** *moderately long, the cervical and pectoral parts the thickest, diminishing to the hind part;* **toe** *minute, soft, papilliform;* **integument** *slightly constricted in the hinder half.*

This species was discovered by Mr. Edward C. Bousfield, who has kindly communicated to me his own careful drawings and descriptive MS. notes. He has "several times observed it *in situ*, in *Naïs barbata*, living free within the cavity of the stomach of its host."

"**Body** cylindrical, soft, hyaline, vermicular, extremely flexible and telescopic, especially the hinder part. Anterior extremity truncate. **Trochal disc** small, oblique, *on dorsal aspect* of body. [One drawing shows that it is invertile, the cilia being depicted far down the buccal funnel.—P.H.G.] **Jaws** very minute, protrusile, snapping. **Alimentary canal** conical, extending through the body, opening at the junction of the last two segments. **Gastric gland** semi-ovoid. **Ovary** straight, slender, cylindro-conical; the ova developed serially. A minute **contractile vesicle.**

"Caudal appendage [= **foot**, P.H.G.] papilliform, composed of two joints [of which the terminal is] soft, resembling in its action the finger of an elephant's trunk."

"**Habitat.** Vicinity of London. Anterior portion of stomach of *Naïs*, in which it moves freely. Egg about one-third of length of parent's body. **Length**, $\frac{1}{270}$ inch."[1] —P.H.G.]

Genus TAPHROCAMPA, *Gosse*.

[GEN. CH. **Body** *fusiform or cylindrical, annulose, furnished with two furcate toes;* **trophi** *forcipate; rotatory* **cilia** *wanting or very limited.*

T. ANNULOSA, *Gosse*.

(Pl. XVII. fig. 12.)

Taphrocampa annulosa . . . Gosse, *Ann. Nat. Hist.* 2 Ser. 1851, p. 199.

SP. CH. **Body** *cylindrical, short and thick, marked throughout with distinct articulations;* **brain** *opaque;* **alimentary canal** *simple, wide, cylindrical;* **terminal fork** *thick, conical, acute.*

This animal is very larva-like; the **body** consists of many well-marked rings or segments which are set within the clear cylindrical integument, apparently touching this only at the points. Each of these, if viewed through the longitudinal line, would be of a sub-square outline, with four projecting angles, as seen at fig. 12*b*. In general no vortices are seen, nor any trace of vibratile **cilia**, so that I long concluded

[1] Thus the three recorded species differ notably in their respective dimensions:—*A. vermiculus* being $\frac{1}{80}$ inch to $\frac{1}{50}$ inch (Duj.); *A. intrusor*, $\frac{1}{100}$ in. (P.H.G.); *A. naïdis*, $\frac{1}{270}$ in. (Bousfield).

rotatory organs to be wanting. Yet, lately I saw one on whose front a strong ciliary action was conspicuous : it seemed as if the ciliate surface were on the prone side of the front. The species, moreover, is furnished with protrusile auricles for augmented locomotion, like *Notommata* proper. I have not myself seen these, indeed; but the fact rests on ample evidence. Dr. Hudson was assured by Mr. Brayley, the Secretary of the Bristol Microscopical Society, that he had seen a *Taphrocampa* "put out very small auricles from the head, and swim with a slight vermiform movement." He had made a pen-and-ink sketch of the creature in both conditions; which sketch is in my possession, and represents indubitably *T. annulosa*. Miss Saunders, too, a careful observer, writes me under date of June 10: "Watching your *Taphrocampa annulosa* a long time, I saw it thrust out an ear-like lobe on each side, and swim frantically about in a most headlong fashion; but only one of three did this. The processes were not very prominent, but were quite distinct." This fact affords an interesting link with the present family.

The form of the mastax and **trophi**, too, though not yet quite satisfactorily defined, is evidently *Notommatous*, and seems to resemble the pattern seen in some of the *Furculariæ*, and some of the *Rattulidæ* also, consisting of an incus with a long fulcrum and a pair of long incurved mallei. The animal can bring the tips of the jaws to the very front, and nibbles floccose matters with them. An **alimentary canal**, broad and straight, with no accessory **glands**, and with no constriction, runs through the cavity to the cloaca close to the forked toes. It is usually empty and colourless. At the occiput, behind the mastax, and almost invariably sharing its motions in contraction and elongation, is a moderate-sized mass of opaque matter, white by reflected light, and probably chalky. Like a similar mass in many *Notommatæ*, with which it is another link, it lies at the bottom of a wide and deep sac. I had vainly searched for any trace of red pigment in this mass which might indicate an **eye**. On one occasion recently, however, I was examining a specimen under direct sun-light, when there suddenly flashed out from the opaque mass a spark of radiance, as if from an eye-lens, though I could not discern any red hue. What represents the ordinary **foot** and toes is peculiar. It would seem rather to be a forked tail; for I have seen, now and then, projecting beneath this, a very delicate rounded lobe, which is possibly the foot, the cloaca opening between these. Or, rather, it is the optical expression of the lower half of the cylindrical rectum, of which the middle of the crescentic fork forms the upper part or ceiling. The intestine can be traced down to this orifice beneath the fork. The fork, or, if this explanation is correct, the *tail*, is formed of two incurved taper, chitinous, clear, sharp spines, together making a semicircle; but not separated into toes, nor articulated with the segment that carries them, and so having no power of motion independent of one another, or of their segment. True toes would have both.

The animal contracts strongly and continually, like a *Notommata*; but the sphere of the contraction is the space occupied by the alimentary canal, the parts both before and behind this viscus remaining unaffected, while the parts included contract forcibly, and both ways, but chiefly from behind forward. In most of its movements it resembles *Chætonotus*, crawling sluggishly about the glass, and the masses of sediment.[1]—P.H.G.]

Length. About $\frac{1}{150}$ inch. **Habitat.** Pools and ditches: common (P.H.G.).

[1] There are two very distinct varieties of the above, well-marked and constant; yet with hardly sufficient dissimilarity to warrant our separating them as species. The one smaller, with the articulation strong, the lateral projections of dark tissue into each segment clearly seen, the caudal points short, stout, and *straight*. This was the form first recognized, is the form above described, and is by far the more common. The other much larger, the articulation and the interior projections both indistinct, often imperceptible; the caudal points long, slender, crescentic, wider at their bases, and making together a regular semicircle. In this variety, an excellent observation which I obtained showed the *mastax*, *mallei*, and *incus*, almost exactly of the same familiar pattern as in *Notommata aurita* (*Phil. Trans.* 1856, pl. xvi. figs. 16–21).

T. Saundersiæ, *Gosse*, sp. nov.

(Pl. XVII. fig. 11.)

Taphrocampa Saundersiæ . . Hudson, *J. Roy. Micr. Soc.* 2 Ser. vol. v. 1885, p. 614, pl. xii.

[SP. CH. **Body** *lengthened, fusiform, annulate;* **brain** *clear; a decurved frontal* **hood**; *two* **eyes** (?); *a distinct* **tail**; **foot** *and furcate* **toes** *of normal form.*

Many examples of this form occurred to my observation in the floccose sediment of water, very rich in Rotiferous life, which was sent me by Miss Saunders of Cheltenham, in May 1885, dipped from a tank which she had used as a preserve of living *Rotifera*. But Dr. Hudson had observed the same species in water from Birmingham, in July 1884; and had prepared a notice of it for the "Journ. Roy. Mic. Soc." The publication was delayed, however, through press of matter, till the following spring. It is a very distinct species, less abnormal than *T. annulosa*, more manifestly Notommatous in its affinities.

The **body** is divided into well-marked rings, about seven or eight, not so numerous as in *annulosa*; each of which rises to what seems a sharp edge; but momentary glimpses, which one has as it turns around the weeds, show a number (not only four) of conical points (perhaps about eight in the dorsal half) in the transverse section (as at fig. 11*b*), the expression of as many series of conical elevations running down the whole (possibly dorsal and lateral) surface. The head is rather large, and sub-globose (fig. 11), and seems permanent in outline; as the restless animal twists and turns itself about constantly, causing much change of diameter, the head remaining undiminished, the neck (so to speak) becomes conspicuously slender, to be filled up by the next contraction, in an instant. Very frequent retractation of the hind parts towards the head occurs. There is a marked diminution in these parts, the ultimate segment bearing two moderately short diverging toes; the penult or antepenult segment sending forth a distinct conical projection, which follows the general direction of the body, and may be called a tail, with more breadth than depth, much as in *Notomm. tripus*, *N. pilarius*, and others (fig. 11*a*). The front of the head bears a projection, which, on a lateral view (fig. 11*a*), looks like a proboscis, and often like a sharp hook, bent forward and downward; yet I think it has considerable width, and Dr. Hudson has found it to be a broad arched hood. Just behind this organ, and so on the very front of the globose head, are a pair of minute colourless globules, quite conspicuous in all aspects, which may be **eye-spots**. The **mastax** consists of two stout, curved, pointed teeth, capable of being widely expanded and closed, like the blades of scissors (fig. 11); these appear based on an oblong transparent body, probably the muscular bulb requisite for motion. The points can be brought to the edge of the front.[1] The **front** is oblique; it is composed of several fleshy eminences, each bearing a crown of cilia, whose vibrations I have distinctly seen, though they do not appear to constitute a disk or *rota*. The animal's motion in the free water, a smooth and rather swift gliding, is doubtless produced by these frontal cilia. Accurate observation, with the high powers required by its minuteness, is very difficult from its incessant restlessness; as it glides through the open, it is constantly contracting and extending the body; at the nearest atom of sediment it pauses, but instantly throws itself into rapid contortions. A long **stomach**, capable of much width where it proceeds from the mastax, reaches to the cloaca under the tail, while a large **ovary** occupies the ventral region. The body is transparent, more or less tinged with yellow. The stomach usually contains particles of dark food, sufficient sometimes to impart a blackish hue to the body; while the entire venter may be filled with a dark egg.

I have honoured this species with the name of Miss Saunders of Cheltenham—from

[1] These seem to be the blades of an incus (of the pattern Fig. 21 of my memoir in *Phil. Trans.* 1856, pl. xvi.); the mallei apparently quite aborted.

whom I have received many specimens—a lady, who, for many years, has given intelligent attention to this class of animals, and who has aided me very effectively in my researches.—P.H.G.] [1]

Length, $\frac{1}{120}$ to $\frac{1}{170}$ inch. **Habitat.** Pools near Birmingham (C.T.H.); Cheltenham (P.H.G.): not rare.

Genus PLEUROTROCHA, *Ehrenberg*.

GEN. CH. "*No* **eyes**; **mallei** *one-toothed*; **foot** *furcate*" (*Ehr.*).

[There seems nothing very obvious to distinguish this genus from *Notommata*, but the lack of eyes, both cervical and frontal; and characters that are merely negative are always somewhat unsatisfactory. The form seems scarcely to have attracted attention in Britain. In the close, almost daily, study of the class, which I pursued some thirty years ago, it never occurred to my notice; no example of it appears in Dr. Collins's richly-stored book of drawings; Dr. Hudson has no record of it; and in my recent resumption of the study, extending over the last year and more, I have met with but three examples; which, with more or less certainty, I identify with the three recorded species of Prof. Ehrenberg. Doubtless, by us all, it may possibly have been confounded with the obscurer species of *Notommatadæ*, and have been overlooked. But yet the common difficulty of discerning the eye in a restless animalcule is more likely to cause a *Notommata* to be taken for a *Pleurotrocha*, than a *Pleurotrocha* for a *Notommata*.—P.H.G.]

P. CONSTRICTA, (?) *Ehrenberg*.

(Pl. XVIII. fig. 3.)

[SP. CH. **Toes** *moderately long, acute, straight.*

If this is identical with *P. constricta*, the singular and almost unprecedented illustration which Prof. Ehrenberg has given us on the testimony of his own eyes, of its predatory instincts, I may cite as adding to it the greatest interest. He has figured the apparently weak and unarmed *Pleurotrocha* as watching a specimen of the swift and vigorous *Notommata lacinulata*; then, as having seized it; then, as sucking out its juices; and then, as having dropped away the now empty skin. Well may he give it the secondary title of The Robber.

I have seen nothing of this in the little delicate creature which I here represent. It occurred to me in the spring of 1885, and then for so brief a period that I had but just time to make a drawing of it, which is here reproduced. It is indubitably rare. Ehrenberg appears to have seen but two examples, one of which was the above warrior of now historic renown. I had no time for measuring mine, but his length of $\frac{1}{144}$ inch would well enough agree with my estimate. But, a few months later, I met with a specimen in water from Dundee represented in fig. 3, which I conclude to be specifically identical with the above, though there are some slight differences. The front is broader; and, though I could not say that auricles were actually protruded, their presence seemed indicated. (I incline to think the existence of these aids to locomotion more usual in the class than is generally accredited.) The toes also are more slender and more acute. It was active and moderately swift, gliding through the clear water; now and then suddenly darting a little right or left of its course, and apparently seizing some invisible prey. The manner of the action could not be mistaken; it was manifestly predatory.

The **mastax** was large and conspicuous; but I could not obtain a look at it sufficiently steady to define it. The intestinal canal was ample and filled with dark bistre-

[1] In one specimen I observed, on a side view, a long egg-shaped contractile vesicle lying between the hind end of the stomach and the ventral surface, and terminating in a delicate tube entering the cloaca. The vesicle filled and emptied every 2½ seconds.—C.T.H.

brown granular food. The **toes** are usually held close appressed when the animal is gliding; but often expanded. It was lost before I could complete my observation.

This individual was found in Monk Mire Loch near Dundee, in August 1885, among slender filamentous weed crowded with minute diatoms, making dense masses of impalpable floccose. The former was from Woolston Pond, Hants.—P.H.G.]

Length, $\frac{1}{144}$ inch (?). **Habitat.** Woolston; Birmingham; Dundee (P.H.G.).

P. LEPTURA (?), *Ehrenberg*.

(Pl. XVIII. fig. 4.)

[SP. CH. **Toes** *moderately long, slender, acute, slightly decurved;* **face** *oblique.*

This species is of equal rarity, in my experience, with its two congeners; a single solitary example alone having occurred to me, and that at about the same time.

The ciliated **front** is much more prone than I observed in the others, and the mastax was at one time so thrust forward that the **trophi** were brought to the very face, as we see with many of the *Notommatæ*. The outline is gracefully swelling, and tapering behind; and the form and curve of the slender toes are elegant.—P.H.G.]

Length. About $\frac{1}{150}$ inch. **Habitat.** Woolston Pond (P.H.G.).

P. GIBBA (?), *Ehrenberg*.

(Pl. XVIII. fig. 5.)

[SP. CH. *Short and thick in proportion to its length;* **toes** *moderately long and broad, nearly straight.*

It is with great hesitation that I attach Ehrenberg's name of *gibba* to this little species. The general shortness and stoutness of form agree, and, though the lumbar parts of the body want the plumpness whence he has selected an appellation, this may be a variable character dependent on repletion of the alimentary canal. My figure was drawn from life; but the example was lost before I had completed my observations. It was in the early spring of 1885; but I made no record of the source whence it was obtained.—P.H.G.]

Length. About $\frac{1}{325}$ inch: whereas Ehrenberg gives $\frac{1}{216}$ inch as the average of his.

Genus NOTOMMATA, *Gosse* (*nec Ehr.*).

[GEN. CH. **Body** *not annulose, cylindrical, furnished behind with a projecting tail; special organs* (**auricles**) *on the head for locomotion, evertile and protrusile;* **brain** *large, containing opaque chalk-masses;* **trophi** *virgate. There are species in which one or more of these characters may not be found.*

The genus *Notommata* of Ehrenberg, even as it left his pen, was a heterogenous mass of dissimilar species. Many naturalists have indicated the need of dividing and redistributing the unwieldy group; but none have yet ventured upon the task. I propose to break it up into three distinct genera. The family *Asplanchnadæ* having been already formed, some species of large size, sacciform body, and hyaline transparency, migrate thither; while others of similar appearance may be associated with the *Hydatinadæ*. These being eliminated, there comes the curious species *N. copeus*, which Ehrenberg distinguished by large dimensions, a fusiform body, a distinct tail, and organs of special sense, projecting from the lumbar regions, as well as from the head. As a number of others, allied to this form, have been discovered, I form them into a separate group with the generic appellation of *Copeus*. Then there is a group of conspicuous species, marked by auricles, by a more or less distinct tail, and by the brain being unusually

developed, and opaque with chalk deposits. This genus may retain the name of *Notommata*. There still remain a multitude of species, mostly of small, none of large, size, with characters mainly negative, yet having much in common with each other, a community more easily recognized than described; but having the ciliate face more or less obliquely prone. These make the genus *Proales*. The second of these three is characterized above, and shall still prolong the time-honoured title. It is even now a populous tribe, as usual with typical groups: yet not unnaturally associated. Its constituent species are easy of recognition, by three prominent characters, all fairly constant—1, the tail; 2, the auricles; 3, the opaque brain. The first is moderately conspicuous, and readily distinguished by being always on the dorsal side of the cloaca, while the foot and toes are always on the ventral. The second is not always available, being often inactive and invisible; but if seen, seen without doubt. The third is the best mark: the opaque brain-mass, like a vast well-defined black cloud, striking the eye at the first glance, unmistakably.

The genus is widely distributed in our fresh waters.—P.H.G.]

N. AURITA, *Ehrenberg*.

(Pl. XVII. fig. 6.)

Notommata aurita . . . . Ehrenberg, *Die Infus.* 1838, p. 430, Taf. liii. fig. iii.
„ „ . . . . Gosse, *Trans. Micr. Soc. Lond.* 1852, p. 93, pls. xii. xv.

[SP. CH. **Body** *sub-cylindric, ventricose;* **brain** *opaque; head wide, furnished with evertile* **auricles**; **tail** *minute.*

Of this moderately large species, of elaborate organization, and of frequent occurrence, the anatomy has been given with so much detail, by myself (*loc. cit. supra*), that only a very succinct account is needful here. Its opaque **brain-mass**, looking like a great black ball in the neck, connected by a tube with the front, renders it conspicuous as soon as it is seen; and when it glides through the clear water, the sudden quickening of its speed, as it everts the great ciliate hemispheres from its two cheeks is hardly less notable.[1] The **foot** consists of two very short and small joints, telescopically infolded; bearing two furcate toes, acute cones, also short and small.—P.H.G.]

Length, $\frac{1}{70}$ to $\frac{1}{100}$ inch. **Habitat.** Fresh waters. Common everywhere (P.H.G.).

N. ANSATA, *Ehrenberg*.

(Pl. XVII. fig. 3.)

[SP. CH. *Closely resembling* N. aurita *in form and structure, but smaller; the* **brain** *not opaque*; *the* **toes** *long.*

The examples of this species that I have observed I could distinguish from the preceding only by the points mentioned above. Perhaps it is slightly more slender, more cylindrical. Ehrenberg gives no appreciable diagnosis between the two forms; nor can his figures be distinguished, save by the lack of opacity on the brain of *ansata*. The length of the toes is, however, a good mark, and readily observed.

A few specimens have occurred to me in water sent me by Dr. Collins from Berkshire, containing aquatic moss. They moved in the clear, with great impetuosity, driving round and round, and turning on their course, with no apparent aim. One made its way just within the edge of a moss-leaf, where it worked for itself a little hollow, in which it remained several hours, incessantly turning round and round, or to and fro, as fast as it could move, without a moment's intermission. In this example the **alimen-**

[1] Herr Eckstein (*Sieb. u. Köll. Zeits.* 1883, p. 361) describes in this, as in many other Rotifera, specks of crimson pigment near the front, each in connection with a setigerous sense-organ. He concludes these to be secondary eyes. I have myself never detected them; neither has Dr. Hudson, nor Dr. Plate.

tary canal was large, not visibly separated, and filled with food of a rich dark-brown hue. The **toes** are long, slender, acute, and slightly decurved. The **auricles**, which were freely protruded, are rather small.—P.H.G.]

Length, $\frac{1}{260}$ inch. **Habitat.** Sandhurst, Berks; Epping Forest; Woolston, Hants (P.H.G.); pools: rare.

N. CYRTOPUS, *Gosse*, sp. nov.

(Pl. XVII. fig. 7.)

[SP. CH. *In* **form** *resembling* N. aurita, *but very much smaller, and more slender in proportion;* **brain** *intensely opaque; no visible* **auricles**; **toes** *long, decurved.*

This little species I had known from a single specimen just dead, in August 1851, which I found in water from Widcombe Pond, Bath. I had never met with it again till June 1885, when I found a second in water from Woolston, and subsequently many, from many localities. It much resembles *N. aurita*; but is smaller; and the **toes** are slender and decurved. A pair of colourless specks, like air-globules, are in its front, which may be **eyes**, and a large **brain**, which carries at its hinder end an aggregation of opaque matter forming a collection of round cells. This, by refracted light, is intensely black, as in *aurita*, and renders the species very conspicuous, reaching far down into the body-cavity. The **mastax** is normal; the **alimentary canal** also large, not visibly divided; **ovary** and **contractile vesicle** as ordinary.

In manners it is particularly sluggish, scarcely changing its place, though in constant motion. It roots and nibbles among the floccose sediment, and affects concealment, seeking the shelter of the thin integument of decaying *Nitella*, and such-like plants, under which it hides; and, if it creep out for an instant, presently betaking itself to its refuge again, where it twists and turns restlessly on its centre.—P.H.G.]

Length. About $\frac{1}{150}$ inch. **Habitat.** Bath; Woolston; Sandhurst, Berks; Epping Forest; Cheltenham (P.H.G.); pools: not common.

N. TRIPUS, *Ehrenberg* (*nec Leydig.*)

(Pl. XVII. fig. 4.)

[SP. CH. **Body** *thick, arched dorsally, diminished behind to a conspicuous tail, and furcate toes;* **tail** *equal in length to the toes;* **brain** *opaque;* **auricles** *small, slender.*

I know this animal by a single specimen, which I found among *Myriophyllum* in a tank in my own garden, near London, in 1854. It has never occurred to me again; and I do not feel quite certain that it is the *tripus* of Ehrenberg. The **body** is marked by several strong folds of the skin. Viewed from the side it is arched, and the ventral outline is concave; but the ovary was undeveloped, which fact might modify the form. The **frontal cilia** are set on a large ovate area looking ventrally (fig. 4), so that ordinarily the front appears rounded and free from cilia. Occasionally, however, the front is elevated and expanded somewhat angularly, and an **auricle** is thrust out on each side, of somewhat serpentine outline, set on its anterior edge with vibratile cilia, whose effect is manifest in accelerated motion. The **brain** runs down to a long obtuse point in the occiput, whose extremity, in my example, was occupied (fig. 4*a*) with some irregular granules of opaque matter; seated on the end of which was a large pear-shaped red **eye**. The posterior extremity of the trunk runs out into a prominent **tail**, a tapering cone, with alternate constrictions and swellings. Beneath this are the furcate **toes**; and as the tail is of the same length as these, and diverges at a like angle, forming three angles of a triangle, the animal well deserves its specific name.—P.H.G.]

Length, $\frac{1}{145}$ inch. **Habitat.** A garden pan, near London (P.H.G.).

N. PILARIUS, *Gosse*, sp. nov.

(Pl. XVII. fig. 5.)

Notommata tripus . . . . Leydig, *Ueb. d. Bau d. Räderth.* p. 37. Taf. iii. fig. 28.

[SP. CH. **Body** *(viewed dorsally) rhomboidal in outline, sub-truncate at both ends;* **head** *broad, with great globose* **auricles**; **brain** *pointed, filled to a greater or less extent with opaque matter;* **tail** *and* **toes** *as in* N. tripus.

This little creature has much likeness to the preceding, from which, however, it sufficiently differs in the trapeziform **outline**, tapering from the middle to the foot; in the size and form of the **auricles**, which are very large, hyaline, and round, more than a semi-globe being exposed; in the conspicuous **eye**; in the singular overarching of the edges of the dorsal region, like the carapace of an *Oniscus*. Mr. Perty mentions this peculiarity in his *N. onisciformis*; yet a glance at his figure proves that the two species are not identical. The singular effect produced when the little creature suddenly pushes out, and as suddenly withdraws, its frontal balls of glass, reminded me of the ancient *pilarii*, or jugglers with balls, and suggested a specific name.

The great transverse diameter of the body is remarkable. The rhomboidal outline has much of the appearance of a lorica; for it is constant, and the viscera within take the form of great sacculate lobes, varying, and more or less receding, from this outline. The **brain** is a large, perfectly defined opaque mass stretching almost wholly across the head.[1] There seems to be a very minute crimson **eye-speck** in the centre of the front, discernible with difficulty. The **contractile vesicle** is very large; its period of discharge was just two minutes. The globular **auricles** are exserted only at uncertain intervals, as when the animal wishes to swim swiftly. We may watch one by the hour, creeping up and down the stems, nibbling ever as it goes, or even now and then slowly gliding through the clear water; yet not once see the crystal balls thrust out by the little juggler. Yet is he unmistakable, in whatever condition, when once familiarly known; and a very pretty, attractive little fellow he is.

I first became cognizant of it in February 1855, when examining a tangle of conferva and *Nitella* in one of my window-reservoirs at Torquay. But I have since met with it on many occasions and in many waters. It is moderately lively, actively grubbing about the vegetation and sediment, now and then swimming across the open spaces, generally with little speed or energy, till the great glassy globes are set to work. The interior structure calls for no special notice.—P.H.G.]

Length, $\frac{1}{200}$ inch; breadth, $\frac{1}{400}$ inch. **Habitat.** Woolston Pond: common (P.H.G.).

N. FORCIPATA, *Ehrenberg.*

(Pl. XVIII. fig. 1.)

Notommata forcipata . . . Ehrenberg, *Die Infus.* 1838, p. 428, Taf. li. fig. 5.

[SP. CH. **Form** *lengthened, saccate, large in front, tapering to a small* **foot**, *and very minute furcate* **toes**; *occipital end of* **brain** *semi-opaque, a small inverted pyramid;* **eye** *a broad transverse lens.*

This is an active, graceful, attractive animal, somewhat sack- or purse-like, slender behind, but enlarged towards the head, which is in constant contraction. The front is obtuse in the dorsal and lateral aspects; the **face** is slightly prone. Behind a large **mastax** of normal jaws, very protrusile, an ample **brain** descends into the occiput, whose pyramidal tip, for a small space, is occupied by a well-defined granulation of clear brown tissue, *not white* by reflected light, and so not cretaceous; on the frontal end of which is seated a broad, somewhat square **eye** of pigment darkly red. Two small ciliate

[1] From this transverse development of the opaque chalk-masses, I infer that Dr. Leydig's *tripus* is this species.

auricles can, at will, be protruded from the head, and I believe there is a small appressed **antenna**. The cloaca is very manifest, overhung by a minute wart-like projection. Then the **foot** tapers rapidly, ending in small, sometimes very minute, furcate toes, which about mid-length lessen abruptly, leaving a marked shoulder (fig. 1*b*).

I am indebted to Mr. Bolton for many specimens on repeated occasions.—P.H.G.]

Length, $\frac{1}{86}$ inch. **Habitat.** A ditch in Sutton Park, Birmingham (P.H.G.).

N. BRACHYOTA, *Ehrenberg.*

(Pl. XVII. fig. 1.)

Notommata brachyota . . . Ehrenberg, *Die Infus.* 1838, p. 435, Taf. li. fig. 3.

[SP. CH. **Brain** *clear;* **body** *fusiform;* **auricles** *small;* **foot** *invisible;* **toes** *minute; no* **tail.**

Outline rounded and plump, stout in the middle, tapering to each end. The **face** is obliquely prone; a pair of very small **auricles** are thrust out from the sides of the head, occasionally, when pushing between stalks of *Nitella*, and not only when swimming. Fore and hind extremities hyaline, but corrugated longitudinally. **Mastax** large and round; mallei strong, of several teeth, on a long-stalked incus, much on the pattern seen in *N. aurita*, which worked vigorously and perseveringly, boring its way into a *Nitella* stalk, and nibbling till it had cleared a great space of its green pulp-cells. The **eye-spot** is moderately large, of full crimson. This, in an instant's good view, I discerned to be a regular globe, of which only the hinder half was red, the anterior half being quite colourless; the two halves being distinctly divided by a clean line (fig. 1*b*). The clear half was doubtless a crystalline lens of very perfect form and of powerful magnification. This eye is seated near the end of a long occipital **brain**. I could detect no dark spot, on each side of the eye, as figured by Ehrenberg; but have little doubt of the species. A great sacculate **stomach** comes up, as a brown granular mass, to the mastax, furnished with the usual pair of ear-like **gastric glands**. It reaches, without any manifest division, nearly to the clear space around the base of the foot; a **contractile vesicle** intervening. The **foot** is scarcely distinguishable, the pair of very minute conical toes apparently emerging from the rounded end of the body. No projection could be called a tail. It was not till I had watched the creature a considerable time, actively engaged, that I suspected the head to be other than simple in outline. Then, as it was swimming smoothly, I noticed its motion suddenly augmented; and at the same instant I saw that two minute clear semi-globes were extruded, but only for a few moments; then withdrawn, and no trace left. The absence of these organs, therefore, must not confidently be inferred from the non-observation of them, particularly in species inadequately observed. The plump body seems very soft, compressible, and flexible; the integument thin, elastic, and yielding. The animal is eager, impatient, persevering, pushing everywhere. It really seemed to have some sense of locality, which its perfectly-formed eye might assist. For though it often strayed to a considerable distance, beyond many stalks, it invariably returned, and sought out its feeding-ground within the *Nitella*. I was called away; but, after nearly two hours, there he was, pegging away at the very same hole!—P.H.G.]

Length, $\frac{1}{130}$ inch. **Habitat.** Woolston Pond: rare (P.H.G.).

N. SACCIGERA, *Ehrenberg.*

(Pl. XVII. fig. 2.)

Notommata saccigera . . . Ehrenberg, *Die Infus.* 1838, p. 434, Taf. l. fig. 8.

[SP. CH. *Slender, obtusely pointed at both ends;* **face** *prone, greatly lengthened, ending with a prominent chin;* **foot** *and* **toes** *small.*

The form is unusually thin from side to side, compared with the length, widening

sensibly at three-fourths from the head, and thence, more or less abruptly, diminishing. It is rather deeper (viewed laterally, fig. 2*a*), the dorsal outline rising to about the middle, thence falling to the tail. The ventral line is nearly straight, only that the ciliated face, almost quite prone, extends fully one-third of the length, and there forms a sort of projecting chin. The outline of this part is, however, very flexible and versatile. The dorsum terminates in a minute conical tubercle, beneath which the cloaca opens; so that it is a true **tail**. Below this is a very short and inconspicuous **foot**, and two minute furcate conical toes. The front is rounded, and can evolve two small hemispherical **auricles**, very observable, because they are freely protruded, even when the animal is not swimming, but pushing its way among the tangled algæ. The **mastax** is ample, and the trophi of the normal pattern; behind, the **brain** descends low into the occiput, and carries a dark red **eye** near the middle of the sac. I have not seen this sac so pyriform as Prof. Ehrenberg has figured it. It is, in general, turbid toward the lower part, and sometimes quite opaque with angular chalk-masses. A large **stomach** and intestine, with **gastric glands**; a wide ovary; indications of a **vascular** or **branchial** system, and a small **contractile vesicle**, are all normal, and require no remark. The animal is usually tinged with an olive-brown hue, especially in the abdominal viscera.

Both the form and manners of this species strike the observer, at once, as unusual. It swims almost constantly; and affects the surface when in freedom. It makes a smooth rapid course, devious, and apparently objectless; probably, however, governed by aims which we cannot appreciate. For it frequently makes little darts and jumps as it goes, with a sensible snap of the jaws, as if it took invisible prey. A number of examples occurred in water collected by Mr. Bolton from a ditch in Sutton Park, Birmingham, and specially marked "surface."

I presume this to be the *N. saccigera* of Ehrenberg, from the general form, the long pointed head, the long prone ciliated face, the short toes and shorter foot. Yet he has not noticed the auricles, nor the opacity of the brain. The former, however, are retractile; and the latter varies much.—P.H.G.]

Length, $\frac{1}{150}$ to $\frac{1}{108}$ inch. **Habitat** Birmingham (P.H.G.).

N. NAIAS, *Ehrenberg.*

(Pl. XVIII. fig. 2.)

Notommata najas . . . . Ehrenberg, *Die Infus.* p. 429, Taf. lii. fig. 2.

[SP. CH. *Of large size, fusiform;* **brain** *clear;* **head** *broad, obscurely* **auricled**; **foot** *long;* **toes** *short, pointed.*

This is a large and imposing form, evidently approaching the genus *Copeus*, yet showing no visible sense-organs projecting from the trunk. Its claim to a place in the present genus is slight, for the brain has no opacity, there is no tail, and the auricles, if present, are small, and appear to be permanent, as globose ciliated knobs, not evertile. Yet there is no prone face, and the general appearance and structure show affinity with these higher forms. The **body** is nearly cylindric, somewhat ventricose; the head nearly of the same width, divided into several broad but shallow lobes, the cilia on which make independent whorls. The **mastax** is ample, the jaws of the normal pattern. A **brain** descending into the occiput, and carrying a transversely ovate dark-red **eye** near its middle,[1] is flanked by a shorter sac on each side;—another point of resemblance to *Copeus*. A small **antenna** projects from the occiput. Several annular folds of the skin —false joints—encircle the body, three in the anterior half, and one distinguishing the trunk from the **foot**. The latter consists of three well-marked joints rapidly diminishing, terminated by two forked acute toes which are rather short. Two pyriform **mucus-glands** run through the foot from the toes. The **branchial system** is well displayed:

[1] Eckstein figures two tentacular brushes of setæ on the front, with a crimson eye-speck at the base of each.

a rather thick ribbon, slack, but scarcely convolute, passes down each side, apparently lost in (perhaps beneath) the lateral brain-sac, bearing sundry vibratile tags, and merging into a small **contractile vesicle.** The **alimentary canal** and the **ovary** were both amply sacculate in such specimens as I have examined.

I first met with this fine species on the dichotomous leaves of the Water Crowfoot, growing in a sunken pan in my own garden near London, in the summer of 1849. It was vigorous and active, swimming rapidly through the water, with a headlong, pushing violence, or fixing itself slightly by its toes, and thrusting about its head in all directions. It seemed fierce and voracious; for, though I did not actually see it swallow food, it several times munched with apparent greediness the side of a large *Rotifer*, returning to the attack, and seeming to bite ferociously. The *Rotifer*, if not materially injured, was thoroughly alarmed. I have since met with the species, but very rarely.—P.H.G.]

Length, $\frac{1}{50}$ inch. **Habitat.** Near London (P.H.G.); Sandhurst, Berks (Dr. Collins).

N. TUBA, *Ehrenberg.*

(Pl. XVII. fig. 8.)

Notommata tuba . . . . Ehrenberg, *Die Infus.* 1838, p. 433, Taf. xlix. fig. 3.

[SP. CH. **Body** *trumpet-shaped;* **brain** *clear; a cervical* **eye**; **toes** *furcate, conical, minute.*

My right to mention this species rests on a pencil-sketch which I made from life, many years ago, and which I still possess, but without sufficient detail to warrant description, and of which I have preserved no accompanying notes. In Dr. Collins's Note-book, which is kindly entrusted to me, there is a pencil-drawing to which he has attached this name; but this also is unaccompanied by any note, except the date 1866.

From Ehrenberg's figs. I conjecture that its affinities are with *Hydatina*, the cervical eye notwithstanding.—P.H.G.]

N. LACINULATA, *Ehrenberg.*

(Pl. XVII. fig. 9.)

Notommata lacinulata . . . Ehrenberg, *Die Infus.* p. 428, Taf. li. fig. 4.

[SP. CH. *Small;* **body** *cylindrical, thick, broadly truncate;* **brain** *clear;* **foot** *short;* **toes** *long;* **trophi** *forcipate;* **incus** *much developed, hemispheric;* **mallei** *very small.*

This tiny, sprightly atom is of pleasing **form**; vertically viewed, it is a very regular oval in outline, the head dilated, archedly truncate, and of a width, when the hemispheric auricles are out, equal to that of the body; while at the other end the acute divergent toes, set on a very short foot, make an elegant finish to the form. Laterally viewed, the diameter is nearly the same, the fore and hind extremities nearly perpendicular and nearly equal, the dorsal line arched, the ventral straight, the foot and toes set-on at the end of the latter.

The **mastax** is very large and the trophi peculiar. The incus is remarkably developed, the fulcrum stout and long, the rami forming, when closed, a transparent hemisphere, "so as to resemble, when viewed obliquely from above, a globe of glass standing on a pedestal." (See my mem. "On Manduc. Org." in "Phil. Trans." 1855, p. 432, pl. xvii. figs. 32–34.) The tips of the rami are habitually projected in greater or less degree from the front, so that there is no buccal funnel proper. Behind the mastax there is a large dilated pale-red **eye**, seated near the middle of a moderate **brain**, which carries no opaque chalk-granules.[1] The **alimentary canal** is ample, usually filled with food of a rich yellow-brown hue, which adds much to the attractiveness of the animal.

[1] Eckstein finds his usual two red specks at the ciliate front, in addition to the large red eye at the bottom of the brain; but he does not associate them here with tentacular *setæ*.

I first found this species in various waters around London in 1849; and have been familiar with it ever since. Wherever filamentous sub-aquatic vegetation grows, it is sure to be abundant. A restless little creature, it ranges among the leaves with incessant activity, now pushing its way through some narrow aperture, using its toes as points of resistance; now pausing to nibble among the decaying algæ; now scuttling off, by means of its ciliary paddles, to another quarter. The **toes**, when used as a rest, are often stretched asunder as wide as they will bear. In general a free rover through its tiny ocean, it yet occasionally, though rarely, anchors by the mucous excretion from its toes.[1] These moorings it cannot always loosen when it wishes again to leave port. I have been amused to see one swiftly pursuing its course, dragging after it, at some half dozen times its own length, a bit of floccose sediment attached by an invisible thread. It seemed as it were pursued by an eager persevering enemy through all its windings, which enemy at length proved to be nothing but a bit of inanimate dirt.—P.H.G.]

Length, $\frac{1}{250}$ inch; of toes alone, $\frac{1}{1200}$ inch; of egg, $\frac{1}{700}$ inch. **Habitat**. Everywhere in still fresh waters of aquatic vegetation: abundant (P.H.G.; C.T.H.).

N. COLLARIS (?), *Ehrenberg*.

(Pl. XVI. fig. 6.)

Notommata collaris . . . Ehrenberg, *Die Infus.* 1838, p. 428, Taf. lii. fig. 1.

SP. CH. **Body** *cylindrical, tapering to both extremities;* **ciliated face** *very long and oblique, projecting far out from the ventral surface just below the mastax; head with small evertile* **auricles**; **neck** *large and swollen;* **nervous ganglion** *tri-partite, semi-opaque at the free border;* **tail** *distinct;* **toes** *minute.*

This *Rotiferon* (probably Ehrenberg's *N. collaris*) resembles *Copeus Cerberus*; and, like it, might almost be placed either in the genus *Copeus* or *Notommata*. I have only seen one specimen, which from its size (two-thirds of that given by Ehrenberg) was, I think, a young one. It can at once be distinguished from *Copeus Cerberus* by its singular **ciliated face** (which, on a side view [fig. 6*a*], gives the head quite a triangular outline), and by its **swollen neck**. My impression, when I drew fig. 6, was that this swollen condition of the neck was due to the presence of two unusually large and clear **gastric glands**, which inclosed the mastax between them, on one side, and pushed out the surface of the body on the other. But on referring to Ehrenberg's figure (*loc. cit.*), I found that he had drawn the gastric glands as small round bodies, decidedly below the neck. Unfortunately I lost my specimen before I had an opportunity of revising my sketch. The front of the head carries two low ciliated projections, one above each auricle; the **auricles** themselves are decidedly larger than those of *Copeus Cerberus*.

The **nervous ganglion** consists of three distinct parts: a broad upper portion filling up the head; a narrower truncate part, projecting downwards to the top of the mastax; and a long flask-shaped body, the lower end of which, at times, reaches almost to the bottom of the mastax. There is a splendid crimson **eye**, and a very well developed **vascular system**. The rest of the internal structure requires no notice.

It is a sluggish creature, loving to creep among the algæ; but at times it will protrude its auricles and swim off into the open, giving one, as it turns, a good view of the peaked gutter, in which the ciliated face projects in front of the mastax, just as in *Copeus spicatus* and *C. labiatus*. Although mine was but a young specimen, still it was a handsome Rotiferon; and a full-grown one of $\frac{1}{48}$ inch (Ehr. *loc. cit.*) would certainly be one of the largest and most striking of the *Notommatæ*. I am indebted to Mr. Thomas Bolton for this rare animal.

Length. My specimen, $\frac{1}{70}$ inch (Ehrenberg's, $\frac{1}{48}$ inch). **Habitat**. In water from Sutton Park (T.B.): rare.

[1] I once saw half a dozen of these lively creatures, all in a row, attached by their toes to a delicate green filament, and whirling round it like gymnasts on the horizontal bar.—C.T.H.

Genus COPEUS, *Gosse*.

[GEN. CH. *Usually of large size, ventricose behind the middle, furnished with organs of sense*[1] *in the lumbar regions;* **brain** *usually threefold; body tailed.*

The type of this natural group is, as already observed, *Notommata copeus*, of Prof. Ehrenberg, which I propose to honour with his own name, *Copeus Ehrenbergii*. As I have myself found several other species closely allied to this, yet quite distinct, in a very brief period, and in one locality, it is probable that future research may considerably augment their number.

The feature which peculiarly marks the genus is the existence of organs, doubtless of some unknown sense, not only in the vicinity of the great brain (where their presence is quite normal), but in the lumbar region of the trunk, far from the brain, where it seems strange to find them, and where the form and conditions of the surrounding parts seem to preclude their advantageous exercise. This, however, is but the expression of our ignorance.

In many cases there is some extraordinary development of the ciliary system, in the shape of wide expansions of the face, or remarkable forms of the auricles, lately described; and sometimes the tail takes unusual shape and size. The skin, in several cases, has the power of secreting a dense mucus, insoluble in water, so as to constitute a thick coherent mantle for the animal, in which extraneous matters are entangled; and the production and retention of this seem to be subject to the animal's will.

It is perhaps in harmony with this specialty of sense-development that the brain itself is generally of great size, and of complex form; for there is often, in addition to the central sac, which is sometimes pyriform with a tubular stalk, a secondary sac on each side.

The species are for the most part of large dimensions, heavy and unwieldy in motion, and vegetable feeders.—P.H.G.]

C. LABIATUS, *Gosse*, sp. nov.

(Pl. XVI. fig. 1.)

Notommata centrura . . . Leydig, *Ueb. d. Bau d. Räderth.* p. 33. Taf. iii. fig. 21.

[SP. CH. *Lumbar regions furnished on each side with a stout* **seta** *(apparently single) projecting horizontally;* **tail** *pointed;* **chin** *projected into a long, horizontal, channelled, ciliated process, very versatile;* **brain** *threefold.*

This noble species I at first thought to be the *N. copeus* of Ehrenberg. Yet the dissimilar structure of the head presently showed that it is quite distinct.[2] There is no trace of the great lateral telegraph-like arms which project from the head in *C. Ehrenbergii*; what answer to the **auricles** being small ciliate channels, bent-over at their ends, into which the front is produced on each side. These cilia are continued along the frontal margin: while from the lower part of the **face** projects horizontally forward a very moveable **lip** in the form of a great fold of transparent flesh, of which the two sides, sloping outward, make a channel as long as the width of the head, deep at the base, but coming to a point, its edges, which fold over toward the hollow (see fig. 1*a*), being fringed with locomotive cilia. From the occiput projects, pointing outward and forward, a stout **antenna**, of outline swelling to about seven-eighths of its height, then diminishing with an angle, to a truncate end, whence issues a brush of divergent setæ, evidently connected by internal nerve-threads with the brain beneath. The ciliation of the face reaches far below the lip on the ventral surface. The longitudinal **muscles** are very numerous and conspicuous. Immediately behind the front is a row of (at least) *four* oval translucent masses, which may be compared with the globose masses in the head of *Hydatina*

[1] An account of these "sense-organs," "antennæ," or "tentacles," in the whole Class, will be given at the end of Part VI.—C.T.H.

[2] Dr. Leydig, who (*loc. cit.*) has well described and figured this species, assumes that it is the *N. centrura* of Ehrenberg. But so practised an observer could not have overlooked the great lip, if *labiatus* had indeed been before him.

senta and *Euchlanis deflexa*; these appear to be quite independent of the great **brain** proper. This is here triple; the middle lobe is pear-shaped, depending considerably below the mastax, with a long slender neck, quite pellucid, having a great red **eye** seated near its mid-length; on each side is a similar but shorter lobe. The **trophi** are of the pattern in *N. aurita*: each uncus is somewhat slender, and *seems* to comprise but two fingers; but, from the opacity of the parts, I am not certain. Under pressure, there seemed to be five, blade-shaped, and closely parallel. A very long **œsophagus** leads to a wide and ample alimentary canal, divided by a sensible constriction into stomach and intestine, even when there is no diminution in their common outline. But this condition I saw rather suddenly much altered; so that the constriction was made as manifest as if a cord had been drawn tightly round. Both stomach and intestine were, in all specimens that I have seen, moderately full of dark yellow-brown granular food, interspersed with orange-coloured oil-globules, brilliantly refractive, most thickly at the pyloric end. The alimentary canal, when moderately filled with food, has a very peculiar appearance, as if divided by constrictions, both transverse and longitudinal, into squares. This is not accidental, but characteristic, being seen in every example that has occurred to me, and distinguishing the species from all its congeners. A pair of ovate, colourless **gastric glands** are seated on the two shoulders of the stomach. The **contractile vesicle** is large; the branchiæ take the form of two very long, and very slender bags, transparent, but much corrugated, rather than of convoluted cords. I counted three vibratile tags, which happened to be all on the same side: one level with the eye, one with the lumbar seta, and one intermediate. The **ovary** appeared normal. The fusiform body ends in a well-marked **tail**, stiff, transparent, tapering to a point, but diminishing abruptly in the middle, forming a distinct shoulder there. Through it runs a pair of chain-like glands, resembling those in the toes, supposed to be mucous. A **foot** of two joints carries a pair of straight, short, conical acute toes.

The manners of this striking creature were rather sluggish, though it moved and turned and twisted about restlessly. I did not see it swim. I had an interesting observation of the character of its food, and of its mode of feeding. The water was much stocked with the finer desmids and diatoms,—great Closteriums, Euastrums, Cosmariums, and the like. I caught my *Copeus* eating a great *Epithemia turgida*. He had evidently only just seized it with his protruded jaws, and had drawn one end of the desmid into his mouth, and was vigorously biting it. After a while, the frustule was pierced, as was seen by the cloud of dark granules that rushed down the mastax. All the contents were quickly sucked-in, till the shell was as empty and clear as a glass vessel; to the manifest increase of the dark contents of the alimentary canal. Then it was contemptuously thrown away. Another had partly gnawed through a slender filament of conferva, and had extracted, and was still extracting, the green granules from its interior, *just at that part*. Afterward I saw it devouring a small crescentic *Closterium*. This it ate up bodily; and it occupied considerable time, even after the desmid was within the buccal funnel, and the end within its jaws. Thus it appears that this large species is a true vegetarian in diet. I have seen several more, all from a ditch in Sutton Park, Birmingham. All agree in these characteristic details. Each one has been quite clean, and totally devoid of any gelatinous covering.—P.H.G.]

Length, $\frac{1}{40}$ inch; width, $\frac{1}{175}$ inch. **Habitat**. Birmingham (T.B.).

C. SPICATUS, *Hudson*.

(Pl. XVI. fig. 2.)

Notommata spicata . Hudson, *J. Roy. Micr. Soc.* 2 Ser. vol. v. 1885, p. 612, pl. xii. fig. 5.

[SP. CH. *Lumbar regions furnished with tubules, setigerous at their extremities; two occipital* **antennæ**; **brain** *threefold*; **tail** *saccate*.

In this species we see two pairs of what we may call **tentacles**, of consimilar

structure: the one pair (the ordinary *antennæ*) seated on the occiput, the other on the hinder part of the trunk, one on each side. Each tentacle consists of a tubular column, which has a thickened extremity, whence issues, in the anterior pair, a brush of divergent setæ; in the posterior, a single seta; all of great length and tenuity. The lumbar tubules are much more slender than the occipital, but are twice as long; and the increase to the terminal knob is much more gradual.

The general **form** is sub-cylindrical, becoming more ventricose at the hinder part, then abruptly diminishing. But this form is subject to constant alteration, as the animal is ever lengthening or shortening, swelling one point, and contracting another. A very curious appearance is presented by the two sides at intervals. There is, near the middle of each side, a portion of the outline, which is now and then thrown into folds,—not constrictions of a rounded saccate body, as usual, but presenting the exact appearance of a single thin tissue, the edge of which is thrown into sharp, minute, and close-set wrinkles, like those of a frill of crimped muslin. The appearance is very frequent, seldom lasting more than a minute or two: not peculiar to one individual, but common and characteristic. I cannot explain it. The body is contracted into a true **tail**, which is of a thick sub-cubical form, corrugated with strong folds of the skin, like that of *C. pachyurus*, presently to be described, but smaller. Below this is a small **foot**, bearing a pair of furcate toes, short, taper, and drawn out to excessively slender points, often slightly incurved, the flexure varying in different examples. The frontal cilia appear to be seated on slight eminences. The **face** projects into a channelled protrusile lip, whose edges are ciliated; agreeing both in shape and structure with the like organ in *C. labiatus*, but not nearly so large (figs. 2*a*, 2*b*). The **brain** is 3-lobed, composed of three pyriform ovate sacs; the outer two clear, the middle one shorter, and turbid or almost opaque, with a broad red **eye** lying transversely across its upper part, in shape like a shallow lens. The **trophi** are large and distinct, of the form seen in *Notom. aurita*. A long **œsophagus** leads to an ample alimentary canal, on which are seated a pair of kidney-shaped **gastric glands**. In the specimen which I have delineated (and I have observed it in others), the alimentary canal formed a great bag, one side of which was smooth and expanded, a most delicate transparent tissue, enclosing many small diatoms and other algæ; while the other half was thrown into close longitudinal wrinkles. Within it were four or five oil-globules of brilliant orange-hue, varying in size, the light refracted through which made very attractively beautiful objects, as the focus was ever and anon changed. The **ovary** takes the form of a long and slender band, full of clear embryonic vesicles, passing in a sigmoid curve from near the gastric glands to the bottom of the cavity. At its hinder extremity was an ephippial **egg**, covered with transparent spines, broad-based, much curved, much like the prickles of a rose, of whose development Dr. Hudson has given an interesting account (*loc. cit.*). Just above this was another smaller egg, maturing and already opaque. The undeveloped portion of the ovary is speckled all over with minute light-refracting dots. The **branchiæ** take the ordinary form of slender, somewhat twisted cords, probably tubular throughout, beginning apparently at the front face, by many attenuate ramified channels, with doubtless open ends, to receive the influent water for respiration; and terminating each on one side of a large **contractile vesicle**, occupying the hinder end of the visceral cavity. Each branchia has attached to it by a slender stem a pear-shaped bag, which hangs free in the cavity, at about mid-body; and, a little below this, an ovate enlargement, which is sessile by its whole side. The contractile vesicle takes a globose form when full; when it is seen to have a number of very minute clear glands (?) scattered over its surface. I found the period of filling, between one contraction and the next, to be just three minutes. At the point where the pear-shaped bag is given off, each branchial cord adheres firmly to the epithelial lining of the skin; but is free above and below that point. I searched carefully, but vainly, for any vibratile tags in the course of either branchia. But, in one I saw, in a very slender offshoot, close to the attachment of the pear-shaped bag, which yet was not a "tag," a vibration exactly similar to that of a

"tag." From each **toe** runs up a thread, which in the foot dilates into an ovate **gland**, studded with minute vacuoles. Probably these are mucous glands: but no mucus-strings were visible from the foot, nor any gelatinous envelope of the body, in all the specimens (nearly a score) that I have examined. The brush of each occipital **tentacle** (*antenna*) consists apparently of three, or at most four, setæ; each lumbar tentacle carries but a single seta. Through all, lines are seen running down from the setæ to the base. From the base of each lumbar tentacle the thread which descends from the seta is distinctly seen to pass for some distance up the visceral cavity toward the brain, till it can be no longer distinguished among the multitude of lines. On the other hand, the thread issuing from the base of each antenna may be traced to the very summit of the brain.

This is, perhaps, the largest of all known *Rotifera*. Some among the *Rhizota* may exceed it in length, a great part of which is occupied by the foot of almost linear tenuity. But, bulk for bulk, *Copeus spicatus* far exceeds them all. It is a noble, as well as a very interesting, member of its class. Viewed on the stage of the microscope, we forget that we are contemplating a speck, such as a lady's cambric needle might prick in a sheet of paper, and are struck with what we are ready to call its gigantic dimensions. For, with a half-inch objective, it almost crosses the round field of view, and with a quarter, such as is needful to interpret the organization of the Rotifera, we are obliged to examine it piecemeal; for a large portion of the creature is necessarily beyond our vision. Its great size, slow movement, and brilliant transparency make it a subject very favourable for observation. Perhaps this is the finest addition made to our knowledge of the Rotifera since Ehrenberg's *magnum opus*. And we owe our acquaintance with it to Dr. Hudson, who named, described, and figured it in the "Journ. Roy. Micr. Soc." for May 1885. It was discovered by Mr. Bolton, who sent him specimens, as he has lately sent to me also, obtained from Sutton Park, Birmingham.—P.H.G.][1]

Length (moderately extended), $\frac{1}{2\cdot3}$ inch; width, $\frac{1}{130}$ inch. **Habitat.** Birmingham: Coleshill (T.B.); Sandhurst (Dr. Collins).

C. PACHYURUS, *Gosse*, sp. nov.

(Pl. XVI. fig. 4.)

[SP. CH. *Front furnished with a pair of long and thick* **auricles** *projectile and retractile; lumbar regions with tubules, destitute of setæ;* **tail** *saccate.*

The general accuracy of Prof. Ehrenberg's details, where he gives them, makes me distinguish this species from his *N. copeus*; though it comes very close to that fine species, perhaps even closer than does Dr. Hudson's *N. spicata*, or any other. It is, indeed, less than half the size of *Copeus* (= *Ehrenbergii*), my specimen measuring $\frac{1}{75}$ inch in length, when moderately extended; I could not be sure that the **brain** had more than one lobe; the lumbar **tentacles** are placed far back, as in *spicatus*, and differ in apparent structure from those of either; and finally the **tail** is neither a minute conical tubercle nor a long stiff point, but a wide sub-globose sac (as in *spicatus*, but far larger), whose walls are thrown into stiff sharp folds, as if composed of a firm leathery skin.

Yet the general aspect is that of *Ehrenbergii*; the **auricles** have the same form and direction, and the same comparatively large dimensions. Ordinarily they are quite un-

[1] A side view of this fine Rotiferon has been accidentally omitted from pl. xvi.; but will be given in pl. xxx. It shows that the two occipital antennæ are connected by a transverse ridge crossing from the base of the one, to that of the other. My solitary specimen had a semi-transparent gelatinous covering, out of which peeped the ends of the four tentacles. The ephippial egg, when I first saw it, was quite smooth, and separated by a clear space from its outmost covering. I saw its prickles begin to grow, and watched them slowly stretching across to the outer shell. Two hours elapsed before they had accomplished the distance.—C.T.H.

suspected, being absolutely concealed within the rounded outline of the head; but, at the will of the animal, are suddenly pushed out horizontally, by eversion of the skin, to a length more than half the diameter of the head. They then form oblique cones, which are truncate at their tips; but the skin there, which seems in some sort double, is at every instant drawn in a little, as if very sensitive. The outer upper corner of each is richly ciliated; and the ciliary action, at this point of each, makes a strong vortex, into which floating atoms are drawn, and whirled round as in those of the *Bdelloids*. The auricles are often extruded when the animal is not swimming, but grubbing among the sediment; and they do not sensibly augment the speed, then; but if extruded during the swimming, they do so notably. Each can be thrust out in varying degrees; and very often one is out while the other remains concealed: they are manifestly very flexible. No **antenna** from the occiput is visible; and the tentacles on the lumbar regions are very minute tubules projecting through the internal skin, and connected with a visible basal area on the exterior of a vascular membrane which surrounds the abdominal viscera. I can discern, even with a high power, no setæ at the tips of these tubules: but possibly these may be retractile. Indeed, the tubes themselves are not always apparent. After death, the ventral surface being in view, a thread was distinctly seen on each side proceeding from the base of the lumbar tentacle, dividing into two branches at about mid-length, and going up to the sides of the brain. Each thread, both before and after the division, had a sensible diameter, and showed a double outline. No under lip breaks the uniform rotundity of the frontal outline. But, in a ventral view, when it was still and contracted in dying, I have observed an ovate line, as of a minute orifice, just within the edge (fig. 4*b*), which may possibly have marked the place where a lip had protruded.

The general figure of the animal much resembles that of *N. aurita*; but is more variable, as if the integument were softer and more flexible. A momentary glance while it was turning left the impression that a segment would be as at fig. 4*a*; as if the ventral surface were dilated and flat. The skin was free from gelatinous envelope.

A stout **foot** of three joints carries two toes of the blade-form, stout, of uniform width, somewhat long, *straight*, and pointed. Behind them, separated from them by the cloaca, and from the gibbosity of the trunk by a strong constriction, there is a large bladder-like inflation of the skin, thrown into strong folds or creases, which must be taken to represent the tail. It is colourless, and appears quite empty; it is constantly changing its outline, but ever falls into the same folds. It is slightly bilobed, and seems somewhat dilatable. This great fat ventricose tail is a conspicuous character, by which this species may in a moment be recognised. The internal economy is, in most examples, sufficiently clear. A three-fold **brain** is seen: the mid-lobe pear-shaped with a long slender neck, the bulb reaching far below the mastax; the side-lobes comparatively short. I have seen the mid-lobe filled with granular matter, not quite opaque, but darkly turbid. A deep-red **eye**, large, oblong-square or ovate, is seated on the neck of the mid-lobe. An ample **mastax**, with normal trophi, nearly fills the breadth of the pectoral region; followed by a vast stomach, in most examples, densely filled with dark-brown conglobate rolls of food; sometimes with no **glands** visible, at others with two small glands, dark, with a large oil-globule within each, of deep orange hue, whose rich refraction of light has a very striking effect, like a pair of coloured carriage-lamps. The **ovary** often has a great egg, nearly mature. **Lateral canals**, one on each side, are more or less clearly discerned, on one of which I have seen one vibratile tag; but I have not been able to detect a contractile vesicle.

In manner of life this, like its congeners, is dull and slothful, rolling stupidly and aimlessly about, and ever altering its form, but not much given to locomotion. Now and then, however, it seeks a new locality; and then it shoots away in a straight line, with considerable swiftness and grace, cleaving its path, with dilated front, through the water. I was so fortunate as to be present at the dinner of this species, as I had been at that of *C. labiatus*. Several large algæ were strewn around, among them a *Closterium*,

dark green, very slender, nearly straight, and longer than the *Copeus* (perhaps *C. lineatum*). The animal attacked two of these in succession, taking hold transversely, yet not attempting access there. But feeling its way, it worked, very cleverly, and with manifest intelligence, till its jaws reached the tip. At this, then, they worked eagerly, drawing it in, so that it stretched out lengthwise from the head. No impression, however, was made on the flinty frustule, and it was presently relinquished, to attack another, equally in vain. After some hours, I perceived that it was essaying food again; and again one of the same long *Closteriums*, which now was drawn far down the buccal funnel; while the mastax in its usual position had already eaten a good deal of the desmid, chewing it away, as one would eat a radish. The great **auricles** (in this very example) were reluctantly and charily put out. They would not be suspected at other times. During several hours' observation I saw them extruded only on one occasion, when the creature was gliding through clear water. And then, it thrust out first one and then the other, timidly and tentatively, as it were, and drawing each back before it was nearly out; then again protruding it; till, by this time, some impediment was reached, and I saw neither any more. Such was very much my experience of others also. The first specimen that I saw occurred in water sent me, in June, by Dr. Collins from his "happy hunting-ground" at Sandhurst. But more recently Mr. Bolton has sent me examples from the prolific ditch in Sutton Park, near Birmingham, where it revels in company with *labiatus* and *spicatus*.—P.H.G.]

Length, $\frac{1}{75}$ inch. **Habitat.** Pools and ditches where the larger *Diatomaceæ* abound. Sandhurst; Birmingham (P.H.G.).

C. CAUDATUS, *Collins.*

(Pl. XVI. fig. 5.)

[SP. CH. **Form** *slender, swelling in the middle;* **auricles** *wanting; one occipital antenna, and one lumbar* **tentacle**; **tail** *minute.*

In "Science Gossip" for 1872, Dr. Collins described and figured this *Notommata* of singular facies. I had long desired to examine it, having had my curiosity excited, not only by the brief diagnosis of its discoverer, but by numerous pencilled sketches in his well-filled note-books, committed to me from time to time by his courtesy. At length, by his kindness in sending me samples of water from the original habitat, I have been gratified by the sight of several specimens in healthy activity. It is a species much more abnormal in appearance than in structure: an appearance which depends on the seeming severance of the head from the body by a long interval. The **head** is large, somewhat square in outline, and, owing to the definition of the brain with its eye, and of the mastax, it catches the observation in a moment. Then follows a neck of unusual length; and though its thickness is scarcely less than usual, its extreme transparency and colourlessness render it hardly visible till focussed; and it contains no organs, save on each side the twisted **lateral canals**, of such filmy mistiness as scarcely to be perceptible when searched for; and so there seems nothing at all, save the œsophagus, a tube of great subtleness and slenderness running through the middle of its entire length. We seem to see an oval abdomen filled with viscera, and a head tied to it at the end of a long string. The head carries at each frontal corner a small globe refractive of light, which I take to be an **auricle**, though I have not seen them retracted or protruded, nor are they manifestly ancillary to speed, being visible uniformly in the animal's twinings and crawlings. The frontal surface between these auricles bears vibratile setæ, as well as ordinary locomotive cilia. A large well-developed **brain** occupies the whole width, and descends, sack-shaped, far down the occiput, bearing on its facial side a brilliant crimson globular **eye**, and in its rear, supplying a nerve-thread to the sensitive seta which runs through an antennal tubule, projecting from the back of the head (figs. 5*c*, *d*). A **mastax** of ordinary form in the family has the bent mallei of some thickness. It is figured at 5*b* from some very good observations, though, from difficulties inseparable

from the circumstances, I dare not vouch for the minute details, particularly of the *incus-rami*. The **respiratory organs**, in the form of slender cords, loosely twisted together, but, as I presume, tubular, can be traced to the very front of the head; at least to the point on each side where the proximity of the brain to the integument allows them to be no longer discerned; and thence backward without interruption, till their ends ramify and are lost on the walls of the ample contractile vesicle that occupies the termination of the abdominal cavity. It was an operation of much delicacy, but with a $\frac{1}{4}$-in. obj. I think I satisfactorily followed the entire course described. In the ample abdomen the viscera are large. The **alimentary canal** is clearly separated into a stomach and an intestine. In all the individuals examined, neither of these held any visible food, but both were tinged with pale umber-brown. An **ovary** of embryonic vesicles, and a great dark ripening ovum, were conspicuous in one. At the expansion of the long œsophagus into the stomach are the pair of ovate colourless **glands**, which possibly are biliary, and may impart the prevalent yellow-brown tinge to the digestive canal. The dorsum, just before the point where it contracts into the foot, rises into an angular prominence; which must be regarded as a true **tail**, because beneath and behind it is the common excrementary outlet, whether for matters urinary or fæcal—the *cloaca*. The anterior side of the orifice is crowned with a bristled tubercle (fig. 5*d*), very closely resembling that projecting from the hind head. It seems a tubular wart with a thickened rim, bearing a rather short seta on the summit. From the base of this are discerned, clearly running down through the transparent tube, two fine lines, which probably are the optical expression of a nervous cord, bending forward to some sensible distance up the body, till lost behind the viscera. I searched (vainly) for some ganglion in the vicinity, with which this thread may communicate. But I rather presume that it runs through the body, and communicates with the great brain at the very front. It seemed to me that each of these tentacular warts, both that on the head and that on the tail, is susceptible of sensible elongation, and of occasional withdrawal, partial or perfect. The **foot** is slender and colourless, like the anterior parts, and is terminated by two minute and delicate toes; from which two long, club-shaped muscles pass forward nearly to the cloaca.

The species was discovered by Dr. Collins in 1865, in a small pool near Sandhurst Military College, whence he has recently sent me a supply. There seemed here the exercise of a sense of companionship, at least in captivity. After some days this species became rather numerous in the bottle of water-moss, and I have had, perhaps, a dozen in my live-box at once, of various ages. I noticed, much too often to be merely fortuitous, that they were in the habit of associating in couples, two being generally in close contiguity, and now and then coming into actual contact; the one crawling, in their lithe embracing manner, over the foreparts of the other; separating, however, immediately after. It was not sexual. In young individuals, not more than half as long as the adult, all the characters are developed; except the great length and almost invisibility of the neck, which are not so manifest.—P.H.G.]

Length, $\frac{1}{130}$ inch. **Habitat.** Sandhurst, Berks (Collins); Dundee (P.H.G.).

C. Cerberus, *Gosse*, sp. nov.

(Pl. XVI. fig. 3.)

Notommata centrura . Gosse (nec Ehr.), *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 200.

[SP. CH. **Tentacles** *wholly wanting (or unobserved);* **auricles** *small;* **brain** *three-lobed;* **tail** *a minute tubercle.*

This species approaches the ordinary *Notommatæ*, in form and in the absence of those projected organs of sense which characterise the other species of this genus. Yet the general aspect, the sluggish manners, and the three-lobed brain, seem to war-

rant me in placing it in this genus. Indeed, when, five-and-thirty years ago, I first met with it, I concluded that it was identical with Ehrenberg's *N. centrura*. But I have lately seen several more examples, which have convinced me that it is still an undescribed species.

The **form** is rudely cylindrical, with many irregular constrictions, and the abdominal regions somewhat swollen. The front is rondo-truncate, with a minute **auricle** on each side. These seem scarcely protrusile, though the oval space in which ciliary action is seen appears in each. The ciliated **face** is prone, and reaches far down; no lip appears. At the hinder extremity there is a distinct **tail**, small, saccate, almost amorphous, beneath which the cloaca opens, as I saw by the actual emptying of the rectum. A very short **foot** carries two minute, conical, pointed toes. The **brain** consists of three sacs, of which the central hangs low, being seen behind the mastax, and as usual forms a long tube at the origin, in which is the **eye** of lenticular form, and brilliant crimson hue. The lateral sacs are moderately short. All three are more or less occupied with opaque granular matter; but in the central sac this is *generally* (not always) so much diluted as to be pellucid. The central sac, too, is occasionally seen truncate at its lower end, exhibiting very distinctly at its margin the separate cells of which it is composed. The **trophi** are normal: the mallei apparently four-fingered. The **alimentary canal** is large, saccate, furnished above with small globose **gastric glands**, and not sensibly divided; its central longitudinal cavity may usually be traced, full of digesting food of a dark umber-hue, while the thick surrounding walls are tinged with the same. The voluminous **ovary**, forming a wide horseshoe across the ventral region, its horns directed backwards, is full of clear embryonic vesicles, and often carries a dark maturing egg which I have seen discharged. The **branchial system** has the usual form of a rather thick cord (probably tubular), not twisted, but hanging so loose as to be thrown into many curves, with at least three vibratile tags on each, and the usual **contractile vesicle** of moderate size occupying the hind mid-ventral region. **Muscles**, both longitudinal and transverse, agree with those that I long ago demonstrated in *Not. aurita*.[1] The whole head is usually tinted with buff, and the mastax-front with red-brown.

My first example of this species was found in June 1850, in a phial dipped on Hampstead Heath three weeks before. The more recent were in the sediment of a phial sent me by the kindness of Dr. Collins, from the historic pool in Sandhurst Wood. The creature, like its congeners, is slow and deliberate in manners, burrowing and rooting in its floccose surroundings. Its motions are much like those of the water-bears; indeed, on first catching a glimpse of my subject among the half-hiding sediment, I have repeatedly been doubtful whether I was looking at a Tardigrade or one of these massive *Notommatadæ*.—P.H.G.]

A specimen of Mr. Gosse's *Copeus Cerberus*, which I found in some water from Sutton Park, Birmingham, enabled me on one occasion to obtain an excellent view of the mastax and trophi; for it every now and then slowly turned its head back, so as to bring its ciliated face up to the cover-glass, and thus to rotate the mastax, for me, with all its parts in their natural position. I could distinctly see the massive malleate trophi unusually thick and broad; the short, wide, yet graduated teeth of each uncus opposing each other at the top of the mastax, like the fingers of the two hands brought just to touch at their tips. Immediately above them were two very prominent lips, like a parrot's beak, and evidently of a much harder substance than the rest of the mastax: they were seated upon it, on each side of the opening between the buccal funnel and the teeth. These I saw repeatedly open and shut as food passed down the funnel to the trophi.

Length, $\frac{1}{75}$ inch. **Habitat.** Hampstead Heath; Sandhurst, Berks (P.H.G.).

[1] *Trans. Micr. Soc. Lond.* vol. iii. p. 101. pl. xv.

Genus PROALES, *Gosse*.

GEN. CH. *Of moderate or small size;* **body** *generally cylindric, or larviform; ciliated* **face** *more or less prone;* **brain** *clear;* **auricles** *and* **tail** *wanting.*

This again is an extensive group, containing many species, some of them of familiar occurrence, often obscure, of indefinite character, and hard to be distinguished. Some are entozoically parasitic on other creatures. The vibratile cilia are disposed on a face, along that side of the head which is more or less in the ventral plane. Their bodies are usually lithe, soft, and versatile; their motions rapid and various.

P. DECIPIENS, *Ehrenberg*.

(Pl. XVIII. fig. 6.)

Notommata decipiens . . . Ehrenberg, *Die Infus.* 1838, p. 431, Taf. lii. fig. 6.
„ *vermicularis* . . Dujardin, *Hist. Nat. Zooph.* p. 648, pl. xxi. fig. 7.

[SP. CH. **Body** *cylindric, slender, worm-like;* **foot** *undeveloped;* **toes** *minute.*

This much resembles a dipterous larva; having a soft, flexuose, slender body, with a rounded front, and two minute, conical toes, without any sensible foot. A large, occipital **brain** carries a red **eye**, distinct, though small; a crystalline lens is conspicuous, seated on, and partly imbedded in, the pigment-globule; the latter much the larger. (See Duj. *loc. cit.*) Near the front are two clear colourless granules, usually distinct in the many examples that I have met with. These may be readily mistaken for eyes when the animal is in motion. A **mastax** with trophi of normal form leads by a very long and slender œsophagus to a cylindric alimentary canal, with usual accompaniments.

I first found this in 1849, in waters near London both north and south. Since then it has occurred repeatedly in various localities. When I saw my first example, it was spinning round on its long axis. After a while it became less impatient, but still very lively. It frequently bent itself up double, in the manner of a caterpillar, and occasionally shrank up into a wrinkled, shapeless ball, remaining thus awhile quiet. Gliding through the water by means of its rotatory cilia, its motion was not particularly rapid. Though I have called the trophi normal, there is, in the form of the rami, a manifest approach to these organs in *Diglena*.—P.H.G.]

Length, $\frac{1}{100}$ to $\frac{1}{145}$ inch. **Habitat.** Near London; Epping Forest; Birmingham; Stapleton Park, Yorkshire; Dundee (P.H.G.): pools: not common.

P. FELIS, *Ehrenberg*.

(Pl. XVIII. fig. 17.)

Notommata felis . . . . Ehrenberg, *Die Infus.* p. 431, Taf. lii. fig. 7.

[SP. CH. **Body** *cylindric, slender; a large decurved fleshy* **proboscis;** **eye** *very large;* **trophi** *Diglenoid;* **foot** *stout;* **toes** *slender, pointed.*

Of this little species, the slender **trunk** is strongly fluted longitudinally. The curious projection which Ehrenberg calls a horn, is a thick soft lobe of translucent flesh, which curves down before the head, perhaps a tentative organ, and recals what we see in some of the *Diglenæ*. So also do the pincer-shaped **rami**; and, as in that genus, they are capable of being rapidly and forcibly thrust forth, with a snapping action. The **brain** is broad, and descends far; it bears on its round extremity an **eye** so large that it occupies fully half the diameter of the body. Yet it is seldom seen; being a lens seated transversely, and edgewise to the observer. The **stomach** too, with high lateral shoulders, usually densely filled, hinders the observation, not only of the eye, but of all

the viscera.[1] Its manners are lively and restless; rarely swimming, but incessantly boring and pushing through the yellow sediment in which it chooses to dwell; and that so pertinaciously, that when it comes to the edge of a mass, it will not (or very rarely) go on into the clear, but turns back, and bores its path anew. If it does sail out for an instant, it presently stops short, turns tail, and hurries back to its cover. I have seen the pincer-jaws rapidly protruded almost to their full length. I have seen many specimens, in water and sediment from the ditch in Sutton Park, Birmingham, which Mr. Bolton has so successfully explored.

The new Rotifera *Pleurotrocha mustela* lately described and figured by Mr. W. Milne ("Trans. Phil. Soc. Glasgow," 1885), is very like the present species. He has represented the **male**, which closely resembles the female, but is smaller, and devoid of digestive system. The memoir is of high value.—P.H.G.]

Length. About $\frac{1}{175}$ inch. **Habitat.** A ditch near Birmingham (P.H.G.); Glasgow (Mr. Milne).

P. GIBBA, *Ehrenberg.*

(Pl. XVIII. fig. 8.)

Notommata gibba . . . . Ehrenberg, *Die Infus.* 1838, p. 430, Taf. lii. fig. 4.

[SP. CH. **Body** *compressed; back much arched, deeply incised above the stout foot;* **toes** *slender, pointed, slightly decurved.*

The fore parts are separated from the trunk by a marked infolding, as well as the foot; this latter constriction, when viewed sidewise, forms a deep sinus. The first example that I met with was in November 1849, in a pond at Battersea Rise. I afterwards found other specimens. The **front** is prominent and round; over it projects a semi-ovate plate apparently slightly bent downward, on each side of which is a fine seta. Perhaps the more natural place of this species would be in the (restricted) genus *Notommata*, near *lacinulata*. But the ciliated face is prone. The **brain** descends bag-like, into the occiput, and bears a wart-shaped red **eye** on its very end. The taper rectum terminates in a cloaca, in the deep posterior infolding. A minute **contractile vesicle** is in almost incessant contraction. The **foot**, with its curved toes, is often thrown forcibly back, in the manner of *Rattulus*.

The animal is lively, actively swimming, and contracting strongly as it goes, and throwing the toes backward and forward.—P.H.G.]

Length, $\frac{1}{300}$ to $\frac{1}{200}$ inch. **Habitat.** Battersea; Stapleton, Yorkshire; my domestic aquarium (P.H.G.): rare.

P. SORDIDA, *Gosse*, sp. nov.

(Pl. XVIII. fig. 7.)

[SP. CH. **Body** *nearly cylindrical;* **head** *broad, truncate;* **foot** *very broad, with a depression through the median line;* **toes** *minute, conical.*

This is a somewhat clumsy, ungraceful, unattractive species. The whole integument is flexible, and thrown into transverse folds, though seemingly stiff. The **corona** is broadly truncate, formed by numerous ill-defined globose masses, on which the cilia are grouped. The whole front is capable of little expansion or change, and the motion consequent, not very swift. The **mastax** is ample, of the *Notommatous* pattern; behind which a **brain**, moderately developed, carries a red **eye**, on its side. The eye is often invisible; then suddenly appears as a minute speck (or, as I once saw, two red specks, apparently in contact), or, often, as a well-defined considerable mass of rich colour. I

[1] Herr Eckstein (*Sieb. u. Köll. Zeits.* 1883, p. 363, fig. 29) describes and figures a pair of minute dark-red points one on each side of the front, whence a brush of setæ springs. These I have not seen but cannot doubt that they are of the nature of antennæ, and that the red speck is imaginary. He describes the proper eye besides, and notices the distinct refracting lens, by which it is embraced.

have seen the saccate brain at its hinder end, densely opaque in a great ball, just as in *N. aurita*, while all the remainder was clear. In every other respect the specimen was a normal *sordida*. The most observable characteristic of this species, by which it may without fail be identified (for it is quite constant), is the condition of the **foot**. The hinder half of the trunk, viewed dorsally, insensibly diminishes to a width about one-third that of the widest part, where it is abruptly truncate; the hind half of this is separated by a slight fold, and appears to constitute the foot-proper. Yet there are no visible joints in it, and its outline, as I have said, simply continues the gradual tapering. Down the middle of this foot there runs what seems a shallow depression, crossed by two similarly depressed transverse lines, and the whole ends in two small conical toes. When once this peculiarity has been noticed, there is no mistaking it.

I first found the species in a tube sent me by Mr. Hood from Dundee, and since then in water from Miss Saunders of Cheltenham, and abundantly from Woolston, sent by Miss Davies. Some of these last were hyaline, and more active.—P.H.G.]

Length, $\frac{1}{150}$ to $\frac{1}{130}$ inch. **Habitat.** Many localities in England and Scotland: common in pools (P.H.G.).

P. TIGRIDIA, *Gosse*, sp. nov.

(Pl. XVIII. fig. 10.)

[SP. CH. **Body** *cylindric or fusiform, curved in the manner of* Rattulus; **foot** *and* **toes** *both long, and bent in a sigmoid curve.*

This animal, I do not doubt, has been confounded by observers, as it was by myself, with the *N. tigris* of Ehrenberg, but this latter I now relegate to another genus, in the Sub-order LORICATA. The present is certainly il-loricate, and its long ciliate **face**, almost absolutely prone, shows its affinities to be here, though it is certainly osculant with *Rattulus*. Its **trophi**, too, are symmetrical, and of the *Notommatous* pattern. The cilia of the face seem set on minute eminences; and there are longer setæ among them. The belly line bends upward and then downward to include the base of the deep **foot**, which again bends upward (*i.e.* backward) to the toes, and these bend downward at their tips. So that the whole line from the face to the toe-tips forms a double sigmoid curve of much elegance. In June 1885 I first became cognizant of this interesting form. It was haunting the decaying whorls of *Nitella*, in water from Woolston Pond, sent me by the kind courtesy of Miss Saunders. It has occurred also in other waters.

It is an energetic animal, given to sudden and rapid changes of motion, shooting through the free water with great celerity, the toes stretching behind straight and parallel; now abruptly turning on itself to pursue another course, now arrested by a cloud of floccose, to dig into the decaying vegetation with apparent determination and vigorous perseverance. The **digestive canal** is almost invariably dark with granular food, of a deep rich-brown hue. A **contractile vesicle** is usually conspicuous.—P.H.G.]

Length, $\frac{1}{170}$ inch. **Habitat.** South and Midland England; pools (P.H.G.): rare.

P. PETROMYZON, *Ehrenberg*.

(Pl. XVIII. fig. 9.)

Notommata petromyzon . . . . Ehrenberg, *Die Infus.* p. 427, Taf. l. fig. 7.

[SP. CH. **Body** *ovate;* **foot** *long, stout, and very distinct;* **toes** *minute.*

The **form** is gibbous-ovate, truncate at each extremity, when contracted; the head is rounded, protrusile; the **foot** apparently of one joint, very large and long, but abruptly less in width than the truncate body whence it issues; the two toes are very minute cones. The character of the foot makes the species particularly easy of recognition.

The simplicity of the **trophi** makes them very instructive. The *incus-fulcrum* is

thin and blade-like, straight but slightly incurved at the free end, deeply truncate above where the rami are jointed, which are long triangular blades arching backwards. The *mallei* are slender rods, each with a process, and an *uncus* of two fingers.[1]

Ehrenberg describes the species as parasitic on the branching Bell-vorticels *Epistylis* and *Carchesium*, among whose twigs it lays its eggs; and also in *Volvox*. I have seen it always free, though repeatedly in close association with both these Infusoria. I have been acquainted with it from many localities since 1850. It is lively in its motions; yet frequently adhering to the glass, and moving by a feeble crawling; it can, however, swim rapidly. Its contractions are almost perpetual, and very vigorous.—P.H.G.]

Length, when extended, $\frac{1}{110}$ inch. **Habitat.** Around London; Walthamstow; Leamington Canal; Cheltenham; Woolston; Birmingham: pools and garden reservoirs (P.H.G.).

P. PARASITA, *Ehrenberg.*

(Pl. XVIII. fig. 11.)

Notommata parasita . . . Ehrenberg, *Die Infus.* 1838, p. 426, Taf. l. fig. 1.
Hertwigia volvocicola . . . Plate, *Jenaisch. Zeits. f. Natur.* 1885, p. 26, figs. 7, 8.

[SP. CH. **Body** *cylindric or gibbous, rounded at each end;* **foot** *and* **toes** *wanting. Parasitic in* Volvox.

To the characters just given may be added that the **jaws** are long, slender, protrusile, and asymmetric: the mallei being dissimilar in length and curvature; thus recalling the *Rattulidæ*. A brilliant crimson **eye**, wart-shaped, sits on the dorsal corner of a large occipital **brain**; from the front of which projects a club-shaped **antenna**, sometimes drooping, sometimes erect. The prominent round head is clothed with fine cilia, and surrounded by a wreath of stronger vibration; when this is retracted the margin is thrown into puckers.

The habits of this inconspicuous species are curious; for it is parasitic within the spheres of *Volvox globator*. Examining this elegant creature, we may, even with a pocket-lens, discern which are tenanted, by a spot differing from the young clusters in form and colour. Such a spot proves to be the *Proales*, snugly ensconced within the globe, in whose spacious area it lives at ease, and swims to and fro like a goldfish in a glass vase. For the most part it affects the inner surface, engaged in devouring the green Monads that stud the gelatinous expanse, or else eating away the embryo clusters. Sometimes laid eggs are present, with the *Proales*; sometimes eggs alone. The young seems always hatched in a *Volvox*, and, entering an embryo cluster, is expelled with it. Often they eat their way out, and swim at freedom. Observing in a globe one large egg, I opened the globe with a needle, and freed the *Proales*, placing it in water, and adding several *Volvoces*, all untenanted. But it did not enter one, during several hours' observation. During this period it discharged, loose in the water, an ephippial egg, covered with prickles. I have seen a prickly egg and a smooth one, transparent, with eye and jaws visible, in the same sphere. One of the latter I saw hatched, the young just like the adult. The *Volvox* appears to suffer little from the depredations of its ungrateful guest. The *Proales* is lively and energetic in freedom. It glides wildly about, often in a zigzag course, turning from side to side, as it dashes rapidly along. Sometimes it rotates on its axis as it goes; or, becoming stationary, it turns on its blunt extremity, as on a pivot. It is perpetually contracting and elongating, and throwing itself into angular folds and contortions.—P.H.G.]

This is one of the partially loricated Rotifera. The soft front of the head, seen dorsally, is truncate, and much like that of *Notops hyptopus*. The edge of the trunk, within which the head can be withdrawn, is chitinous, and scolloped in regular curves, just like the edge of a lorica. At the hind end of the trunk, and on the median line of the dorsal

[1] See *Phil. Trans.* 1855, p. 432, pl. xvii. figs. 27–31.

surface, is a forked projecting pucker of the hardened skin, so greatly resembling the notch in the lorica of a *Brachionus*, that I thought at first that the structures were identical. Ehrenberg (*loc. cit.*) says that the creature has a minute, and slightly projecting foot; which, as Mr. Gosse has stated above, it certainly has not: but it is clear, from Ehrenberg's description and figure, that he has mistaken the forked pucker which I have just described for a pair of small toes; a mistake easily made when the dorsal surface is presented to the line of sight from a certain point of view. The animal's dorsal outline reminds one of *Notops hyptopus*; which Rotiferon is also partially loricated.

I have often seen one of these little creatures ineffectively nibbling at the gonidia of the *Volvox* which it inhabited; but once I watched one bite its way into what was, I suppose, a softer place than usual; and a moment after I saw a long stream of bright green globules course swiftly through the mastax, down the œsophagus, and into the stomach.[1]

Length, $\frac{1}{225}$ to $\frac{1}{160}$ inch. **Habitat.** Wherever *Volvox* is numerous: London, Birmingham, Leamington, Dundee (P.H.G.); Clifton (C.T.H.).

Genus FURCULARIA, *Ehrenberg*.

[GEN. CH. **Body** *generally larviform, cylindrical, with a tendency to enlargement in the lumbar region; usually compressed;* **front** *conical, broad, and deep;* **eye** *single, frontal, sometimes wanting;* **incus** *forcipate, much developed, protrusile;* **toes** *two furcate, usually conspicuous.*

It is not easy to attach to this genus such a definite character as shall be really useful to the student for identification and diagnosis. Ehrenberg is very vague. He gives but two distinctive points,—the frontal eye, and the forked toes. The latter is worthless, as being indistinctive; and the former is unfortunately not constant, or not always available. Eckstein's character for the genus is really but the character of one species, inapplicable to others. Yet it is a good genus (as used by Ehrenberg, not by Dujardin), and easily recognized in almost all its members, by one who is personally familiar with them. Possessing much resemblance to the species of the extensive genus *Proales*, the *Furculariæ* have an aspect, as well as habits, of their own. Both aspect and habits are more easily detected than described. The front, more or less a low cone of wide base, in vertical aspect, with a minute but usually conspicuous crimson eye set at the very point, with no lateral developments—this is doubtless highly characteristic. So also are the toes, in general strongly marked, very active, and often thrown spasmodically backward, above the body-plane. There is one feature in their habits which is markedly prevalent: the predilection which many of them show for darkling retreats, and the tenacity with which they cling to them. No hare flees to cover more eagerly. Examples will be given in detail presently.

The species are vivacious, energetic, restless, eager, predatory. The strongly developed *rami* of the powerful *incus*, moved by proper muscles, are capable of protrusion from the face of the front, with a fierce snapping action, in which, however, they are rivalled by other kindred genera, such as *Diglena* and *Distemma* in particular. The recognized species are not numerous. Ehrenberg admitted four. To these I have added five others, including the *F. marina* of M. Dujardin (if, indeed, mine is identical with his); but one of Prof. Ehrenberg's has not been yet met with in Britain. They are wide-spread, and are not very uncommon, in the sediment of pools and ditches. Two species which Ehrenberg placed in his great genus *Notommata*, I prefer to place here.—P.H.G.]

[1] Dr. Plate (*loc. cit.*) has described *P. parasita* (*Notommata parasita*, Ehr.), male and female, as a new species under the name *Hertwigia volvocicola*, on account of its having no toes. Dr. Cohn gave an excellent figure of the **male** in *Sieb. u. Köll. Zeits.* 1858, but drew the female with two minute toes.

F. FORFICULA, *Ehrenberg*.

(Pl. XX. fig. 1.)

Furcularia forficula . . .	Ehrenberg, *Die Infus.* 1838, p. 421, Taf. xlviii. fig. 5.
„ „ . . .	Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 199.
„ „ . . .	Lord, *Micr. News*, 1884, p. 235, fig. 27.

[SP. CH. **Body** *stout, straight, nearly cylindrical; broadest at the head, which comes to a frontal point, where is a single red* **eye** *;* **toes** *two, furcate, blade-shaped, acute, decurved, the ventral edge of each notched with two strong teeth.*

The deep sickle-shaped **toes**, having their under-edges notched near the base, readily identify this.[1] Its **form** is nearly cylindrical, slightly thicker in front; the back is sometimes gibbous, viewed laterally. The head forms a short regular cone, whose base is the width of the head, at the apex of which is placed the small but distinct red **eye**. The whole front appears set with cilia, which cause two vortices: a turbid occipital **brain** is visible, carrying the eye at its anterior extremity. In contact with this as usual, is an ample sub-globose **mastax**, with characteristic trophi. A long **œsophagus** leads to the alimentary canal, which has thick granular walls, and bears two large **gastric glands**. At times the dorsal portion of the stomach is inflated into a large clear bladder, which displaces the granular walls around it. As this often appears and vanishes rather suddenly, it has a singular effect. Towards the hinder part the granulation becomes less opaque; but whether there is any division between stomach and intestine has not been clearly seen. A small **contractile vesicle** lies around the base of the foot, and I have sometimes been able to trace the lateral canals and vibratile tags. A small oblong or cord-like **ovary** generally occupies the venter, sometimes dilated into a maturing granulate ovum. Many longitudinal **muscles** are visible, but the contractions and contortions of the animal are so incessant as to render it almost impossible to define them. By these contortions the firm skin is thrown into various irregular angular folds. The **foot** seems composed of two joints, of which the basal is by much the stouter, each enclosing a **gland**. The curved broad blade-like **toes** bend downward at their sharp points; each is cut into a strong projecting sharp tooth at its base, and its foot joint immediately preceding has two teeth exactly similar.

Ehrenberg alludes to this animal as very rare. I have been familiar with it for more than five-and-thirty years, and I consider it by no means uncommon. I used to meet with it in the waters around London, and have since found it in very many localities, often among conferva, and in the floccose sediment of ditches. In confinement it is often most restless, constantly swimming about with a swift gliding shooting motion, and throwing itself into frequent folds and twistings. The body is nearly colourless, but for the opacity of the granulate viscera, which appear white by reflected light.

On repeated occasions I have observed, in this species, the curious habits already referred to of inhabiting tubes, for some unimaginable purpose, of its own ingenious manufacture. I cite the following note from my Journal, jotted down while under my eye. "A fine specimen I found tenanting a long curved passage, in the yellow-brown floccose from the ditch in Sutton Park. This was just wide enough to allow it to move freely, and to turn its soft flexible body, when needed. It was about twenty times the animal's length, outwardly undefined, being but a cavity formed in the irregular mass of accumulated floccose. Within this, semi-transparent in parts, the *Furcularia* was diligently pushing its way from end to end, turning back on itself the instant the end was reached, not showing its nose out in the clear for a moment, and returning on its course; moving with considerable rapidity, never deviating and never resting. But after doing this a long while, perhaps an hour or two, it began to pause here and there, and to move

[1] Ehrenberg describes and figures a species, *Distemma forficula*, of which I know nothing more, with toes closely resembling the above. Only, to judge from his figs., the toes are *recurved* instead of *decurved*, and the notching is on the *dorsal* instead of the ventral edge.

more slowly. I at last picked the sheltering material to pieces with needles in order to be quite sure of the species: for I had not yet had one satisfactory view of it at this time. Yet even then it kept obstinately under the floccose, refusing to come out into the open, even when its tube was torn up." On another occasion, lately, a striking illustration of the fierce appetite of this carnivorous creature occurred to me. One in the live-box was driving to and fro in its eager headlong way, when its course was suddenly arrested. A *Naïs* worm had been wounded, probably by the pliers in taking up the milfoil from the phial, and a cloud of the pale flesh-granules had oozed, and was still oozing, out of its side. The *Furcularia*, aimlessly swimming, had come to the outside of this cloud, and its whole manner was changed instantly. It darted at the mass, snapped and snapped again, turning hither and thither, but not leaving the vicinity. The sharp rapid momentary projections of the head and of the jaws showed how heartily it was enjoying its unexpected meal. This went on for some time; but I was called away, and was compelled to leave my hungry little friend at his dinner.—P.H.G.]

Length, $\frac{1}{65}$ inch to $\frac{1}{100}$ inch. **Habitat.** Around London, Dundee, Birmingham, Hants, Devonshire, and elsewhere (P.H.G): by no means rare.

F. GRACILIS, *Ehrenberg.*

(Pl. XIX. fig. 14.)

Furcularia gracilis . . . . . Ehrenberg, *Die Infus.* 1838, p. 421, Taf. xlviii. fig. 6.

[SP. CH. **Body** *slender, compressed, the ventral line making a prominent angle;* **front** *rounded;* **face** *oblique;* **toes** *slender, straight, acute.*

This well-marked little species is of slender **form**, as its name imports, nearly equal-sided, somewhat compressed, occasionally gibbous at the hind-back, the outline of the belly concave, with a salient angle about two-thirds from the head, whence it abruptly recedes to the short conical foot. The front is rather small, rounded; the face obliquely prone, ample, clothed throughout with cilia. The joints of the **foot** are not readily separable; the toes, furcate, slender, acute rods, almost straight, are about one-fourth as long as the body, and are usually carried parallel. The **eye** is small, but conspicuous, of a vivid crimson, situate as usual in the middle of the very front, at the anterior extremity of the brain. A little wart-like projection is seen on the occiput, which is probably an **antenna**. The **mastax** is long and pear-shaped, containing a strongly forcipate incus, of which the fulcrum is evanescent, with a pair of long incurved mallei. The *rami* seem to reach over in a long descending pair of points, probably accessory to, but distinct from, the glassy *rami* themselves. The latter are frequently protruded from the oblique face, to bite the flocculent matter, adhering to the moss, and to seize atoms with a short snapping action.

I obtained this species in some abundance, near London, in my early researches, among the stems and bracts of a submerged moss. Since that time, it has occurred in widely separated localities, never with any notable variation. Its manners are active, writhing nimbly along with the toes stretched out behind, but now and then, for an instant, widely expanded.—P.H.G.]

Length, $\frac{1}{200}$ inch to $\frac{1}{175}$ inch. **Habitat.** Pools, wide-spread; London; Stapleton Park, Yorkshire; Woolston; Caversham; Cheltenham; Dundee; Oban (P.H.G.).

F. CÆCA, *Gosse.*

(Pl. XX. fig. 4.)

Furcularia cæca . . . . . Gosse, *Ann. Nat. Hist.* vol. viii. 1851.

[SP. CH. **Body** *cylindrical, the ventral line straight;* **front** *round;* **head** *separated by a strong constriction;* **eye** *wanting or invisible;* **toes** *slender, slightly recurved, obtuse.*

This species is much like the preceding: yet it seems sufficiently distinct. The figure is truly cylindrical, with a hemispherical head, and a short conical foot, each divided-off by a strong fold. Both the folds are bounded body-wards by a distinct thickened ring, the anterior by far the stronger; there is a third fainter transverse fold just behind the mastax. The **face** is prone; but its plane is curved, not flat as in *gracilis*. The great obtuse cone which forms the **foot** has but two separable joints, of which the hinder is notched behind, and carries two furcate slender rod-shaped toes, one-third the length of the body, very slightly recurved at the tips, which are rounded. This last character, which may seem unimportant, is, I think, constant.

The whole visible head, in vertical aspect a perfect hemisphere, appears clothed with short cilia, which extend also over the prone face, as far as the great constriction. No **eye** was discernible. The toes are commonly held in mutual contact, the tips often slightly crossed.

The manners were much like those of the other smaller *Furculariæ*; it both crawled and swam, but not swiftly. It was found in July 1850, in the sediment of a phial which had been dipped five days before, from Oldham's Pond, Leamington. A few weeks afterward, I met with another in the same phial, which well sustained my judgment of the distinctness of the species; while it gave me a few additional details. It had an occipital **brain**, but again no trace of eye. The alimentary canal has a pair of minute **gastric glands**; it was traced clearly to the cloaca, which appeared on the dorsal surface of the foot as a minute notch. The œsophagus, a long slender and somewhat sinuous duct, leads from the *back* of the mastax to the stomach. These two examples have furnished all the information that I possess of it.[1]—P.H.G.]

Length of body, $\frac{1}{176}$ inch; of toes, $\frac{1}{580}$ inch; total, extended, $\frac{1}{135}$ inch. **Habitat.** Leamington (P.H.G.); Sandhurst (?) (Dr. Collins).

F. GIBBA, *Ehrenberg.*

(Pl. XIX. fig. 13.)

Furcularia gibba . . . . . Ehrenberg, *Die Infus.* 1838, p. 420, Taf. xlviii. fig. 3.

[SP. CH. **Body** *oblong, slightly compressed, convex on the back, flat on the belly; the gibbosity of the back abruptly falling off steep to the foot;* **toes** *furcate, style-shaped, straight acute, nearly half the body-length.*

For more than thirty years I had assumed that this species was well known to me; when at length I discovered that what I had supposed *F. gibba* was really a loricate form, with a cleft dorsum, presently to be introduced under the name of *Diaschiza semiaperta*. Lately, however, I have met with an animal precisely agreeing with Ehrenberg's description and figure. Yet I judge it highly probable that other observers have, like myself, confounded the common *Diaschiza* with the rare *Furcularia*.

As I have seen but a single example of the real *Simon Pure*, I can add nothing to the published descriptions, except what may be gathered from the figure.—P.H.G.]

F. ENSIFERA, *Gosse*. sp. nov.

(Pl. XX. fig. 3.)

[SP. CH. **Body** *gibbous;* **toes** *simple, blade-shaped, wider vertically than laterally;* **foot-joints** *wanting;* **eye** *wanting.*

I first observed this rather attractive species in July 1885, in water taken from one of my window jars, where aquatic mosses had been growing for several months. The

[1] Except that Dr. Collins, in his Note-book kindly communicated to me, has pencil sketches of what he supposes to be this species, taken at Sandhurst, Berks. Its form, however, is much more gibbous behind than that of mine.

mosses originally came from one of the Scottish lochs, and the ancestors of these Rotifera may have been then introduced. But I constantly rinse out my live-boxes, after an examination, in one or other of my reservoirs; and as I have received samples of water, animals and plants, from many kind friends in various parts, it is impossible to trace the original habitat of any species which either of them may now contain.

In form the present species much resembles *cæca* or *gracilis*; it is, however, larger than either, nearly, if not quite, equalling *forficula* in dimensions. The gibbosity of the back, its abrupt descent to the cloaca, and the peculiar mode of carrying the toes behind, more easily seen than described, are all characteristically Furcularian.

A remarkable peculiarity, that strikes the eye at the first glance in the vertical aspect, is that the **toes** seem to be articulated direct to the trunk, without the intervention of the usual foot-joints. This is not an accidental malformation, but is evidently proper to the species, all the specimens being alike. The toes, too, are wide apart at their bases, the interval being sometimes straight, sometimes running up into an angle (fig. 3). They are in general carried nearly parallel; but they are often stretched so wide apart as to be horizontal, or, on the other hand, crossed. I could detect no eye, nor any brain, nor even turbidity, though I sought diligently. All the examples were brilliantly transparent, but most were tinged with a very delicate shade of canary-yellow, the stomach and intestine usually gorged with food of a warmer hue. The front and face are of a pale orange-tint.

The manners of this species are exactly those of its fellows. In the live-box half-a-dozen congregated under a single leaf of the moss, neglecting other leaves, though there were plenty more, apparently as eligible; and there they kept restlessly moving to and fro, twining and twisting on themselves, *suo more*, beneath the translucent green leaf. The freedom and facility with which they turn round within their own length and breadth is remarkable. It is effected with marvellous rapidity, and with no change of place, but only of *position*. You are looking with a high power at the head or mastax—a twinkle, a dimness—and in an instant you see the toes in the very spot! The creature has turned itself quite round, and is off on its steps.—P.H.G.]

Length, $\frac{1}{160}$ inch; of which the toes make about one-fourth. **Habitat.** The leaves of aquatic moss in a tank (P.H.G.).

F. MARINA, *Dujardin*.

(Pl. XIX. fig. 15.)

Furcularia marina . . . Dujardin, *Hist. Nat. Zooph.* 1841, p. 649, pl. 22, fig. 4.

[SP. CH. **Body** *long, cylindrical;* **toes** *blade-shaped, simple, decurved, pointed, minute;* **eye** *wanting. Marine.*

The great length and uniform thickness of this species, truncate at each end, obliquely in front, transversely behind, distinguish it readily from its fellows. There is a lobulate, pointed glandular **brain** in the occipital region, on which no eye-speck can be detected by either transmitted or reflected light. Behind this are some minute, seemingly isolated bodies, which may be connected with the branchial system. The points of the jaws are frequently pushed out from the oblique front to a considerable distance (fig. 15*a*), and retracted rapidly and repeatedly, with a snapping action. A minute protrusile **antenna** (?), ciliated at the tip, is seen behind the buccal funnel (fig. 15*a*).

It was in August 1854 that I became acquainted with this interesting species, already made known by M. Dujardin in 1841. I had been keeping a small marine aquarium ever since February; but during a two months' absence from home in the summer, most of the creatures had died, and were decomposed on my return. The water, however, remained fairly pure; and I therefore merely removed a good deal of the decayed matter from the bottom, and restocked it, mainly with *Actiniæ*. On the sides of the tank, and in the sea-water, I found this pretty *Furcularia* by thousands, associated with

a species of *Euplotes*, and a few of a *Colurus*. I have since found it repeatedly in sea-water from the Tay Estuary. It is active and sprightly in its manners, browsing among the floccose; frequently elongating and contracting its body, and occasionally swimming in the open water.—P.H.G.]

Length, $\frac{1}{220}$ to $\frac{1}{175}$ inch. **Habitat.** A marine aquarium; tide-pools in the Firth of Tay (P.H.G.).

F. Boltoni, *Gosse*, sp. nov.

(Pl. XX. fig. 2.)

[SP. CH. **Front** *rondo-truncate;* **body** *fusiform;* **foot-joints** *small;* **toes** *conical, about half as long as the foot;* **eye** *small. Lacustrine.*

This species I at first supposed to be Ehrenberg's *F. Reinhardti*, which has not yet occurred to British research; but, on mature consideration, there seem important differences, which warrant my raising this to specific rank. *Reinhardti* is stated to be $\frac{1}{120}$ inch in length, which is not so large as *F. forficula* and *F. gibba*; whereas this is $\frac{1}{62}$ inch in length, and so is a very giant among *Furculariæ*. Then the foot in *Reinhardti* is half the length of the body: in *Boltoni* about one-fourth; the toes in the former are minute, one-fifth to one-sixth the length of the foot: in the latter rather long and slender, full half the length of the whole foot and toes. Ehrenberg speaks of "the great eye" as an attractive feature in his species; but in this, the eye is, as usual, minute and inconspicuous. Lastly, his species is marine, living parasitically on the branching stems of the well-known polype, *Laomedia geniculata*; whereas mine occurred in a pool in the heart of England. Thus I venture to pronounce it new; and honour it with the name of that energetic microscopist, Mr. Thomas Bolton, who sent it to me. It has evidently very close relation with *F. Reinhardti*, as is shown by the general form, and especially the spindle-shaped trunk, and abruptly tapered foot. It is a true *Furcularia*, as to its **trophi**, of which I had a very favourable observation; the *mallei* being slight and feeble, while the *incus* is strongly developed with wide, glassy, arched *rami*, produced into long decurved points.

The **front**, in life, is probably conical, as usual; but in the condition in which alone I have seen the species, the cone was so low that its outline was nearly straight, with a minute but clear red **eye-speck** occupying the very centre of its edge. The mastax is of the usual large dimensions, followed by a slender œsophagus, an ample **stomach** with small oval **glands**, a separate intestine full of dark granulate food, an **ovary** with a great opaque maturing egg, and what I took for a **contractile vesicle.** The trunk is thickest at the lumbar region, and that whether viewed laterally or dorsally. Thence it diminishes rapidly to a width less than that of the head, and carries a **foot** of three joints, of which the first is contained within the trunk-walls, and the others are very small and slender, followed by a pair of furcate toes, which are of a long conical shape, acute, and nearly as long as the three foot-joints together. The whole foot is sometimes thrown up towards the belly.

I first became cognizant of this species in October 1885, a specimen having occurred in sediment collected from a ditch in Sutton Park (a locality most prolific in rotiferous and other microscopic life) by Mr. Bolton and sent to me. The animal was dead, but recently; so that the form was little altered, and the organs were all *in situ*, and readily identified. I subsequently found a second rather smaller example in the same tube of water, also dead; which afforded me the advantage, always to be prized, of an additional study. A sight of the living animal is still a desideratum.—P.H.G.]

Length, $\frac{1}{62}$ inch to $\frac{1}{80}$ inch. **Habitat.** A ditch near Birmingham (T.B.).

F. MICROPUS, *Gosse*, sp. nov.

(Pl. XIX. fig. 12.)

[SP. CH. **Foot** *inconspicuous;* **toes** *minute, conical. No* **eye** *visible.*

This small species, known only by a single example, is much like *F. forficula* in form, but the toes are very small in proportion, being cones whose length little exceeds the breadth of their base. The animal is clear and colourless; very soft and flexible; constantly contracting and lengthening. The anterior parts are somewhat thick, gradually attenuating to the foot, where the width, both transverse and vertical, is less than half that of the head. An occasional glimpse of the side (fig. 12*a*) showed that the **face** was truncate, and obliquely prone; whereas the front viewed dorsally was obtusely conical in outline. But the extreme changeability of form, especially in the fore parts, and the flexibility, were notable. No **brain** could be defined, nor any trace of an eye. Though, according to Ehrenberg's arrangement, this should be a *Pleurotrocha*, if the eye is really wanting, yet the whole habit and form of this creature showed its affinities to be with *Furcularia*. I found the specimen described in water sent me by Mr. Bolton in December 1884, obtained from a boggy ditch in Sutton Park.—P.H.G.]

Length, $\frac{1}{250}$ inch. **Habitat.** A ditch near Birmingham (P.H.G.).

F. LONGISETA, *Ehrenberg.*

(Pl. XVIII. fig. 16.)

Notommata longiseta . . . Ehrenberg, *Die Infus.* 1838, p. 432, Taf. liii. fig. 2.

[SP. CH. **Body** *cylindric, round at each end;* **foot** *thick, one-jointed;* **toes** *twice as long as the body, unequal.*

The cylindric **body** is slightly arched, but retains an uniform thickness. The whole rounded front is ciliate, with a semi-prone face. The **toes**, jointed on a thick cylindric foot, seem made of spun glass, thick at the base, but tapering to great tenuity, though not very acute. The right is about one-fourth longer than the left. The **mastax** and its trophi, *in situ*, closely resemble those of *Furcularia gracilis*; but I have not resolved them satisfactorily. A great **brain** carries an opaque terminal mass at its point. The front, viewed dorsally, has the outline of a low cone, with a single minute red eye at the very point; and now and then I have seen pushed out what seemed minute lateral auricles; yet with no perceptible acceleration of motion. The **contractile vesicle** is very large. There is a prominent angle on the occiput, which may indicate a protrusile **antenna**; but I have not seen it exserted.

I had this pleasing species in 1851, from a dyke near Stratford, and presently afterward from Maidenhead. Recently it has occurred in water from Snaresbrook sent me by Mr. H. Davis, and from Woolston, by Miss Davies. It swims slowly, often turning to one side; occasionally throwing apart the long toes, and springing when alarmed, so as to fling the body more than its own length in an uncertain direction, *the sound* made by the toes striking the glass on such occasions *being distinctly audible.*—P.H.G.]

Length, to tips of toes, $\frac{1}{76}$ to $\frac{1}{150}$ inch. **Habitat.** Pools in the southern half of England (P.H.G.).

F. ÆQUALIS, *Ehrenberg.*

(Pl. XVIII. fig. 15.)

Notommata æqualis . . . Ehrenberg, *Die Infus.* 1838, p. 432, Taf. liii. fig. 3.

[SP. CH. *Indistinguishable from the preceding, save that the* **toes** *are equal.*

Though the resemblance between these two species is very close, Ehrenberg was

certainly right in distinguishing them. Quite accidentally I have had the two in sight at once, side by side, yet without the slightest mutual recognition, and thus had facilities for comparison. *Æqualis* has the body longer and slenderer, more taper, where *longiseta* is gibbous, less divided into apparent joints by constriction, especially at the foot, besides the co-equality of the toes in this. Yet, on the other hand, the gibbosity of the former nearly disappears when extended in swimming, and then they are much alike.

I first saw this species together with *F. longiseta*, and both in some plenty, in water from Woolston, in September 1885. Though the species showed no association, their manners were exactly the same. The springs made by both and by *Scaridium*, with which they have apparent affinity, depend, doubtless, on the length and elasticity of the toes: and suggest a certain relation to the *Triarthradæ*, and even to the order SCIRTOPODA, in which, toes being wholly wanting, the same function is performed by special limbs, long, taper, and elastic.—P.H.G.]

Total length, about $\frac{1}{130}$ inch. **Habitat.** Woolston (P.H.G.).

Genus EOSPHORA, *Ehrenberg.*

[GEN. CH. **Body** *oblong;* **head** *dilated and furnished with protrusile* **auricles**; **foot** *very distinct, with telescopic joints, and furcate* **toes**; **eyes** *three, viz. one large, cervical, two minute, frontal.*

Of the four species which Ehrenberg includes under this genus I know but the one which he has not catalogued in its proper place, but which he subsequently mentioned under the head of *Diglena aurita*. His words are: "Dr. Werneck sent me a drawing of a new *Eosphora*, very like the *Diglena* of Berlin. I found, soon after, in the Berlin animal, a pale red point on the opaque sac in the neck, which makes this an *Eosphora*, if it prove to be an eye" ("Die Inf." p. 444).

Judging by this species, there is little to distinguish *Eosphora* from *Notommata* (proper), except the two minute frontal eyes;[1] and this distinction is evanescent, when we remember in how many species of *Notommata* Herr Eckstein has seen frontal pigment-specks. Yet, looking at the form of the trophi, I consider it intermediate between *Notommata* and *Diglena*.—P.H.G.]

E. AURITA, *Ehrenberg.*

(Pl. XVII. fig. 14.)

Diglena aurita . . . . *Eosphora aurita*	Ehrenberg, *Die Infus.* 1838, p. 444, Taf. lv. fig. 2.
,, ,, ...	Gosse, *Pop. Sci. Rev.* 1863, vol. ii. p. 475, pl. xx.

[SP. CH. **Body** *cylindric;* **head** *separated by a neck;* **front** *slightly convex;* **brain** *an opaque globe at the end of a long slender tube;* **trophi** *forcipate;* **foot** *slender, cylindric;* **toes** *slender, acute, furcate.*

This is an attractive species: its **form** is elegant and symmetrical, particularly when the auricles are everted above the neck; the slender foot and toes well finish the body behind; and the prevalent depletion of the viscera with bright pellucid green food, add brilliancy of colour to the clear glassy vase. To the naturalist, too, it is specially interesting. Far down in the body is a transparent ball, filled with opaque matter, whence a slender tube extends right up the very front: this tube is more or less turbid with like matter. On the ball just where it contracts to the tube is a broad and thick

[1] The frontal specks Dr. Leydig denies to be eyes, in the species *aurita*; but I have no hesitation in pronouncing them to be strictly analogous with what we call eyes throughout the class.

lens of crimson pigment, and at the frontal end of the tube, one on each side of it, are two small crimson globules.[1] All three are beautifully rich and distinct, even by transmitted light. It is indubitably Werneck's *Eosphora aurita*. The **jaws** are quite of the *Diglena* type, but the mallei are stouter, as in *Notommata*: the points are often protruded. A curious feature is that the capacious stomach juts up in two long horns, as high as the top of the mastax, distinct from the **gastric glands**. An **ovary** and a **contractile bladder**, both ample, help to fill the cavity; and the body terminates dorsally in a broad triangular tail, which projects far above the foot, with the cloaca between. On the occipital edge is a minute **antennal tube** and a bristled wart on each side of it. This triple arrangement is peculiar. The manners are usually sluggish.[2]—P.H.G.]

Length, $\frac{1}{125}$ to $\frac{1}{100}$ inch. **Habitat.** Greenwich Park; Hampstead Heath; Birmingham: pools; not rare (P.H.G.).

Genus DIGLENA, *Ehrenberg*.

[GEN. CH. **Body** *sub-cylindric, but very versatile in outline, often swelling behind and tapering to the head;* **eyes** *two, minute, situated near the edge of the front;* **foot** *furcate;* **trophi** *forcipate, generally very protrusile.*

This genus, while Notommatoid in form, has a certain aspect of vigour and intensity of function peculiar to it. Though one or two assigned species are massive, the majority are slender, lithe and energetic; the taper and elongate anterior parts habitually thrown above the general line of progression, in the manner of some lepidopterous and dipterous larvæ, as if eagerly exploring. The form of the trophi, though on the Notommatous pattern, is very predaceous; and the sharp, formidably-armed *rami* of the *incus* can be, and frequently are, thrust far beyond the limits of the head, and forcibly snapped. The front, in most of the species, is furnished with a hooked proboscis. The furcate toes are, in general, long and sharp, sometimes sickle-shaped.

Of the eight species included in the genus by Prof. Ehrenberg, *lacustris*, *conura*, and *capitata* have not been recognised in Britain; *aurita* is an *Eosphora*, and has been just described. To the remaining four, seven species are now added.—P.H.G.]

D. GRANDIS, *Ehrenberg*.

(Pl. XIX. fig. 6.)

[SP. CH. **Body** *massive, sub-cylindric;* **head** *rounded, with a frontal proboscis;* **face** *nearly prone; a tuberculiform tail;* **foot** *large, bulbous;* **toes** *straight, parallel-edged, abruptly pointed.*

Of this imposing species my knowledge for many years was limited to a specimen which I found in September 1851, already dead, in a dyke at Maidenhead. The **trophi** were beautifully distinct. Their structure was nearly the same as in *D. forcipata*, but the bristle-like teeth that line each side of the incus were much more conspicuous, and apparently larger; arranged in double rows. In August 1885, examining an aquatic moss growing in a glass reservoir in my study, I found, first one, and then another, of the same species, alive and active. The agreement in detail with my dead original was exact. Two very minute **eyes**, nearly close together, are at the front, whence projects a small hooked **proboscis**; and below this the ciliate **face** is very prone. The

[1] Eckstein says that these are connected with the great cervical eye by nerve-threads.

[2] Eyferth (*On the Lowest Forms of Life*, 1878) says that *Triophthalmus* of Ehrenberg is but the young condition of *Eosphora*; and that, even in the egg, are seen two dark specks, near the eye, which subsequently disappear. But Eckstein (*Sieb. u. Köll.* 1883) holds this conclusion doubtful, till the entire development from the egg has been watched. He confronts the points of consimilarity with those of dissimilarity in two instructive tables.

PLATE XVI.

1.	Copeus labiatus	dorsal view	G
1*a*.	,, ,,	edges of lip	G
2.	Copeus spicatus	dorsal view	G
2*a*, 2*b*.	,, ,,	side views of head	G
3.	Copeus Cerberus	dorsal view	G
3*a*.	,, ,,	side view	G
4.	Copeus pachyurus	dorsal view	G
4*a*.	,, ,,	transverse section	G
4*b*.	,, ,,	head, showing buccal orifice	G
5.	Copeus caudatus	dorsal view	G
5*a*.	,, ,,	side view	G
5*b*.	,, ,,	mastax and trophi	G
5*c*.	,, ,,	occipital antenna	G
5*d*.	,, ,,	hind dorsal tentacle	G
6.	Notommata collaris (?)	dorsal view	H
6*a*.	,, ,,	side view	H

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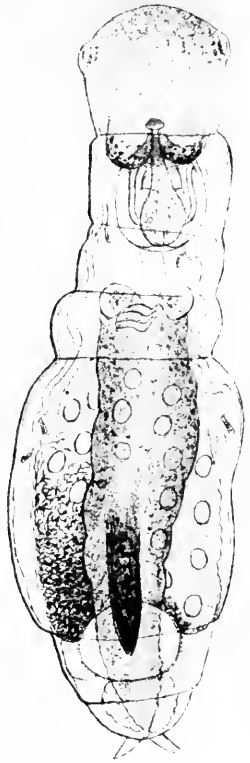

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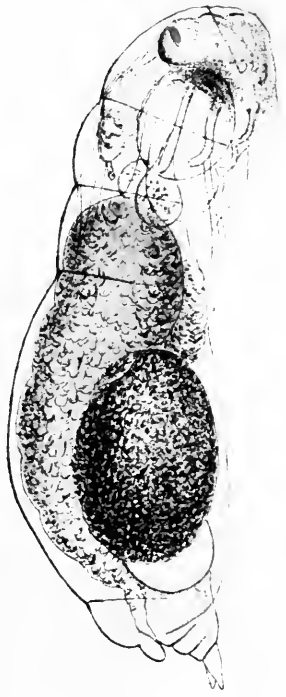

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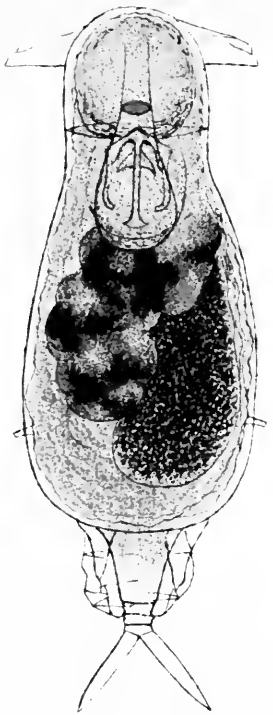

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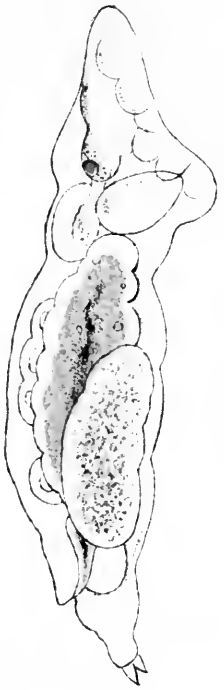

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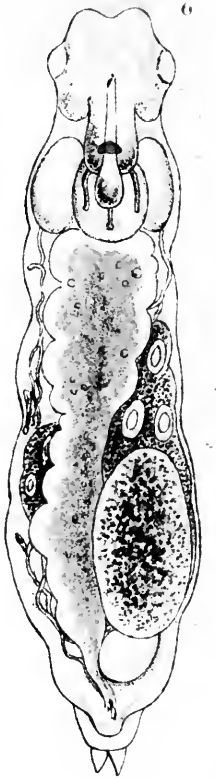

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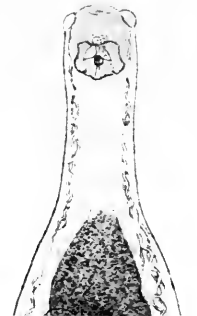

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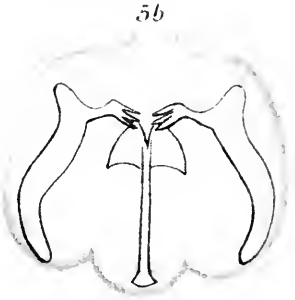


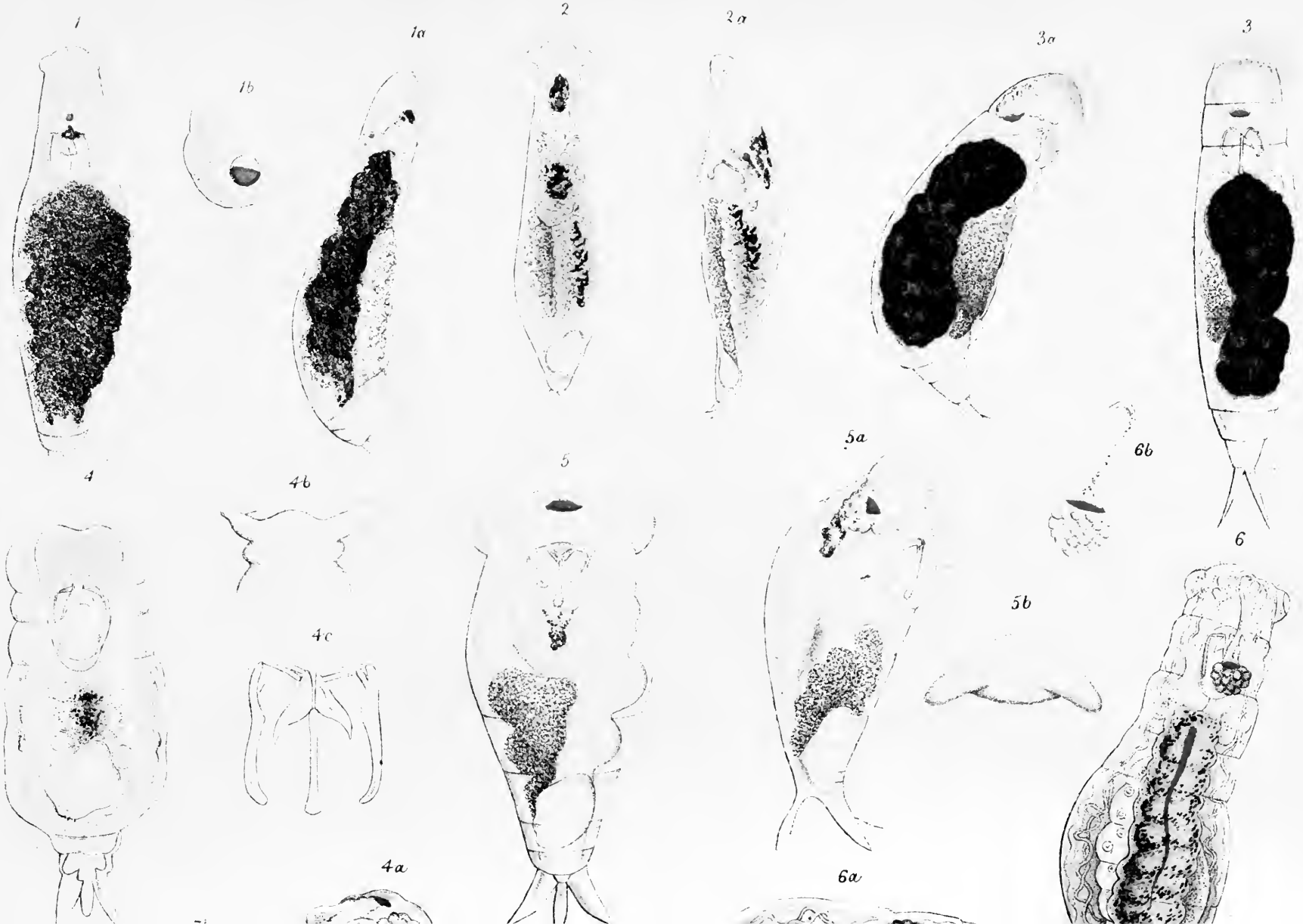
5d

COPEUS; NOTOMMATA.

1 C. LABIATUS. 2 C. CILIATUS. 3 C. CLAUSUS. 4 C. PACHYURUS
5 C. AUDAX. 6 N. COELLAPIS

PLATE XVII.

1. Notommata brachyota	dorsal view	G
1*a*. „ „	side view	G
1*b*. „ „	end of brain, with eye; side view	G
2. Notommata saccigera	dorsal view	G
2*a*. „ „	side view	G
3. Notommata ansata	dorsal view	G
3*a*. „ „	side view	G
4. Notommata tripus	dorsal view	G
4*a*. „ „	side view (smaller scale)	G
4*b*. „ „	head, showing auricles	G
4*c*. „ „	trophi	G
5. Notommata pilarius	dorsal view	G
5*a*. „ „	side view	G
5*b*. „ „	transverse section	G
6. Notommata aurita	dorsal view	G
6*a*. „ „	side view	G
6*b*. „ „	central lobe of brain, with eye	G
7. Notommata cyrtopus	dorsal view	G
7*a*. „ „	side view	G
7*b*. „ „	trophi	G
8. Notommata tuba	dorsal view	G
9. Notommata lacinulata	dorsal view	G
9*a*. „ „	side view	G
9*b*. „ „	trophi, ventral view	G
9*c*. „ „	trophi, side view	G
10. Eosphora aurita	dorsal view	G
10*a*. „ „	side view	G
11. Taphrocampa Saundersiæ	dorsal view	G
11*a*. „ „	side view	G
11*b*. „ „	transverse section	G
12. Taphrocampa annulosa	dorsal view	G
12*a*. „ „	side view	G
12*b*. „ „	transverse section	G
12*c*. „ „	trophi, side view	G
12*d*. „ „	trophi, ventral view	G
12*e*. „ „	tail (var.)	G
13. Albertia intrusor	ventral view	G
13*a*. „ „	side view	G
13*b*. „ „	trophi, ventral view	G
14. Albertia naiadis	side view (after Mr. E. C. Bousfield)	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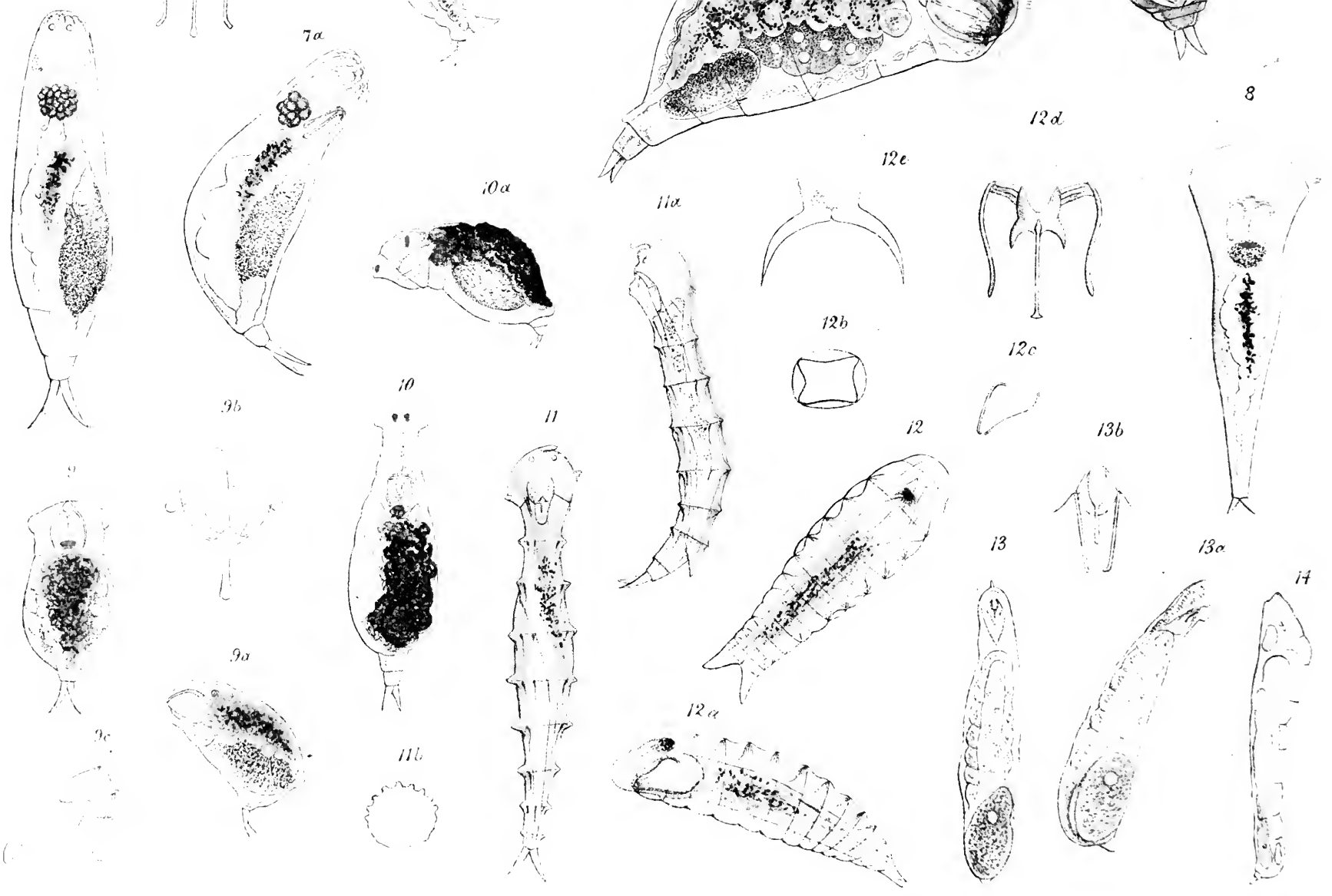
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9c
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PLATE XVIII.

1.	Notommata forcipata	dorsal view. G
1*a*.	„ „	side view G
1*b*.	„ „	toes G
2.	Notommata naias	ventral view G
2*a*.	„ „	head; dorsal view G
2*b*.	„ „	mastax and trophi G
3.	Pleurotrocha constricta	dorsal view. G
3*a*.	„ „	side view G
3*b*.	„ „	head; ventral view G
3*c*.	„ „	foot and toes G
4.	Pleurotrocha leptura	dorsal view. G
4*a*.	„ „	side view G
5.	Pleurotrocha gibba	dorsal view. G
5*a*.	„ „	side view G
6.	Proales decipiens	dorsal view. G
6*a*.	„ „	side view G
7.	Proales sordida	dorsal view. G
7*a*, 7*b*.	„ „	side views G
7*c*.	„ „	trophi. G
8.	Proales gibba	side view G
9.	Proales petromyzon	ventral view G
9*a*.	„ „	side view; extended G
9*b*.	„ „	side view; contracted G
9*c*.	„ „	head, side view; enlarged G
9*d*.	„ „	eye G
10.	Proales tigridia	dorsal view. G
10*a*.	„ „	side view G
11.	Proales parasita	side view G
11*a*.	„ „	mastax and trophi G
12.	Distemma labiatum	dorsal view. G
12*a*.	„ „	side view G
13.	Distemma Collinsii	side view G
14.	Triophthalmus dorsualis (?)	dorsal view. G
14*a*.	„ „	side view G
15.	Furcularia æqualis	dorsal view. G
15*a*.	„ „	side view G
16.	Furcularia longiseta	dorsal view. G
16*a*.	„ „	side view G
17.	Proales felis	dorsal view. G
17*a*.	„ „	side view G
17*b*.	„ „	trophi. G


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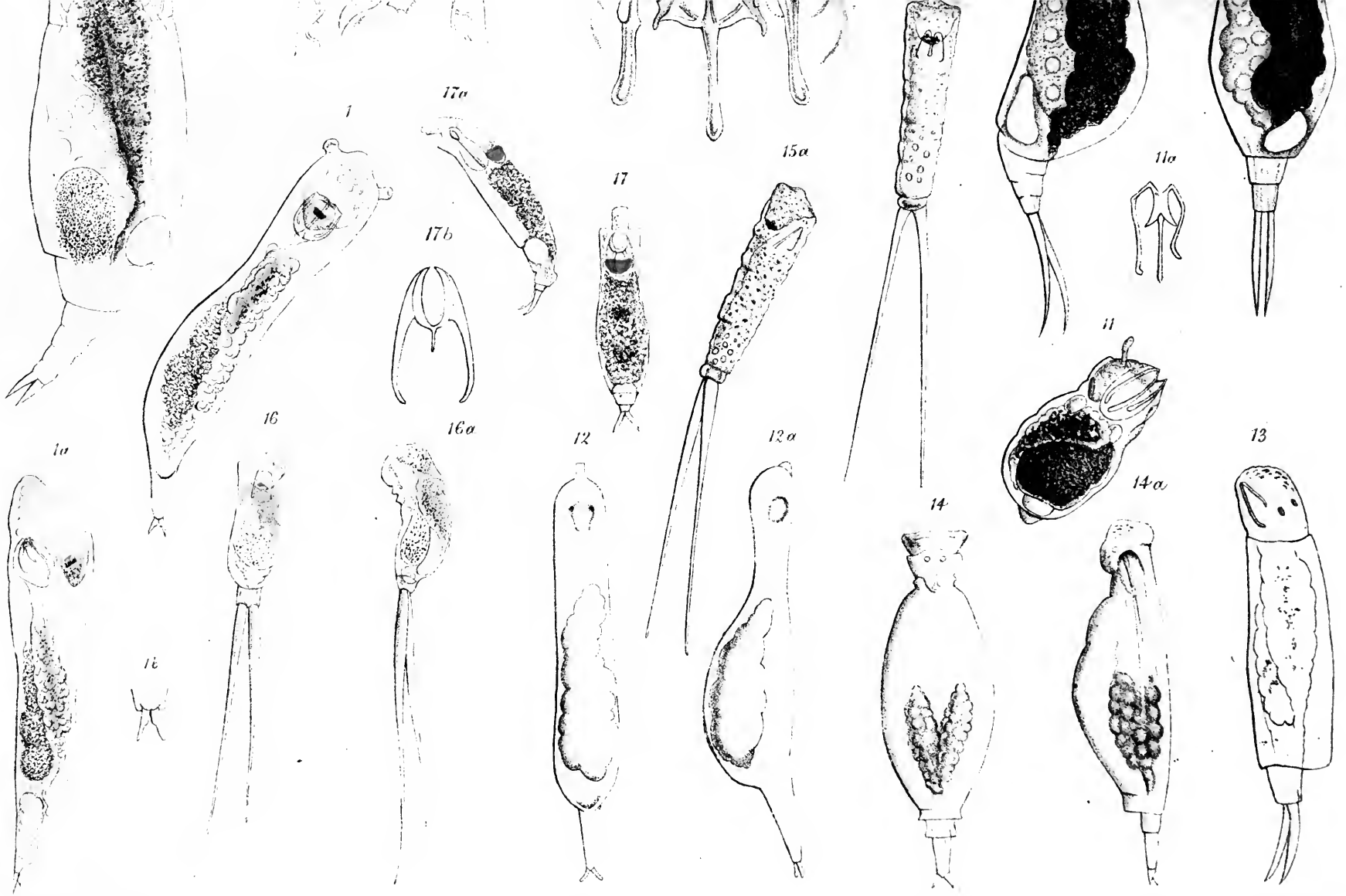
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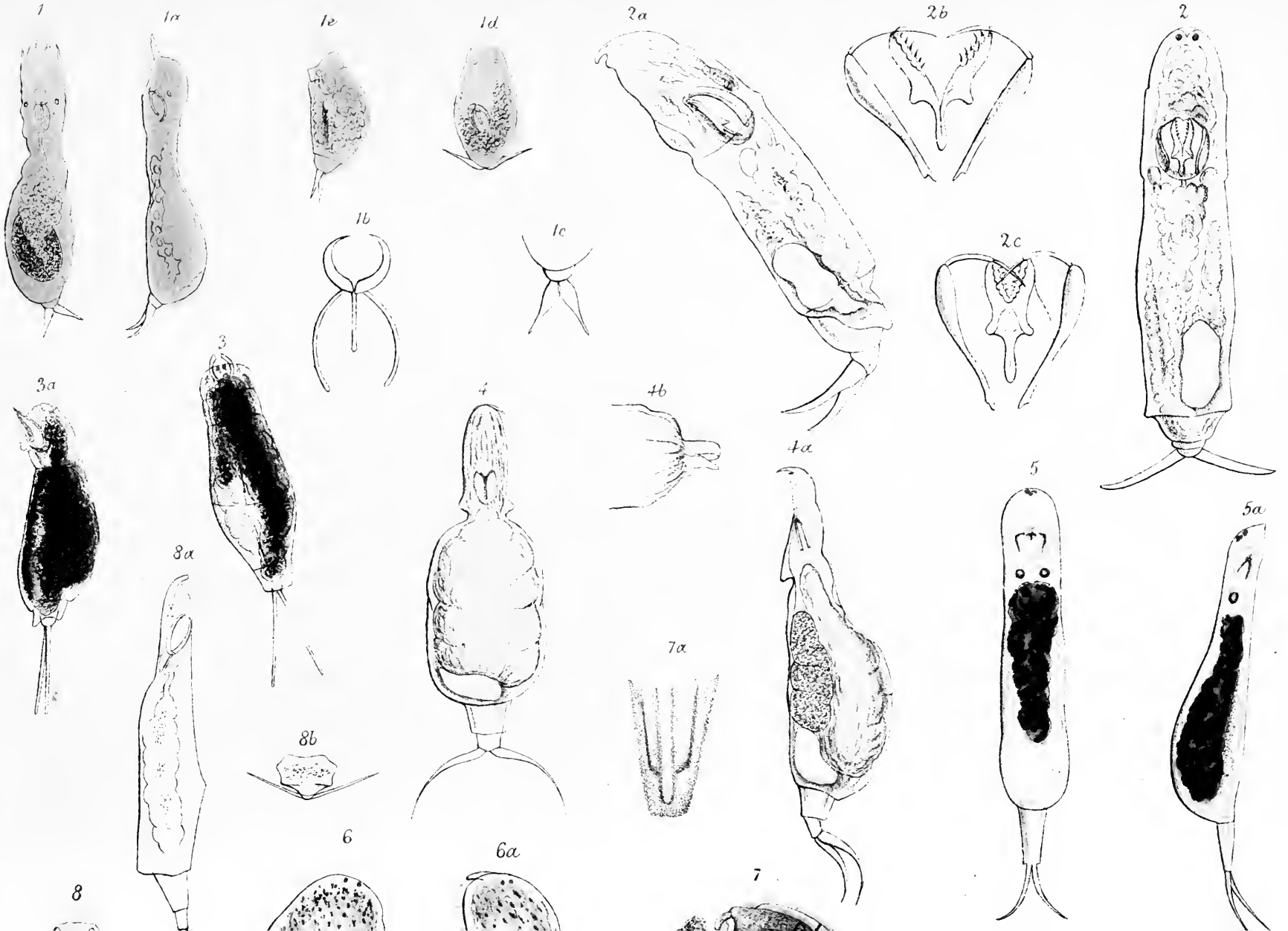
PLATE XIX.

1.	Distemma raptor	dorsal view G
1*a*.	„ „	side view G
1*b*.	„ „	trophi G
1*c*.	„ „	foot and toes G
1*d*.	„ „	contracted; dorsal view G
1*e*.	„ „	„ side view G
2.	Diglena forcipata	dorsal view G
2*a*.	„ „	side view G
2*b*.	„ „	trophi, expanded G
2*c*.	„ „	trophi, shut G
3.	Diglena biraphis	dorsal view G
3*a*.	„ „	side view G
4.	Diglena circinator	dorsal view G
4*a*.	„ „	side view G
4*b*.	„ „	fore parts, in contraction G
5.	Diglena clastopis	dorsal view G
5*a*.	„ „	side view G
6.	Diglena grandis	dorsal view G
6*a*.	„ „	side view G
7.	Diglena gibber	side view G
8.	Diglena caudata	dorsal view G
9.	Diglena giraffa	side view G
9*a*.	„ „	head, dorsal view G
10.	Diglena catellina	dorsal view G
10*a*.	„ „	side view G
11.	Diglena permollis	dorsal view G
12.	Furcularia micropus	dorsal view G
12*a*.	„ „	side view G
13.	Furcularia gibba	side view G
13*a*.	„ „	mastax and trophi, obliquely ventral view G
13*b*.	„ „	trophi, expanded G
13*c*.	„ „	trophi, shut G
14.	Furcularia gracilis	dorsal view G
14*a*.	„ „	side view G
15.	Furcularia marina	side view G
15*a*.	„ „	protruded trophi, and antenna G
15*b*.	„ „	trophi G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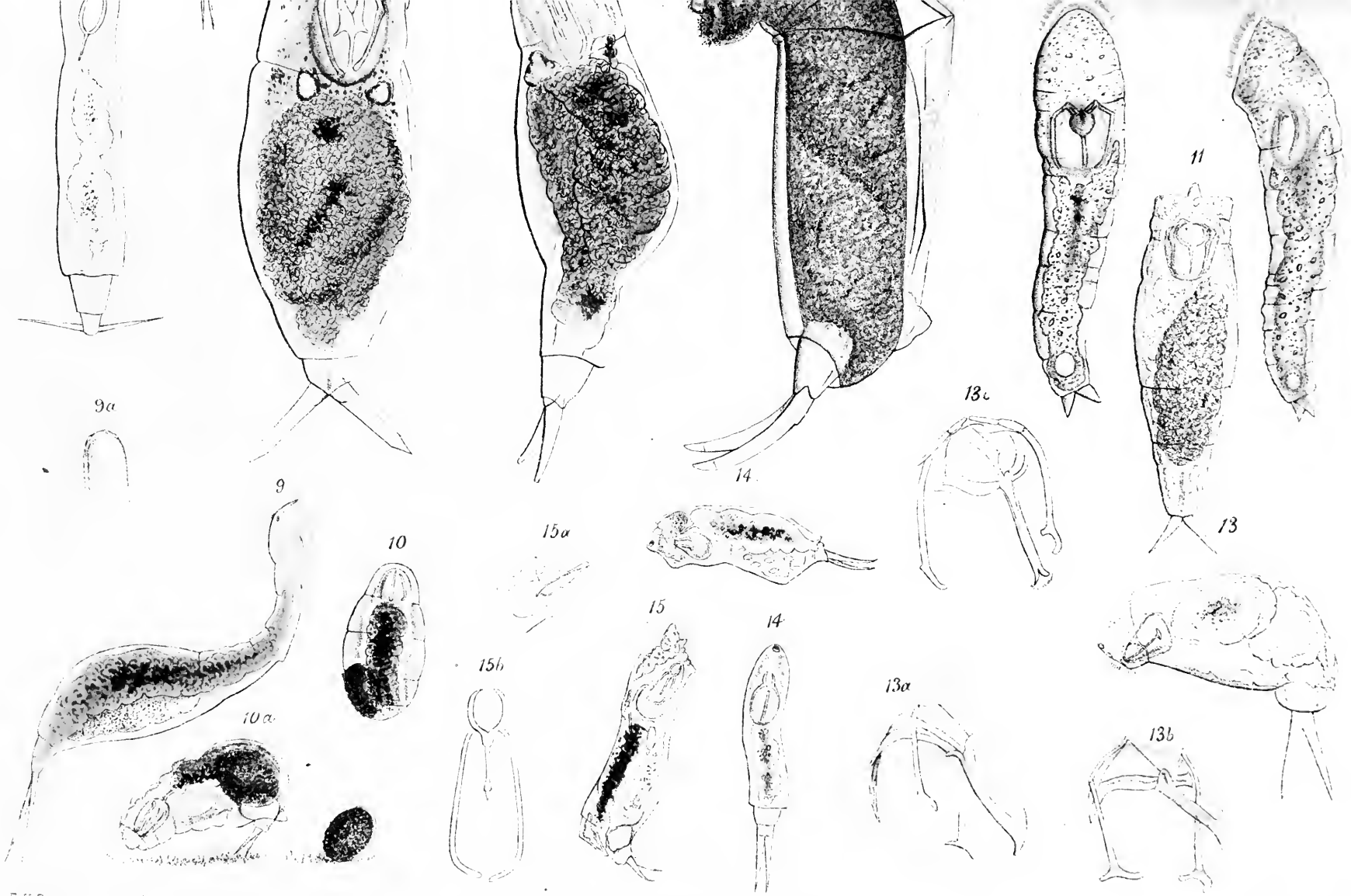

DISTEMMA, DIGLENA, FURCULARIA.

1. DIG. RAPTOR. 2. DIG. FORCIPATA. 3. DIG. BIRAPHIS. 4. DIG. CIRCINATOR. 5. DIG. CLASTOPIS. 6. DIG. GRANDIS. 7. DIG. GIBBER. 8. DIG. CAUDATA. 9. DIG. GIRAFFA. 10. DIG. CATELLINA. 11. DIG. PERMOLLIS. 12. F. MICROPUS. 13. F. GIBBA. 14. F. GRACILIS. 15. F. MARINA.

PLATE XX.

1.	Furcularia forficula	dorsal view . . . . . G
1*a*.	„ „	side view . . . . . G
1*b*.	„ „	toe . . . . . G
2.	Furcularia Boltoni	dorsal view . . . . . G
2*a*.	„ „	side view . . . . . G
3.	Furcularia ensifera	dorsal view . . . . . G
3*a*.	„ „	side view . . . . . G
4.	Furcularia cæca	dorsal view . . . . . G
4*a*.	„ „	side view . . . . . G
5.	Mastigocerca bicornis	dorsal view . . . . . G
5*a*.	„ „	side view . . . . . G
5*b*.	„ „	muscles . . . . . G
6.	Mastigocerca stylata	side view . . . . . G
6*a*.	„ „	mastax and trophi . . . . . G
6*b*.	„ „	muscles . . . . . G
7.	Mastigocerca carinata	side view . . . . . G
7*a*.	„ „	insertion of toe . . . . . G
8.	Mastigocerca elongata	side view . . . . . G
9.	Mastigocerca rattus	dorsal view . . . . . G
9*a*.	„ „	side view . . . . . G
10.	Mastigocerca lophoessa	side view . . . . . G
10*a*.	„ „	empty lorica . . . . . G
11.	Mastigocerca scipio	side view . . . . . G
12.	Mastigocerca macera	side view; dead . . . . . G
13.	Rattulus tigris	side view . . . . . G
13*a*.	„ „	mastax and trophi . . . . . G
13*b*, 13*c*.	„	foot and toes . . . . . G
14.	Rattulus cimolius	dorsal view . . . . . G
14*a*.	„ „	side view . . . . . G
14*b*, 14*c*.	„	mastax and trophi . . . . . G
15.	Rattulus sejunctipes	dorsal view . . . . . G
15*a*.	„ „	side view . . . . . G
16.	Rattulus calyptus	side view . . . . . G
17.	Rattulus helminthoides	obliquely ventral view . . . . . G
17*a*.	„ „	side view . . . . . G
18, 18*a*.	Cœlopus porcellus	side views . . . . . G
18*b*.	„ „	front of lorica . . . . . G
18*c*.	„ „	transverse muscles; and toes, apart . . G
18*d*.	„ „	toes, one within the other . . . . G
19.	Cœlopus tenuior	dorsal view . . . . . G
19*a*.	„ „	side view . . . . . G
20.	Cœlopus minutus	dorsal view . . . . . G
20*a*.	„ „	side view . . . . . G
21.	Cœlopus brachyurus	side view . . . . . G
22.	Cœlopus cavia	side view . . . . . G


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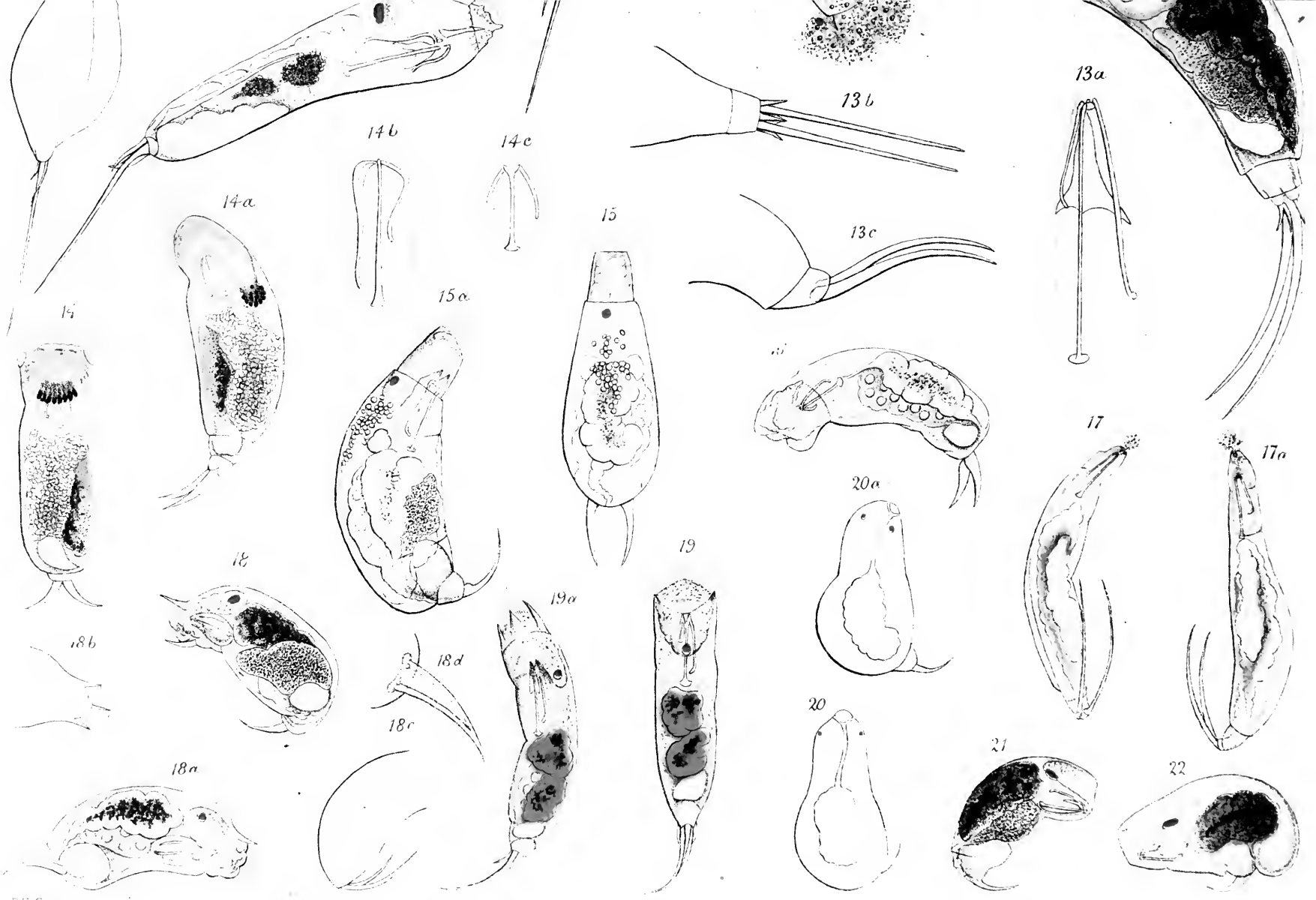


P.H. Gosse, ad vivum.

Hanhart imp.

PYECYLARIA, MASTIGOCERCA, RATTULUS, TELOPUS.

EXPLANATION OF THE PLATE. FIG. 1 MONOCERCA LATA. 2 M. BICORNIS. 3 M. STYLATA. 4 M. CARINATA. 5 M. LONGATA. 6 M. RATTUS. 7 M. COPROESSA. 8 M. SCIPIO. 9 M. MACERA. 10 R. TIGRIS. 11 R. LIMOLUS. 12 R. SPJUNCTIPES. 13 R. CALYPTUS. 14 R. HELMINTHOIDES.

brain has a turbid yellowish appearance, at times clearly defined. The **alimentary canal** is very large, darkly granulate, composed of many sacs; and a slender rectum clearly opens into a cloaca below the tubercular tail. Convoluted **lateral canals** run down each side; but no contractile vesicle could be discerned.

The manners are sluggish; it twists and wriggles much, with little change of place. It is a fine large species, not devoid of elegance when extended; but it often contracts into very uncouth shapes.—P.H.G.]

Length, $\frac{1}{35}$ inch. **Habitat.** Maidenhead; an aquarium at Torquay (P.H.G.): rare.

D. GIBBER, *Gosse*, sp. nov.

(Pl. XIX. fig. 7.)

[SP. CH. **Body** *encased in a transparent leathery sheath, hunch-backed;* **face** *prone; frontal* **proboscis** *small;* **toes** *long, decurved.*

In sediment from one of my window-reservoirs, I found this large *Diglena*. About the size of *D. grandis*, it much resembles that fine species in general appearance. Its **form** is that of a cylinder, flattened along the belly; the entire soft parts are encased in what we might call a *lorica*, only that it is manifestly flexible: a difference, perhaps, merely in degree. This sheath, of a glassy transparency, is almost unchangeable in shape; yet it has marked creases here and there, which are permanent, serving for needful flexibility. At what might be called the shoulders, it rises to a conspicuous conical hump, diminishing thence by a gradual slope to the hinder parts. The internal organs do not rise above the cylindrical body-wall, leaving thus an ample cavity within the sheath all down the back; quite empty, save that a very delicate conglobate gland, attached by a thread to the hinder extremity, works up and down within it, by the contractions and contortions of the animal. What seemed the trochal front was, through the inclination of the head, nearly on the level of, and continuous with, the ventral surface, and was covered with vibratile cilia. Behind, the body-sheath is cut off obliquely, with a well-marked edge, for the emission of a stout **foot**, which carries two long curved blade-like toes, often thrown widely apart. On each toe, at about one-fourth of its length, there is an abrupt decrease of diameter on its superior edge, with the appearance of a joint; and a delicate line crosses each near its point.

This individual appears to have been subjected to the remarkable accident of the protrusion of the entire mastax, with all its accessories, from the frontal face, so that it was totally unable to retract it. Whether this was the result of over-eagerness in feeding, producing unguarded muscular exertion, or of violence from some of its predatory foes, I cannot guess. I could discern no mark of any pinch on the body. But there was a great extruded mass of flesh, amorphous and motionless, yet bearing a manifest resemblance in outline to a mastax: while in an occasional glance that I could get at its front, I saw what looked exceedingly like a long incus and a hooked malleus on each side, though only the bottoms of these organs could be shaped, and that very vaguely. Besides, there was not a trace of mastax to be seen within the head, for I searched carefully for it; the protruded mass was just where it would be, if such a misfortune had occurred; there was a conspicuous constriction behind the mass, evidently preventing retraction; while the mass was apparently of definite and unyielding shape, containing hard and lengthened organs. The frontal disk, both above the mass and also to a small extent below it, was covered with cilia in rapid, but feeble vibration; no whorls were produced in the surrounding floccose; no swimming or crawling progress was made by the animal; though it constantly contorted its body, and threw about its toes. Its vital power was manifestly stricken, and even the movements gradually grew feebler and feebler. I had not detected the slightest motion within the (supposed) mastax; its nerves had been probably paralysed at once. But fragments of the floccose sediment kept on adhering to the exposed parts, as if these were glutinous; and this was more manifest at first than after some time. From the summit of the front a minute finger-like proboscis descends.—P.H.G.]

Length. Of head and body, $\frac{1}{100}$ inch; of toes, $\frac{1}{250}$ inch; total length, about $\frac{1}{72}$ inch; vertical height at hunch, about $\frac{1}{250}$ inch. **Habitat.** An aquarium (P.H.G.).

D. FORCIPATA, *Ehrenberg*.

(Pl. XIX. fig. 2.)

Diglena forcipata . . . Ehrenberg, *Die Infus.* 1838, p. 443, Taf. lv. fig. 1.

[SP. CH. **Body** *cylindric, rather stout, obtuse at each end;* **face** *long, prone;* **trophi** *typically forcipate;* **toes** *scythe-shaped.*

This is one of the imposing species; stout, though more larva-like than either of the foregoing. The integument is again firm and thick, and forms tranverse folds, which are constant. The bluntly-tapered **head** carries the usual decurved fleshy proboscis, whence the ciliated **face** descends in the ventral plane to a length about one-third that of the body. A turbid **brain** descends far down the occiput, and bears two minute **eyes** on the very frontal edge. The **mastax** and jaws show a fine development of the form normal in this genus,[1] and perhaps they could nowhere be studied with greater advantage. The digestive apparatus differs little from that of *D. grandis*, or other species, but there is here no projection above the cloaca. The **foot** is large and bulbous, severed from the body by one of the strong folds; it bears two toes, which are stout, shaped like the blade of a pocket-knife or scythe. A large **contractile vesicle** occupies the lower abdomen, which appeared strangely divided into two by a strong constriction. Small vibratile tags were seen on attenuate threads running down each side.

I made acquaintance with this species, crowding the edges of a jar of water dipped from the "Black Sea" at Wandsworth, in January 1850. It was active, but little given to locomotion. Its numerous cilia are in constant agitation, and appear pale blue by reflected light; while the minute ruby-like eyes sparkle on the colourless body, the turbid parts of which are like whitish clouds. What I have called the proboscis may possibly be a broad lip, for it is visible only from the side. The wide spread of the toes is characteristic.[2]—P.H.G.]

Length, $\frac{1}{85}$ to $\frac{1}{72}$ inch. **Habitat.** Domestic aquaria near London, and Torquay (P.H.G.); Sandhurst, Berks (Collins).

D. CIRCINATOR, *Gosse*, sp. nov.

(Pl. XIX. fig. 4.)

[SP. CH. **Body** *slender at each end, gibbous in the middle;* **proboscis** *acute;* **mastax** *moderate;* **toes** *slender, strongly incurved.*

The fore parts are slender and nearly cylindrical (but flattened on the oral surface), swelling somewhat suddenly to a great ovate body, gibbous on the back, but flat on the belly; and as suddenly diminishing behind to a rather thick and short **foot**, which carries a pair of toes, each one a very regular quadrant of a circle in outline, broad at the base, running off to a very fine point. These toes are decurved, and also incurved towards each other, like the legs of a pair of calliper-compasses; and often thrown widely apart. The skin is very flexible, and, as the animal is every moment lengthening and contracting, and throwing itself into the most varied contortions, makes many irregular folds; yet the form delineated always recurs, and is evidently characteristic. The under surface has a remarkable projection (fig. 4*a*), pointing obliquely backward, more or less conspicuous, visible sometimes on each side in the dorsal aspect (fig. 4). This seems the limit of the ciliated face. The very front is furnished with a hook, which is capable of being thrown forward, as if hinged or jointed; and apparently sidewise also, for it is occasionally glimpsed for an instant, at either side of the head. This process is not a bent finger, but a regularly curved hook, hard and sharp-pointed. After a while

[1] They are described and figured in my Mem. "On the Mand. Org." (*Phil. Tr.* 1856) 435, figs. 50, 51.

[2] The animal described and figured by Mr. J. E. Lord (*Microsc. News*, 1884, p. 146, figs. 23*a*, *b*, *c*) is, I have little doubt, the present species.

the slender fore parts were retracted, and then from the gibbous body was seen projecting a curious little puckered bundle of transparent flesh and skin, as shown at fig. 4*b*.

This species I first found in the sediment of one of my indoor tanks among decaying conferva and milfoil: this was in June 1885. Afterwards it occurred again in a tube sent from Dundee by Mr. Hood. All the features were exactly the same as before; but this was more impatiently restless. I *thought* I saw a pair of frontal **eyes**, but I could not be quite positive. In a brief quiescence I made a careful study of the trophi, whose points are in contact with the very skin of the front.—P.H.G.]

Length, $\frac{1}{130}$ inch. **Habitat.** An aquarium at Torquay; Dundee (P.H.G.).

D. GIRAFFA, *Gosse*, sp. nov.

(Pl. XIX. fig. 9.)

[SP. CH. **Body** *slender, necked;* **eyes** *distinct, frontal, protuberant;* **toes** *slender, straight.*

This form, having some resemblance to *D. circinator*, differs from it, not only in the more marked neck, but in the toes being quite straight instead of circularly curved. For, though this may seem an unimportant character, I think the form of the toes will be found to present remarkable constancy in the same species. In *circinator* I could not be certain of **eyes**, but in this species they are well-marked, though minute, of dark hue, situate on the very front of the head, so close to the skin as to be prominent as tiny black warts on the surface. The **head** is small, and its connection with the body is by a sort of neck which can be greatly lengthened and attenuated, as the animal makes its frequent explorations through the free water in all directions, feeling about, very much as an earthworm does in the air. For this the skin is very flexible and versatile. The **abdomen** is tumid; but not so abruptly gibbous as in *circinator*. The **foot** is taper, and the toes moderately long, straight in every direction, not blade-shaped, but regularly diminished to great slenderness, and very fine points. There is no tail. Beneath the eyes the front forms a well-marked **proboscis**, which takes the shape of a decurved hook. At times this appears of equal thickness throughout, and blunt, or even truncate; then it is distinctly seen in the same individual much lengthened, and tapering to a fine point. Can the terminal part be protrusile? The ciliated **face** is quite prone, and appears to run far back on the ventral surface, where a chin-like prominence indicates the end of a ciliated furrow. (See *Diglena forcipata*, fig. 2*a*.) The skin, though flexible, seems very strong; it is continually thrown into folds by the unceasing contortions and contractions of the animal; it looks leathery, but is perfectly colourless and brilliantly transparent. It is a lively, vigorous, attractive creature; pushing among the sediment, occasionally swimming with a smooth gliding motion.

I found another specimen in the same water, exactly agreeing with the above. It had the odd habit of forcibly contracting the foot, and throwing back the toes, as far as the tapering outline of the body would allow; and then protruding the foot with a jerk, bringing the toes at the instant to a right-angle with each other, and therefore horizontal; immediately repeating the curious action; and so for fifty times together. When swimming glidingly, it will suddenly quicken its pace an instant, and make a sensible snap, as if it seized something; and this again and again; though my eye could detect no atom in the clear water.—P.H.G.]

Length, $\frac{1}{100}$ inch. **Habitat.** Woolston (P.H.G.): rare.

D. CAUDATA, *Ehrenberg*.

(Pl. XIX. fig. 8.)

Diglena caudata . . . Ehrenberg, *Die Infus.* p. 445, Taf. lv. fig. 6.

[SP. CH. **Body** *cylindric, long, slender;* **front** *broadly truncate, with two frontal colourless* **eyes**; **foot** *short, very thick, with two long straight slender toes.*

It is excessively versatile and variable in form, constantly contracting into inde-

scribable shapes (of which fig. 8*b* may serve as an example), with various sharp folds and angles. Yet it may be said to have a characteristic form, which is sub-parallel-sided viewed dorsally; but which, viewed laterally, is narrow for the anterior third, where it rises abruptly to nearly double the height. This is generally maintained to the end of the trunk, where it descends with even a sharper angle to give emission to a thick foot, carrying two long, straight, slender, acute toes. The **front** is unusually wide and truncate, viewed dorsally; but laterally, it is seen to project into the usual fleshy hook, which is probably sensitive, and used to collect and test food. The ciliated **face** is almost prone; behind this is an ample mastax with jaws of the normal pincer-form. The viscera present nothing noteworthy. The whole animal is of crystalline clearness; and is devoid of colour, so far as I have seen. The **eyes**, too, if eyes they are, are two colourless globules of considerable size and of somewhat irregular outline, placed wider apart than in Ehrenberg's figure, at the very front. The **toes** are long, tapering regularly to produced acute points, but slender throughout and quite straight, whereby they differ from those of *clastopis*. They are frequently thrown forward suddenly to more than a right-angle. (See fig. 8 and Ehrenberg's fig. 4.) The lumbar fold of skin is often strong and sharp; but there is no projection really answering to a tail; and the specific name is a misnomer. I examined two specimens in September 1885, from water which had stood on my table about four weeks, originally from Woolston Pond.—P.H.G.]

Length. About $\frac{1}{175}$ inch. **Habitat.** Woolston (P.H.G.); Sandhurst (Collins).

D. PERMOLLIS, *Gosse*, sp. nov.

(Pl. XIX. fig. 11.)

[SP. CH. **Body** *extremely soft and versatile in form, swollen in the middle, broad and truncate in front, tapering behind to a thick and long foot;* **toes** *two furcate, slender, acute.*

I am conscious that the above is an unsatisfactory diagnosis of what I am sure is a distinct form. In a tube dipped from a fresh-water loch by Mr. Hood, containing a few leaves of milfoil thickly studded with *Rhizota*, I found a Notommatoid creature, certainly new to me, and apparently undescribed. Its most salient character was its excessive softness, as if it had no skin at all, but were a lump of mere jelly, yet intensely active and restless, swelling and contracting, lengthening and shortening, twisting and infolding, without the slightest intermission, for more than two days while under observation. All this made it quite unlike any other Rotiferon I had ever met with. The slender **toes**, at the end of a rather large foot, are very mobile, ever thrown about to their utmost, or suddenly brought point to point with a snap; in this specimen they had the remarkable peculiarity of what looked like a minute terminal joint, like a separate claw, which, however, was not apparent in other examples. The **front** is widely truncate, composed of many globose transparent cells; from the midst of which projects the usual soft triangular **proboscis**. The ciliated **face** below this is prone, whence frequently the trophi,—an incus with circularly forcipate rami, worked by long mallei,—are protruded with energetic snaps and snatches. Below the mastax is a vast **alimentary canal**, consisting of nucleate cells; an **ovary** of embryonic vesicles occupying the venter. I could not detect any **eye-spots**; but a rather short **brain** filled the occiput.

I subsequently obtained other examples from the same quarter. In one was a large **contractile vesicle** which I saw discharged, but I could not time its period. The corners of the front, when rotating, have almost the appearance of auricles.—P.H.G.]

Length. About $\frac{1}{130}$ inch. **Habitat.** A pool near Dundee (P.H.G.)

D. CLASTOPIS, *Gosse*, sp. nov.

(Pl. XIX. fig. 5.)

[SP. CH. **Body** *cylindric, long, slender;* **front** *rounded, without visible hook;* **foot** *long, slender, with two long decurved toes.*

I am not quite clear whether I ought to name this form. But, assuming that the cluster of unequal-sized and irregular-shaped red specks, resembling the fragments of crushed rubies, at the very front of the head, represents two frontal **eyes**, I place it in this genus, especially as the trophi appear to agree with those of the slenderer *Diglenæ*, and there is much similarity to them in general contour and conformation.

Its **shape** is long, thin, and nearly parallel-sided, viewed dorsally (fig. 5), abruptly narrowed to a very slender foot, and long, thin, acute, decurved toes. Laterally (fig. 5*a*), the lumbar region is gibbous without any marked fold. The eyes, resembling broken fragments, as said, are placed at the very front; and are conspicuous, even in the swift shootings of the animal. The front descends to a blunt angle, which may be the anterior point of a prone ciliated face. I could discern no fleshy hook. I did not detect the **brain**; but behind the mastax were two opaque globules, which seemed not to be eyes, but were possibly chalk-masses, smaller, and more shapely, than usual. A very long **alimentary canal** reached far down the cavity, well filled with food of various tints, accumulated in many dark nodules, which imparted to the animal in its movements a very peculiar spotted appearance. Most of the internal structure is as yet undefined.

This is one sample of the very rich harvest of species that I reaped out of a small bottle procured for me from Sandhurst Wood pool, by Dr. Collins, in June 1855. Though I had the specimen under my eye for an hour or more, I could scarcely, in all that time, find it still long enough to permit me to turn to the paper, in order to delineate it; and if I did, I was almost sure to lose it out of the field, to find it again with difficulty. It is swift and headlong in its course, shooting through the free water rather than swimming, and only now and then entering a cloud of floccose sediment, to push, with persevering violence, a way through it.

Only this single example has been subjected to examination.—P.H.G.]

Length, $\frac{1}{175}$ inch. **Habitat.** Sandhurst, Berks (P.H.G.).

D. CATELLINA, *Ehrenberg.*

(Pl. XIX. fig. 10.)

Diglena catellina . . . Ehrenberg, *Die Infus.* 1838, p. 444, **Taf.** lv. fig. 3.

[SP. CH. **Body** *cylindric, short, abruptly truncate at each end;* **toes** *short, straight acute, projected from the ventral side, at a right-angle to the body-axis.*

This plump, sturdy little creature occurred among my earliest researches in the summer of 1849. It is a true *Diglena*, yet is very dissimilar to its fellows, replacing their long, lithe slenderness by a short thick body, having strong skin-folds, often quite abruptly truncate before and behind. Now and then, indeed, a bluff rounded head is pushed out, carrying two **eye-points** at its front, and a ciliated face, hardly prone. From the broad square stern, a small **foot** projects at the lower margin, and two small, slender, acute toes, pointing downward, serve the creature for support and for locomotion. The internal organs are little noteworthy. There is a large **occipital brain**, and an enormous mastax, of which the jaws are normal.

Ehrenberg describes this tiny species as both marine and lacustrine. I have found many specimens from tide-pools in the Tay estuary, collected by Mr. Hood.—P.H.G.]

Length, $\frac{1}{250}$ to $\frac{1}{175}$ inch. **Habitat.** A garden near London; a pond at Snaresbrook (P.H.G.); Sandhurst (Dr. Collins); marine tide-pools in the Firth of Tay (P.H.G.).

DIGLENA (?) BIRAPHIS, *Gosse.*

(Pl. XIX. fig. 3.)

Diglena (?) *biraphis* . . . Gosse, *Ann. Nat. Hist.* vol. viii. 1851, p. 200.

[SP. CH. **Body** *oblong, the head and abdomen gently swelling;* **toes** *long, slender, straight, and perfectly even in thickness;* **eyes** *placed close together frontally;* **jaws**

protrusile; **alimentary canal** *very large, projected behind and above the mastax, always filled with green matter.*

This is an animal of no inconsiderable size, which has the technical characters of *Diglena*, but has little affinity with that genus, in structure or manners. My first acquaintance with it was in October 1849. A filamentous plant, growing in a pan sunk in my own garden, was thickly covered with a floccose matter, inhabited by numbers of *Stentor polymorphus*. Among them were specimens of this *Diglena* (?). In January 1851, I again found it in the same water, and on a subsequent occasion; but I have never met with it since.

The **form** is gracefully swelling and vase-like, not at all resembling a *Diglena* in appearance; it has much the aspect of being loricate, but it is not. Two **eyes** are placed at the extreme front; small, so close together as to be readily mistaken for one, brilliantly crimson. The transparent **mastax**, *in situ*, shows a pair of incurved strong pincers, whose approaching tips are two-toothed. These can be extended from the front for half their length, and seem to be a formidable instrument for seizing prey. These are, no doubt, the *rami* of an *incus*. What appears remarkable is that a great saccular lobe of the stomach runs up behind the mastax into the occiput, and divides into two lobules. The whole alimentary canal, with these lobes, was, in every example, uniformly filled with round green granules, the exact similarity of which to the component granules of the *Stentors* and the *Loxodes*, which abounded in the same water (together with various species of *Euglena*), suggested that the normal food of the Rotiferon may consist of the juices of these Polygastrica, especially as its formidable forceps seems to indicate carnivorous propensities. The long straight rod-like **toes** are now and then turned up, so as to incline over the back; occasionally their tips are crossed.—P.H.G.]

Length, $\frac{1}{100}$ inch. **Habitat.** A garden-pan near London (P.H.G.): rare.

Genus DISTEMMA, *Ehrenberg.*

[GEN. CH. **Body** *more or less cylindric, long, slender before, swollen behind, versatile; two cervical* **eyes**; **front** *furnished with a fleshy* **proboscis**; **toes** *two, furcate.*

This somewhat obscure genus Ehrenberg constitutes on four species. These, however, must be reduced to two: for *D. setigerum* clearly belongs to the family *Rattulidæ*; and *D. marinum* is one of the *Loricata*. The others I have not met with. But I enumerate three species, apparently undescribed, which seem to come into the genus.

In aspect and manners they closely resemble *Diglena*, especially in their long, lithe, versatile forms, generally swollen behind; in the presence of soft tentacular appendages to the front; in the forcipate form and protrusile character of their trophi; and in their fierce raptorial habits. The species inhabit the sea and fresh waters.—P.H.G.]

D. RAPTOR, *Gosse*, sp. nov.

(Pl. XIX. fig. 1.)

[SP. CH. **Body** *long, gibbous behind, very changeable;* **front** *with a long projectile* **lip**; **foot** *short;* **toes** *small, slender, decurved. Marine.*

The lithe flexible **form** is usually lengthened, slender in the middle, becoming high behind, its outline descending in an abrupt curve to the very small **foot.** This is armed with two toes, whose thickness tapers abruptly at the middle (fig. 1*c*). It is near *D. forcipatum*, but is distinguished by this peculiarity of the toes, and by their curvature. And it is marine. The head is rounded, the front produced into three fleshy ciliate points, and a conical projection on each side. The central point is probably the tip of a curious fleshy process, which is now and then rapidly pushed out and in (figs. 1, 1*a*), quite straight, thus differing from the proboscis of *Diglena*. The lateral projections, when this

lip is retracted, close against each other, as in *Dinocharis*. The median line of the dorsum makes a sharp roof-like angle, especially at the lumbar part, but does not rise to a ridge. **Eyes** are sometimes clear and distinct, one on each side of the mastax, wide apart, highly refractile, very pale red, but well defined; but in some specimens they are quite invisible. The **trophi** consist of an *incus*, with *rami* broad and circularly forcipate, on which work slender bowed *mallei* (fig. 1*b*). The mastax is often retracted below the middle of the body; then the animal will suddenly elongate, and the mastax will be driven forward and backward, rapidly and far, the rami snapping fiercely. This snapping snatching action is very observable. Sometimes the mastax is, fully half or more, protruded from the front, and this again and again in rapid succession, the jaws giving a short snap at each time. It is incessantly restless, sudden and rapid in its contractions and turnings, yet not very locomotive, remaining long anchored to the glass by the toe-tips, swaying to and fro, much like a *Monostyla*, often stretching the toes apart.

I owe my acquaintance with this interesting form to Mr. John Hood, of Dundee, who, lately, at my request, searched for marine Rotifera. He presently sent me contributions of sea-water, from the estuary of the Tay, in which I found many species. Among the stems of a conferva this new *Distemma* was pushing and snatching.

It seems tenacious of life. The individual first observed lived in a live-box, containing a thin pellicle of water, for parts of three days, during which other Rotifera, its associates, had one by one succumbed. Perhaps from hunger, this specimen roamed incessantly through the clear water, snapping at every atom, now and then seizing a small diatom, and drawing it into the buccal funnel, to reject it instantly. The jaws were protruded and retracted every moment with lightning-like rapidity. Now and then a tiny cloud of floccose would be dragged in and chewed eagerly, then forcibly ejected. The force and energy displayed by so small an atom was remarkable. The sight seems to have a very small range. This one seized and devoured many Monads and even large Protozoa; but it seemed to have no power of discerning them till they were close to its head; then the action was prompt enough.

The highest expression of animal life that I have observed among Rotifera is this little obscure *Distemma*. As a fowl picks up minute atoms of food from the earth and pebbles and rubbish with which it is mingled, showing sight, observation, discrimination, selection, will, so does this *Distemma* manifestly snap up its food-atoms, often invisible to our eyes, selecting them [1] with rapid precision from other surrounding atoms. The jaws are thrust out and withdrawn, as I have said, with a quickness which we cannot follow, and with stroke succeeding stroke, quite as rapidly as a hen's beak picks its morsels, and evidently takes something at each. The way in which it pounces upon animacules that we *can* discern, and the energetic vigour with which it seizes them, are admirable, and quite unparalleled among Rotifera, so far as my experience goes; and there is hardly a species described in this work that has not come under my observation. If we could descend to his level, and form a personal acquaintance with him, I am sure we should find this *Distemma* a person of great decision of character.—P.H.G.].

Length, (as in figs 1, 1*a*) $\frac{1}{130}$ inch. **Habitat.** Tay-mouth: tide-pools (J.H.).

D. COLLINSII, *Gosse*, sp. nov.

(Pl. XVIII. fig. 13.)

[SP. CII. **Body** *cylindric, long;* **head** *large;* **foot** *stout;* **toes** *two, furcate, long, slender, unnotched, acute. Lacustrine.*

This species is known to me only by a drawing in Dr. Collins's Note-book. It is represented with a long body, a head of increased diameter, a stout foot, and two toes.

[1] "The power of choice is the distinctive peculiarity of a *mental* being." "All activities that are indicative of choice [except reflex actions] are indicative of consciousness. Wherever we see a living organism apparently exerting intentional choice, we may infer that it is conscious choice; and therefore that the organism has a mind."—Romanes, *Ment. Evol. in Anim.* pp. 47, 17.

which are thick, decurved at the tips, and of a length *equal to one third of the whole animal* when extended. The pencil-sketch has not many details of organisation.

The only note which the observer has added is the following :—"It has the power of drawing-in the first joint of the foot into the interior of the body; and has a peculiar manner of separating the pair of curved toes."—P.H.G.]

Length. Unrecorded. **Habitat.** Sandhurst, Berks (Dr. Collins).

D. (?) LABIATUM, *Gosse*, sp. nov.

(Pl. XVIII. fig. 12.)

[SP. CH. *Slender, long, gibbous;* **front** *furnished with a protrusile* **lip**; **foot** *long, with two minute furcate, virgate* **toes.**

Beyond what the mere outline suggests, as conveyed in the figures, I can give little information concerning this species. With much doubt I place it in the present genus; and that only on the possibility that two obscure spots, dimly seen in the neck, may have been **eyes.** They may have represented the **trophi.** In fact my knowledge of this form rests on a single brief observation. I was examining an aquatic moss, which Dr. Collins procured for me in June 1885, when this little creature glided out. I saw in a moment it was new to me, but my attention was already occupied. There were in that live-box, at that instant, three or four Rotifera unknown to me; as many papers were before me, on which I was labouring to reproduce the portrait of each, feature by feature, as I could catch it. Here was one more. It was a complete *embarras des richesses.* What could I do? I hastily threw in the outlines here given, careful to secure correctness in what was produced, but deferring minute examination in the hope of seeing it again; while I pursued the study of those already in hand. The present subject, however, found speedy concealment among the moss, and I could find it no more; nor has it ever reappeared. The **form**, particularly in the lateral aspect, recalls the *outré* shape of *Notommata caudata*, with its long neck, elevated back, and slender foot; but the resemblance is only superficial. Its chief peculiarities are—(1) a slender parallel-sided, squarely-truncate **proboscis** or lip, projecting medially from the front, which is seen in the side view to be somewhat low in position; it seemed retractile to some extent; (2) a long, slender, and tapering **foot-joint**, furnished with a furcate pair of toes, very minute, *of equal thickness* throughout, obtuse; like tiny pegs.

I can find nothing in Ehrenberg with which satisfactorily to identify it.—P.H.G.]

Length. About $\frac{1}{150}$ inch. **Habitat.** Sandhurst, Berks (P.H.G.).

[N.B.—In Dr. Collins's Note-book are pencil-sketches of an evidently large animal, which may possibly be the *Triophthalmus dorsualis* of Ehrenberg. I have carefully copied the sketches (Pl. xviii. figs. 14, 14*a*); but the details are not sufficient for diagnosis; and there are no descriptive notes. I have not myself met with anything like it. —P.H.G.]

CHAPTER X.

PLOÏMA

(LORICATA).

How much weariness has there been in the human race during the last fifty years, because the human race cannot stop politically where it was, and, finding no rest, is pushed to a strange future that the wisest look forward to gravely, as certainly very dark, and probably very dangerous! Meanwhile have the bees suffered any political uneasiness? have they doubted the use of royalty, or begrudged the cost of their Queen? Have those industrious republicans, the ants, gone about uneasily seeking after a sovereign? Has the eagle grown weary of his isolation, and sought strength in the practice of socialism? Has the dog become too enlightened to endure any longer his position as man's humble friend, and contemplated a canine union for mutual protection against masters? No! the great principles of these existences are superior to change; and that which man is perpetually seeking, a political order in perfect harmony with his condition, the brute has inherited with his instincts.

P. G. Hamerton. *Chapters on Animals.*

Presumption is our natural and original disease. Man withdraws and separates himself from the crowd of other creatures; cuts out the shares of the animals, his fellows and companions; and distributes to them portions of faculties and force, as himself thinks fit. How does *he* know, by the strength of his understanding, the secret and internal motions of animals?—Montaigne.

CHAPTER X.

Sub-Order LORICATA.

Integument *stiffened to a wholly, or partially, inclosing shell;* **foot** *various.*

Family XI. RATTULIDÆ.

[**Body** *cylindric or fusiform, smooth, without plicæ or angles; contained in a* **lorica** *closed all round, but open at each end, often ridged;* **trophi** *long, asymmetric;* **eye** *single, cervical. Generally subject to abnormal conditions.*

This family comes first in the Loricate sub-order, because the loricate structure is in varied condition; for, whereas in some species it is indubitable, in others, which yet cannot be severed from these, the integument is still thin, flexible, and membranous. Ehrenberg, indeed, while he assigned *M. carinata* to the Loricata, removed his genus *Monocerca* far away to Il-loricata. Yet that *carinata* and *rattus* are congeneric cannot be doubted by anyone who knows both; *bicornis* certainly goes with the latter. The sausage-shaped species have many family affinities with these; though subdivisible *inter se*. The peculiar form of trophi represented in figs. 60–62 of my Memoir "On the Mandue. Organs" runs with little variation through all.

The most curious peculiarity in the family is its tendency to asymmetry, which appears in many organs. In the mastax the right malleus always differs from the left; when there is an elevated ridge on the dorsum, it is apt to be bent over on one side, and, instead of running straight down the middle, to pass slantwise from right to left; when two antennæ are present they are unequal. The toes, sometimes normal, are often reduced to a single style, with minute sub-styles grouped around its base. In other cases they are modified in a most unprecedented manner, described under the genus *Cœlopus*. On the whole, it is a group of very peculiar interest, both to the scient and to the intelligent seeker for amusement.—P.H.G.]

Genus MASTIGOCERCA, *Ehrenberg.*

[GEN. CH. **Body** *fusiform or irregularly thick, not lunate;* **toe** *a single style, with accessory stylets at its base;* **lorica** *often furnished with a thin dorsal ridge.*

The terminal style is by no means a tail, but a true **toe**, however modified. The homology of the sub-styles is not clear. The surface of the body is usually smooth and polished, often elegantly tapered; nor does the thin elevated carina of the dorsum materially interfere with this elegance, which the long taper toe admirably finishes. This organ, though inflexible throughout, is capable of rapid and sudden motions, being bent right and left, and whisked to and fro with great agility. The **mastax** is usually pear-shaped and very long, but the œsophagus, a sinuate duct, leads from it almost at its very summit occipitally, just where the mallei work upon the incus. Thus the great length of the mastax does not intrench on the needful length of the stomach, since this viscus begins far forward. The **muscles**, in many species, especially the transverse series, have been well resolved. Mueiparous **glands** are richly supplied. Surprise is often felt that Rotifera with but a single style should be able to maintain so firm a hold upon

glass as to resist the force with which the surrounding water is carried up into a pipette by the pressure of the atmosphere. It is doubtless by the adhesive power of the clear glue secreted and poured out by the oblong foot-glands. In *Mastigocerca* this may often be seen running down the outside of the toe, its production seemingly subject to the animal's will. When first put into the live-box, it is commonly poured forth abundantly, so as to accumulate around the point, and to drag in a thick glairy stream behind it. I have seen it surround the terminal half of the spine to a thickness four times as great as that of the spine itself. Or it will run from the base downward, like a thick spiral cord. Sometimes it is not perceptible. The **male** has not been detected in the family. —P.H.G.]

M. CARINATA, *Ehrenberg*.

(Pl. XX. fig. 7.)

Mastigocerca carinata . . . Ehrenberg, *Die Infus.* 1838, p. 460, Taf. lvii. fig. 7.

[SP. CH. **Body** *long-oval;* **lorica** *ridged;* **ridge** *high, arched, reaching to middle of body;* **toe** *straight, equal in length to body-and-head;* **sub-styles** *very minute.*

The height of the dorsal **ridge** is very characteristic in this familiar species, rising, in the midst of its length, to fully half of the vertical thickness (*i.e.* from back to breast) of the body. Its cessation, too, just beyond the middle of the back, gives a peculiar humped outline to the forepart, viewed laterally. The belly-line is about equally curved with that of the back. The ridge, as already observed, is not set-on straight down the dorsal centre, but on a line that slants considerably to the left, while in its elevation it leans over to the right. It is manifestly hollow along its base, for the viscera may often be seen extending into it for a little way. It is marked on its basal part, through its length, with close-set corrugations. The front is rounded, with many minute eminences, on which the cilia, which make two distinct vortices, are set; they increase in size and height to the occiput, where an **antenna** projects, capable of being erected or inclined. A long occipital **brain** carries a rather large bright-red **eye**, set like a wart at its interior lower angle. The **mastax**, a pear-shaped bag, is enormous, reaching, from the front, half the body-length. It contains an incus with a slender straight fulcrum, the rami of which are obsolescent and the alulæ very large, and two bent mallei, unequal in size and form. There is a very small **contractile vesicle**, whose period is shorter than I have observed in any other Rotiferon, twenty-five times a minute. The distension of the viscera conceals the branchial vessels, but I have seen one **vibratile tag**.

The **foot** consists of an ovate bulb, to which is jointed the toe as a slender spine in the midst of two or three bract-like accessory styles, one of which is slightly longer than the others, distinctly moveable. The toe moves in all directions except backwards.—P.H.G.]

Length. Of lorica, $\frac{1}{150}$ inch; of toe, $\frac{1}{150}$ inch; depth to summit of ridge, $\frac{1}{250}$ inch.
Habitat. Pools; generally distributed: common.

M. LOPHOESSA, *Gosse*, sp. nov.

(Pl. XX. fig. 10.)

[SP. CH. **Body** *long-oval; dorsal* **ridge** *reaching to the foot, nearly uniform in height;* **toe** *straight, two-thirds as long as body;* **sub-styles** *one-third of toe-length.*

This I think a well-defined species. The **ridge** attains nearly to as great a height as in *carinata*, and is continued to the base of the foot. Its outline runs in several arches, and descends rather abruptly at the end. It is marked with faint radiating corrugations. The principal **toe** is a straight slender style, gradually tapering to a fine point, as in *carinata*, but not quite so long in proportion; and the accessory styles, of which I could discern two, are of unequal length, the longer equalling fully one-third of the principal; whereas in *carinata* it is not more than about one-eighth, by very careful micrometric measurement. The **mastax** and jaws seemed much shorter than usual, but of the common

form. I did not discern any eye, but do not doubt its presence in life. None of the viscera showed any peculiarity.

This species I met with at the beginning of October 1885, among sediment furnished me by Mr. Bolton. It was just dead; but afforded me a good observation. A week or two later, the empty lorica of another example occurred from the same ditch; and, a little afterwards, in water from Bracebridge Pool, still from Mr. Bolton, I found it yet again. And since, from Mr. Hood. The characters were constant in all.—P.H.G.]

Length, $\frac{1}{60}$ to $\frac{1}{80}$ inch; lorica, $\frac{1}{145}$ inch; depth at middle of ridge, $\frac{1}{185}$ inch. **Habitat.** Birmingham; Dundee. Pools: rare (P.H.G.).

M. SCIPIO, *Gosse*, sp. nov.

(Pl. XX. fig. 11.)

[SP. CH. **Body** *sub-cylindrical, slightly larger in front, thick and round behind; the front of the* **lorica** *set with three spines; a long low* **ridge** *considerably on the right side;* **toe** *half the length of the lorica;* **sub-styles** *one-fourth the length of the toe. Greatest width about one-eighth of total length.*

This and the following two species have much in common; yet are distinguished by details of form and structure. The general outline differs in each, as shown in the figures. The particulars detailed in the technical *Spec. char.* of each, though minute, seem trustworthy. What appears distinctive of the present is that the front edge of the **lorica**, otherwise smoothly truncate, carries three projecting spines, one occipital and two lateral, each of which runs down the outside of the lorica for a short distance as a sharp ridge. There is thus a certain resemblance to *M. bicornis*.

The general outline is that of a stout straight stick, thickened slightly near the head, with both ends rounded abruptly. At the extremity a very low **ridge** is seen, which runs up, considerably to the right of the medial dorsal line, almost imperceptibly at length, to the very front. The **foot**, which is short and bulbous, is contained within the rounded end of the trunk, but carries, attached to it by a very facile joint, a toe in the form of a slender spine, about two-fifths as long as the lorica. The spine, as in *carinata*, is not quite straight; it bears at its base a short supplementary style on each side, which moves on the basal joint with its own motions. Each is about one-fourth as long as the toe. The **mastax** is of immense size, occupying much more than half the body-length; the trophi are often pushed to the very front. Vibrating cilia are disposed on minute eminences, of which the central one is continually lengthened and shortened. An ample **brain** runs down the occipital region, bearing a conspicuous crimson **eye** *on its extreme point.* I saw no protruded **antenna.** Very characteristic (in all the specimens observed) was a long clear blank space, wide at the foot-point, and tapering to near the mid-venter: probably a **contractile vesicle**; only that I could never see it contract. The whole animal is transparent and colourless.

I first saw this species in the summer of 1885, on an aquatic moss, growing in one of my window tanks. I subsequently saw other specimens; one in particular, glued fast to a filament by the toe, illustrating the abundance and tenacity of this excretion, which, evidently, is not always under the control of the animal, so that, if usually it is a convenience, it may become a snare. This individual was not quite dead, yet the turbid matter of the head was already forced out, together with many oil-globules.—P.H.G.].

Length. With the toe, $\frac{1}{100}$ inch. **Habitat.** On water-moss in pools (P.H.G.).

M. MACERA, *Gosse*, sp. nov.

(Pl. XX. fig. 12.)

[SP. CH. **Body** *fusiform, thickest behind the middle;* **lorica** *smooth-edged in front; without visible* **ridge**; **toe** *half the length of the lorica;* **sub-styles** *one-fourth the length of the toe.*

I can give little information about this species, which yet seems distinct. I have seen but a single example, and that was moribund, if not actually dead. I met with it in June 1885, in water from Woolston Pond, Hants, courteously supplied by Miss Davies. Spontaneous motion had not ceased, particularly in the toe-spines, and the structure of the abdominal viscera was still perfect; yet all the foreparts were one mass of dissolving flesh and air-bubbles, protruding from the front and spreading around. An **eye**-spot could be detected in the mass; but of the **trophi** not a trace.

The form recalls *M. rattus*; but greatly produced in length, and without discernible carina. I hesitate whether it should not be placed in the genus *Cœlopus*; for it appears to have two unequal **toe-spines**, the smaller fitting beneath the other, and about one-fourth of its length. But the longer is straight, the shorter curved. So that, in defect of fuller observation, I assume that the shorter is but one of the supplementary styles common in this family; though I could detect other minuter spinelets at the base.

The specimen I unfortunately neglected to measure; but the total length to the toe-point was, approximately, $\frac{1}{100}$ inch.—P.H.G.] **Habitat.** Woolston (P.H.G.).

M. ELONGATA, *Gosse*, sp. nov.

(Pl. XX. fig. 8.)

[SP. CH. **Body** *nearly cylindric, slightly larger before than behind;* **lorica** *smooth-edged in front;* **ridge** *long, low, medial;* **toe** *as long as the lorica;* **sub-styles** *one-twentieth the length of the toe.*

This seems a very distinct species. Its smooth, hyaline, arched **lorica**, with a widely truncate front edge, quite smooth, but tapering in a graceful curve to the hinder end, where a small tubular orifice, also abruptly truncate, allows emission of the foot; is very distinctive from the preceding two species, to which, however, its remarkable length allies it. It is nearer to *M. carinata* than they; yet sufficiently remote from this by conspicuous characters; in particular, by the dorsal **ridge**, which is low throughout, and, as I believe, medial. The greatest depth of the lorica (viz. just behind the front edge) is just one-fourth of its length. This front edge, destitute of points, is apparently attenuated to thin membrane, thrown into minute transverse folds, inverted and everted with the motions of the head-mass. The **foot** is of one minute joint, exterior to the lorica. It bears one toe, a spine of great length and slenderness, almost quite straight, nearly uniform in thickness to the fine point. Its length *about equals that of the lorica.* Two accessory styles, very minute, are appressed to its base. The **mastax** is ample, and, as in *M. carinata*, having two mallei, unequal and dissimilar.

I owe my acquaintance with this charming species to Mr. Hood of Dundee, whose keen eye had already detected its specific distinctness. He sent me, in November 1885, water from one of the pools near Dundee, containing a number of living specimens. They are sprightly and active, swimming elegantly through the clear water, with a smooth but swift gliding movement.—P.H.G.]

Length. Total, $\frac{1}{52}$ inch; of toe, $\frac{1}{116}$ inch; of sub-styles, $\frac{1}{1700}$ inch; depth of lorica, $\frac{1}{370}$ inch. **Habitat.** Loch near Dundee (J.H.); Birmingham (P.H.G.): not rare.

M. RATTUS, *Ehrenberg.*

(Pl. XX. fig. 9.)

Monocerca rattus . . . Ehrenberg, *Die Infus.* 1838, p. 422, Taf. xlviii. fig. 7.

[SP. CH. **Body** *ovate, truncate in front, pointed behind;* **ridge** *reaching to two-thirds, evenly arched;* **toe** *longer than body-and-head together;* **sub-styles**, *very minute.*

The **lorica** is elegantly ovate, subtruncate before, where a thick head protrudes, with a rounded front, on which numerous pimples are beset with bristle-like cilia, making

a single vortex. Behind the head is a strong transverse fold, seen in retraction, but obliterated in extension; close to which projects horizontally backward a long **antenna.** The whole structure bears a very close resemblance to that of *M. carinata*, from which, however, it is distinguishable at a glance. The **mastax** and trophi are on the same pattern; but the right malleus is even still further reduced, only a slight vestige of it remaining. The dorsal **ridge** is evident but very low, with an outline regularly and elegantly curved. The **foot** is small and short; the toe nearly straight, long, slender, acute, closely embraced at its very base by several very short sub-styles. A copious secretion of mucus is often seen running down like a cord, from the base, whose viscosity is attested by the force with which the tip is moored to the glass.

This very elegant and sprightly animal is well named, for its resemblance to a rat is at once manifest, both in form and movement. It moves nimbly about among the vegetation, now nibbling, now turning short, now scudding hither and thither by little starts, whisking its long tail (toe) about in all directions. It swims gracefully and rapidly, revolving often on its axis. The periodic evacuations of its small **contractile vesicle** are thirteen in a minute. The species is often found in company of the finer *Desmideæ*, and from the alimentary canal being commonly distended with matter of a rich golden-brown hue, I conjecture that some of these may form its ordinary food. In the discharge of fæces, I have noticed such a quick closing contraction of the rectum at the point where the intestine merges into it (yet *without constriction* of the whole tube) as suggests a sphincter there: and the distinction between the coloured contents of the intestine and the perfect clearness of the rectum is well defined.—P.H.G.]

Length. Of body and head, $\frac{1}{160}$ inch; of toe, $\frac{1}{135}$ inch; total, $\frac{1}{73}$. **Habitat.** Pools, widely dispersed, not uncommon (P.H.G.).

M. BICORNIS, *Ehrenberg.*

(Pl. XX. fig. 5.)

Monocerca bicornis . . . Ehrenberg, *Die Infus.* 1838, p. 423, Taf. xlviii. fig. 8.

[SP. CH. **Body** *fusiform-ovate, with long thick head armed with two projecting unequal spines;* **lorica** *not ridged;* **toe** *two-thirds as long as body-and-head, with a bulbous base, and no sub-styles.*

The integument is truly a **lorica**, though more flexible than usual. It is truncate at the neck, whence a thick cylindrical head protrudes, the anterior half of which can contract by bringing the sides together in strong puckers. With much resemblance to both *rattus* and *carinata*, there is a marked difference in aspect, from the greater development of this head, and from the unequal spines which project over it; of which the left is medial, much the longer, and decurved. The absence, too, of any dorsal **ridge** is noteworthy. The **toe** is slightly swollen at its base, but I cannot detect any **sub-styles**, though Ehrenberg speaks of them; it is slightly recurved. The right **malleus** has here quite disappeared. The **brain** is of unusual length, even descending below the long mastax, and the **eye**, of moderate size and a pale-red hue, is seated *near its middle.* There are small **gastric glands** at the base of the stomach, and *two similar vesicles* attached to the *rectal end* of the intestine. The **contractile vesicle**'s periods are three in a minute. In other points there seems little to distinguish the species from its fellows. There are, however, two **antennæ**, also unequal, which project, side by side, beneath the chief frontal spine. I have seen an egg matured in the ovary, remarkable for its small size: perhaps male. (Cf. *Monoc. valga*, Ehr.)

In ponds and lakes around London, I met with this species and the preceding, six-and-thirty years ago; I have occasionally found both since, the present the rarer. Yet I have had this multiply in a phial; so numerous and so large, as to be visible to the naked eye. They glide slowly about, sometimes hanging to the glass, or playing around

the floccose attached to growing *Nitella*. It forms a charming object under reflected sunlight. The body is colourless, and sparkling as a vase of glass, as are some of the viscera. An advanced egg is conspicuously white; and so is the head of the mastax; the eye comes out like a ruby; the stomach, full of food, is richly brown, or perhaps grass-green; and the rotating front is enveloped in a cloud of pale cobalt blue. Like its neighbours, it is lively in movement.—P.H.G.]

Length. Of body, $\frac{1}{110}$ inch; of toe, $\frac{1}{160}$ inch; total, $\frac{1}{85}$ inch. **Habitat.** Pools near London; Birmingham (P.H.G.).

M. STYLATA, *Gosse.*

(Pl. XX. fig. 6.)

Monocerca stylata . . . Gosse, *Ann. and Mag. Nat. Hist.* Sept. 1851, p. 199.

[SP. CH. **Body** *irregularly oval;* **head** *short;* **lorica** *flexible, puckered in contraction, not ridged;* **toe** *less than half as long as body-and-head, simple, with no* **sub-styles.**

In several respects this nimble little species resembles the preceding; the lorica (even more flexible and skin-like) opens wide in front to emit the head, and closes with many folds or puckers, converging to a blunt point. The form is more irregular than in any other species, being plump and gibbous; the skin, which is so flexible as scarcely to be called a **lorica**, is often drawn in, or protruded in angles, which vary the shape. The **foot-bulb** is enormous, usually inclosed within the body; to this is jointed the toe, a taper acute spine, nearly straight, without a swollen base, and without sub-styles.

The **brain** is thick and moderately long, carrying a large **eye** on the middle of its dorsal surface, protuberant as a wart. No **antenna** has been observed. The protruded head is short, set with cilia, strong and bristle-like, around the margin. The **jaws** have the asymmetric character already noticed; the one malleus is very long and simply bowed. As in *bicornis*, there is a long distinct rectum, to which are attached two globular cæca, larger than the **gastric glands** above. There is a small **contractile vesicle.** The cloaca is marked by a depression.

Under strong lateral pressure, a very complicated system of muscular bands is seen (6*b*), mostly transverse, but many irregularly diagonal. I copied them with great care.

I first obtained this species from a garden reservoir near London, in 1850. Its minuteness and its figure, its short foot and great red eye, may cause it to be mistaken for an *Anurœa*, which it resembles in its swift, headlong, obliquely-revolving motion. Specimens in a phial may be detected with a pocket lens, rapidly urging their way, generally in a perpendicular direction, upwards or downwards, always with this revolving action. When alarmed, they suddenly increase their speed, shooting across the field of view with such a fleetness that it is difficult to keep them in sight.—P.H.G.]

Length. Of body, $\frac{1}{250}$ inch; including toe, $\frac{1}{170}$ inch. **Habitat.** South London; Hampstead Heath; Stapleton Park, Yorkshire; Birmingham (P.H.G.).

Genus RATTULUS, *Ehrenberg.*

[GEN. CH. **Body** *cylindric, curved;* **lorica** *smooth,* (*usually*) *without a* **ridge;** **toes** *two, decurved, symmetric.*

The *Notommata tigris* of Ehrenberg, with its rounded body, thickest before, its general curvature, and its two coequal toes, continuing the curve of the body, may be considered the type of this genus, which manifestly, however, forms a connecting link with the *Notommatadæ*, through *Proales tigridia.* The genus is a very natural one, inseparable, notwithstanding some diversities, with a common facies readily apparent to the skilled observer.—P.H.G.]

R. TIGRIS, *Müller*.

(Pl. XX. fig. 13.)

Notommata tigris . . . Ehrenberg, *Die Infus.* 1838, p. 431, pl. liii. fig. 1.

[SP. CH. **Body** *subcylindric, largest in front;* **foot** *thick;* **toes** *two, stylate, long;* **sub-styles** *two pairs, very short;* **brain** *clear.*

The **lorica**, though subcylindric, a tube open at both ends, and bent, is wider in front, where a great thick head is protruded, which is invested in an inflexible shelly coat, running off both frontally and mentally into hard sharp points. The face between bears rotatory cilia set on minute eminences. Ehrenberg says "the outer skin appears somewhat firm"; and I have met with the empty dead shell, as evidently chitinous as that of an *Euchlanis*. The whole animal is rounded, not only as a tube is round, but the outline of the back is the segment of a circle, a form which is unchanged with all the animal's motions. The **foot** appears to consist of one or two thick joints, and carries, besides the two toes, which are long taper styles, evenly decurved, sub-styles one on each side of each toe (fig. 13*b*), usually close appressed and minute. In death the toes are bent up under the belly; but in life they are usually carried straight behind, quite parallel, or often thrown upward, without, however, changing the downward curvature of their points. The ample **mastax** (fig. 13*a*) is pear-shaped: the mallei straight, unequally developed. The large **brain** carries a clear pale-red wart-like **eye**, on its point. The stomach is usually full of dark-brown food, coarsely granular.

Some points in Herr Eckstein's description of *Diurella tigris* make me doubtful whether his species and mine are identical. Mine I have had repeated opportunities of studying, both alive and dead.—P.H.G.]

Length, $\frac{1}{120}$ inch, of which the toes are $\frac{1}{400}$ inch. **Habitat.** Sandhurst, Berks; Woolston, Hants: rare (P.H.G.).

R. HELMINTHODES, *Gosse*, sp. nov.

(Pl. XX. fig. 17.)

[SP. CH. **Body** *very slender, especially in front, the width less than one-fifth of the length;* **toes** *without accessory* **styles** *at the base;* **brain** *clear.*

This obscure species approaches near to *R. tigris* in form, and also in the slenderness and comparative length of the toes. It is, however, much more elongated (even when all allowance is made for the protrusion of the parts in death); and the anterior half is the slenderer, whereas in *tigris* it is the thicker. The **lorica**, if I am not mistaken, has a long low dorsal **ridge**, beginning insensibly near the mid-length, and ending abruptly in an oblique angle (fig. 17) just above the foot. The short, stout, bulbous **foot** carries two long furcate toes, which are simple styles, very slender, tapering to fine points, decurved, closely resembling those of *R. tigris*. Yet I was not able to separate any accessory styles at the base of each, such as are seen in that species. Something was there; if styles, very short and close appressed, but it seemed rather a swelling of the basal part of each toe. It was only a dead lorica that came under my observation; from which the head-mass was extruded by decomposition, as an amorphous turbid cloud. Yet the **mastax** and its jaws of the normal form were still distinct, and the stomach and ovary were scarcely changed. I could not satisfactorily define a **contractile vesicle**, nor branchial tubes. The toes were turned up close to the belly.

The lorica occurred in a tube sent me at the beginning of November 1885, by Mr. Bolton, of water from Blackroot Pool, near Birmingham, in which *Asplancha priodonta* had swarmed, all now dead.—P.H.G.]

Length. To tips of toes, $\frac{1}{100}$ inch; of toes, $\frac{1}{370}$ inch; width (and depth) of body, $\frac{1}{520}$ inch. **Habitat.** A pool near Birmingham (P.H.G.).

R. CIMOLIUS, *Gosse*, sp. nov.

(Pl. XX. fig. 14.)

[SP. CH. **Body** *arched, parallel-sided; skin flexible;* **brain** *opaque;* **toes** *short, blade-like, decurved; no* **sub-styles**.

The **brain**, descending far into the occiput, is furnished at the end with a large and opaque chalk-mass. This I have signified in the specific name, from κιμωλία = chalk. Its component cells are very distinct at the lower margin, which is sub-truncate. When the fore-parts are retracted forcibly, as is frequently the case, the conspicuous chalk-mass will sometimes reach to two-thirds of the entire length, displacing the viscera. A pair of small auricles are occasionally thrust out (fig. 14), without any sensible augmentation of speed, while the animal pushes through sediment. I have looked in vain for an **eye**, though it may have been concealed by the opaque cells. The trophi (figs. 14*b*, *c*) exhibit the virgate pattern common in the family. The **toes** are short compared with those of *tigris*, decurved; set side by side, and widely expanded (fig. 14).

This seems a quite distinct little species, there being no other with which it can be confounded, on examination. The specimen described was in the bottle with which Dr. Collins favoured me in June 1885. Its movements were by no means rapid, but persevering, forcing its way incessantly through the leaves of water-moss and sedimentary floccose. I have lately found a second in water from Mr Bolton.—P.H.G.]

Length, $\frac{1}{200}$ inch. **Habitat.** Sandhurst, Berks; Kingswood Pool, Birmingham (P.H.G.).

R. CALYPTUS, *Gosse*, sp. nov.

(Pl. XX. fig. 16.)

[SP. CH. **Body** *and* **toes** *as in* cimolius; **brain** *clear;* **face** *furnished with pendent veil-like lobes of flesh. Marine.*

This has much resemblance to *R. cimolius*, but it is larger, and the **brain**-sac is clear, not opaque. No **eye** has been visible: the **toes** are of like dimensions, pattern, and decurvation. A remarkable peculiarity is that in the front a thick and broad veil of transparent flesh hangs down, apparently bilobed, meeting another great lobe of like appearance from below. The function of these lobes I do not know. The body is cylindric, with no visible dorsal **ridge**. The **mastax** and trophi conspicuous, but ill-defined. An ample brain descends with a point into the occiput, with neither chalk-deposits, nor eye. A long and slender œsophagus leads to an ample **alimentary canal**. The **ovary** occupies the ventral region of the cavity; and a moderate **contractile vesicle** is behind all.

A single example of this charming little *Rattulus* I found in October 1885, with many other species of Rotifera, in sea-water, procured for me by Mr. Hood from the tide-pools of the Firth of Tay. In manners it was sluggish, contracting and lengthening itself with uniform persistence without changing its place. It was of hyaline transparency and colourlessness.—P.H.G.]

Length, $\frac{1}{130}$ inch. **Habitat.** Tide-pools on the Scottish coast (P.H.G.).

R. SEJUNCTIPES, *Gosse*, sp. nov.

(Pl. XX. fig. 15.)

[SP. CH. **Body** *projecting much above and behind the foot;* **toes** *two, coequal, slender, decurved, set side by side, wide apart.*

Of this remarkable species Dr. F. Collins has made several graphic sketches in his Note-book. It is of the *lunaris* form, stout, plump, and curved; the **foot** consists of a great basal bulb, wholly internal, and a second joint, thick and short, to which are articulated two toes; these are acute slender styles, so curved as to continue the outline of the body, mutually equal, set on the same plane, but (which is most unusual) *wide apart.*

The hinder body is ventricose, greatly overhanging the foot. There is a great aggregation of minute air-(or oil-)globules in the dorsal cavity. The **trophi** I supply conjecturally.

Dr. Collins has added to his figures the following note: "Head very large; rotatory organ compound; a large eye; peculiar ganglionic mass or brain lying on dorsal surface. Two toes, which it sometimes crosses; peculiar from being very wide apart, and decurved, as the toe of *Rattulus lunaris*. Found in a pool near Wellington Military College, Berks."—P.H.G.]

Length. Unrecorded. **Habitat.** As above.

Genus CŒLOPUS, *Gosse*.

[GEN. CH. **Body** *cylindrical, curved;* **foot** *bulbous, inclosed;* **toes**, *one broad plate with another laid upon it, in a different plane.*

A very remarkable deviation from normal structure is found in the species thus associated. Instead of two toes, consimilar and coequal, placed side by side right and left, like the legs of a man; here are two toes very unequal, hollow triangular plates of like shape, but of diverse dimensions, the smaller lying within the hollow of the larger. To use a homely comparison, let us suppose the bowl of a tablespoon, broadly truncate at the top and drawn out to a long point; then the bowl of a teaspoon of exactly the same shape, laid smoothly in its hollow; the two separately articulated to the foot-bulb, so as to be capable of independent motion to a slight extent.

These organs are so anomalous that it is hard to describe them as "toes." If it could be proved that the cloaca opens between them, we might say without hesitation that the larger and upper represents a true *tail*, the smaller and lower a stylate toe. But I have no knowledge on this point; which could be settled only by a rare accident,—the observing of the act of evacuation at the moment when the animal was viewed laterally.

In general figure and organization, there is so close an agreement with the former two genera, that the family affinity is indubitable. Several species I am able to associate as manifesting this structure: and, what is very curious, I have found it exhibited by a member of a remote genus,—one of the *Coluri* (*q. v. infra*).

It is possible that Ehrenberg's *Rattulus lunaris* may represent my *C. porcellus*. But the absence of any detailed diagnosis, in his text, leaves it doubtful; while his assigning of two eyes to his species is against the identification. The *Diurella rattulus*, Eyf., described and figured by Herr Eckstein, may possibly be the same thing. The delicate lines that are drawn through the middle of the toe, in his engraving, may be either the inner edges of two normal toes, or the outer edges of a single superposed toe; and the closest examination does not determine this. If the former, it is a species of my genus *Rattulus*; if the latter, a *Cœlopus*. His text also is ambiguous. "Two toes, long, much bent bellyward, and slender," seem to point to *Rattulus*; while "at their base they do not stand close side by side, but lie with their points one on the other," appear to indicate the peculiarity of *Cœlopus*, ill-understood.—P.H.G.]

C. PORCELLUS, *Gosse*.

(Pl. XX. fig. 18.)

Monocerca porcellus . . . . Gosse, *Ann. and Mag. Nat. Hist.* Sept. 1851.

[SP. CH. **Body** *cylindric, short and plump;* **lorica** *ridged;* **head** *with two projecting spines; the longer* **toe** *equal in length to the depth of the body.*

This neat, plump little creature always reminds me of a fat young pig. The general form may be compared to that of a well-filled sausage, a little bent, as sausages often are, and the varying shades of brown colour produced by the distended stomach and

ovary, add to the resemblance. The large head is bent downward; the brow and the chin project each in a sharp spine, between which the front is capable of a slight protrusion, ciliated, and furnished with a tubular antenna. Viewed dorsally, the front is ever and anon closed by the rapid approach of two triangular pieces from the sides, which recede immediately (cf. *Dinocharis*, &c.). The movement has no connection with the mastax. When the animal is confined by pressure, not sufficient to hurt it, it protrudes the jaws; and besides this a sort of veil is thrust forward, very thin and membranous, seemingly stretched between the frontal and mental points, and from an intermediate point (fig. 18*b*). The action, though frequent, is momentary, and the withdrawal is complete. The **lorica** terminates anteriorly by a strong transverse fold, at its full width, whence the mobile head is emitted, of much less apparent diameter. The difference, however, is mainly owing to a rather high dorsal **ridge**, which rises abruptly from the fold, and continues nearly equal in height to three-fourths of the body's length; or even, in some cases, to the whole.[1] The basal joint of the **foot** is a round transparent bulb of great size, almost wholly enclosed within the body-walls. It must not be confounded with the **contractile vesicle**, which is much smaller, and lies upon it. To this foot-bulb is so articulated as to allow very free vertical motion the remarkable form of toe which has been just described. It is usually bent forward toward the belly, but can be thrown out behind, particularly in swimming. The trophi resemble those of *Mastigocerca*: the fulcrum of the incus a long slender rod with the back elevated into a thin ridge; no trace of rami can be discerned, but their pendent divergent alulæ, which are unequal. The whole **mastax** is covered with fine transverse lines. A wide and long **brain**, of the normal form and position, carries near its middle a great deep crimson **eye**. On killing one by sudden pressure, the branchial vessels were severed from their connection with the **contractile vesicle**, and forced out, displaying some details of their structure. They appeared as a single tubule on each side, striate in parts with cross lines; towards their hinder parts are seen a number of transverse branchlets, whose ends have been torn off, suggesting not one but *many communications* with the **contractile vesicle.** There are also very minute structures attached at intervals to them, one near the head, resembling a twig of several leaves. These I cannot explain.

With this very attractive little creature I have been familiar since October 1849, when I met with it at Clapton, near London. It has occurred in many localities since. Its manners are sprightly and elegant. It is perpetually in motion, threading its way through the tangled conferva wires, and swimming across the open spaces, with a rapid gliding movement, turning on its long axis as it goes. The clear viscera, resembling bladders of various shapes and sizes, some filled with richly-coloured food or fæces, others granulate, or occupied with embryonic globules, all interspersed with orange-coloured fat-bubbles, and all seen through the transparent skin, have a most charming effect, as the animal thus revolves. It frequently arrests its roving course to examine the plants, and now and then to nibble at them, when the mastax is brought to the very front, and the jaws themselves are seen projecting from the head, and eagerly biting. Sometimes it swims round and round, in a circle of which the curved outline of the back forms an arc.—P.H.G.]

Length, $\frac{1}{7\frac{1}{2}}$ inch, of which the double toe forms about one-fifth. **Habitat.** Pools and lakes: widespread through Middle and South England (P.H.G.).

C. TENUIOR, *Gosse*, sp. nov.

(Pl. XX. fig. 19.)

[SP. CH. **Body** *cylindric, decurved, slender;* **lorica** *without sensible ridge;* **head** *defended by two or three projecting points;* **toe** *with two* **sub-styles.**

[1] I am almost sure that the ridge is inclined; its edge bending over towards the right. I have seen it distinctly wrinkled along the base, as seen in *M. carinata*.—P.H.G.

This species has manifest affinity with *porcellus*; but it is much slenderer, and its proportions are different. The width of the body to its length (exclusive of the foot) is as 1 : 4; whereas in *porcellus* it is as 1 : 2½. The **toe** is here beset with a short sub-style on each side (as in *Mastigocerca*); whereas in *porcellus* I can see no trace of these. The **lorica**, moreover, is not elevated into any sensible dorsal **ridge**. In all other respects it appears to agree with the preceding, except in being somewhat longer.

The species first occurred to my notice in water from Woolston Pond, sent me in September by the courtesy of Miss Davies. Several examples occurred, but all dead. A few days later I found it alive in water sent by Mr. Bolton from Birmingham, as well as another dead.—P.H.G.]

Length, $\frac{1}{100}$ to $\frac{1}{124}$ inch; depth, $\frac{1}{500}$ to $\frac{1}{650}$ inch. **Habitat.** Weedy pools. Woolston: Sutton Park and Coleshill, Birmingham (P.H.G.).

C. BRACHYURUS, *Gosse*.

(Pl. XX. fig. 21.)

Monocerca brachyura . . . Gosse, *Ann. and Mag. Nat. Hist.* Sept. 1851.

[SP. CH. **Body** *cylindric, short, plump, decurved;* **lorica** *not ridged;* **head** *without spines;* **toe-length** *less than the depth of the body.*

This species I described in 1851 from a single example taken on Hampstead Heath. It died before I had completed my observations; but I have since seen it on repeated occasions, from various localities, though always scarce. With much resemblance to *C. porcellus*, it is notably smaller; there is no trace of **ridge**; the twofold **toe**, though exactly similar, is proportionally shorter; the front is obtusely truncate, seen dorsally and laterally, and is destitute of projecting spines. When viewed endwise (as on many occasions), the transverse outline appears quite circular, so far as the back and sides are concerned. A long depending **brain** carries a great red **eye** at its tip. The singular appearance of a second eye *in the breast*, mentioned in my original diagnosis, occurred in no other specimen; it must have been illusory, though unaccountable. The viscera agree with those of *porcellus*; the **contractile vesicle** very large. The **toes** are almost always thrust up under the belly.

In manners this varies much from its lively predecessor, for though constantly in motion it is singularly slow and sluggish, creeping to and fro on the leaves of the milfoil, nibbling ever as it goes.—P.H.G.]

Length (without toe), $\frac{1}{175}$ inch; toe, $\frac{1}{580}$ inch; total, $\frac{1}{135}$ inch. **Habitat.** Hampstead Heath; Sandhurst; Woolston; Caversham (P.H.G.): pools: rare.

C. CAVIA, *Gosse*, sp. nov.

(Pl. XX. fig. 22.)

[SP. CH. **Body** *elevated and globose, very protuberant behind the foot;* **lorica** *without ridge or frontal spines.*

In the summer of 1885 Mr. Henry Davis kindly collected water for me near Snaresbrook in Epping Forest. Among other treasures found therein I met with this pretty little creature, which at first I was inclined to identify with *C. brachyurus*. It differs from it in form, however; the great elevation of its hinder quarters, and particularly the development of its buttock into a great plump breech, gives it the aspect of a squatting mouse or guinea-pig, and makes the double curved **toe** proceed (in appearance) from a notch in the belly, far forward. The **mastax** agrees with that of its congeners, of moderate size; but the **brain** is very large, and so is the **eye** at its point. The **stomach** was ample, filled with yellow food. Face truncate, slightly prone. The little thing was rather swift at first, but not wild.—P.H.G.]

Length (without toe), $\frac{1}{350}$ inch. **Habitat.** Epping Forest (P.H.G.).

[I suspect the *Distemma setigerum* of Ehrenberg to belong to this genus. He himself alludes to the liability of confounding it with *Rattulus*, as well as to the difficulty of resolving the very slender toe, which, at first sight, seems single; and to his inability to see any proper foot-joint. Yet he assigns to the species two eyes; which does not accord with any true species of *Cœlopus* known to me.—P.H.G.]

Cœlopus (?) minutus, *Gosse*, sp. nov.

(Pl. XX. fig. 20.)

[SP. CH. *Two* **eyes**, *wide apart;* **mastax** *and rotating* **cilia** (*apparently*) *wanting;* **body** *rotund, minute.*

Little as I know of this tiny animal, enough is manifest to show that it is one of much physiological interest. Though for convenience of reference, and because of certain conspicuous resemblances, I place it with the *Cœlopods*, it must be considered a species *incertæ sedis*. The general figure, plump and round, recalls *C. porcellus* and *cavia*, and so do the short, curved **foot**, thick at its base and tapering to a sharp point, and its manner of articulation. Yet, whether the structure of this member is that peculiar to *Cœlopus*,—a secondary spine lodged within the inferior concavity of the principal,—I cannot certainly affirm. I strove hard to determine this point, but could not obtain absolute certitude. It *appeared* single and indivisible.

But it is at the anterior extremity that the chief anomalies of the little creature are found. Two cervical **eyes** are seen, tiny globelets, brilliant and distinct, set wide apart, close within the outline on either side, in a dorsal aspect (fig. 20). I could find no trace of **mastax** or trophi, in general so largely developed and so conspicuous in this family; but instead of it what seemed a simple slender duct or tube, formed by the union of two short branches which communicate with the front, and open into a great sacculate **stomach**; as if the œsophagus had been continued upward,—the mastax being atrophied,—to the very front, or rather merged into the buccal funnel. Again, with the closest scrutiny I could detect no **cilia** nor any ciliary action.

Only a solitary example has occurred to my observation, from the Black Loch, near Dundee. It was alive but inert, and to a certain extent glued fast to the glass by an excretion from the foot.—P.H.G.]

Length, $\frac{1}{500}$ inch. **Habitat.** Black Loch, near Dundee (P.H.G).

Family XII. DINOCHARIDÆ.

Lorica *entire, vase-shaped, or depressed; sometimes facetted, often spinous;* **head** *distinct, with a chitinous covering;* **foot** *and* **toes** *often greatly developed;* **trophi** *symmetrical.*

Of the three genera, which together form the *Dinocharidæ*, two, viz. *Dinocharis* and *Scaridium*, resemble each other in the great length of the **foot** and **toes**, and in their conspicuous **condyles**. Both these genera are also completely **loricated**; but whereas in *Scaridium* the chitinous cuticle is thin, somewhat flexible, smooth, and transparent, in *Dinocharis* it attains a greater development than in any other genus of the Rotifera. For, not only is the trunk completely enclosed in a dense lorica shagreened with little knobs, ornamented with ridged facets, or bristling with spines, but the head and foot also are similarly protected, and the lorica stretches down even to the base of the toes. The third genus, *Stephanops*, resembles the first two in having a chitinous covering for the head, and in bearing stiff spines, which are not organs of locomotion, on various parts of the trunk; but its skin can hardly be termed a lorica, and its foot, though well-jointed and often spinous, is never immoderately long. The **head-gear** in the

three genera is also very different, and *Stephanops* has two **eyes** remote from the mastax, while *Dinocharis* and *Scaridium* have but one, closely applied to it. In all, however, the **trophi** are symmetrical, the family differing widely in this respect from the *Rattulidæ*.

Genus DINOCHARIS, *Ehrenberg*.

GEN. CH. **Lorica** *vase-shaped, dense, shagreened; facetted, and with projecting plates, or armed dorsally with spines;* **head** *retractile within a chitinous cap;* **eye** *single, apparently attached to the mastax;* **foot** *and* **toes** *very long, the former bearing spines.*

Two of the species of this genus, viz. *D. pocillum* and *D. tetractis*, resemble each other very closely; the main difference being that the former has, on the last joint of the **foot**, a small spine between the two toes. But the third species, *D. Collinsii*, is strikingly unlike the other two, in several respects. Their **loricæ** are vase-shaped, facetted and spineless; whereas its lorica is quadrangular, much depressed, free from facets, but notched round its edge and bearing long dorsal spines. The **head-coverings** are also unlike. Those of the first two species consist each of quadrantal pieces that can be brought close together so as to enclose completely the withdrawn corona; but in the latter species the head is protected on the dorsal surface by a notched shelly hood, and is uncovered on the ventral surface.

D. POCILLUM, *Ehrenberg*.

(Pl. XXI. fig. 1.)

Dinocharis pocillum . . . Ehrenberg, *Die Infus.*, 1838, p. 472, Taf. lix. fig. 1.
„ „ . . . Grenacher, *Sieb. u. Köll. Zeits.* Bd. xix. 1869, p. 497.

SP. CH. **Lorica** *vase-shaped, sub-cylindrical, facetted, without spines;* **foot** *and* **toes** *very long, and together nearly twice the length of the trunk;* **spurs** *curved; a short* **spine** *between the toes.*

The vase-shaped **lorica** of this species has a flat portion with scalloped edges down the centre of its dorsal surface; and a similar, but somewhat protuberant, portion on the ventral surface. These two plates are connected by stippled concave surfaces, which pass from a dorsal scallop to a ventral one and meet each other in stout transverse ridges, which are very prominent in a side view; and, when the creature is viewed directly in front, so as to obtain transverse views of the trunk, it is evident that the lorica, as shown in the elegant figure 1*c*, is produced on either side into delicate wing-like plates at right-angles to its surface. The **head** is protected by a complete cap, consisting of two pieces, which can fit together closely so as to conceal the corona, or fall back on each side into a fold in the neck in order to permit the head to protrude. The loricated **foot**, which is as long as the trunk, has three joints; on the last of which are two slender toes, decurved, bent outwards, and as long as the foot itself. Between the toes is a short chitinous **spine**. The first joint bears two stout **spurs**, usually about as long as the joint that bears them, but occasionally more than double the length. The front is rounded and set with small cilia: it is difficult to say what is the exact structure of the **corona**, or the arrangement of the ciliary wreath. There are a large **mastax** with sub-malleate trophi; two conical **gastric glands**; a broad cylindrical stomach; short intestine; moderate **ovary**; and very large **contractile vesicle**. This latter lies athwart the body when distended, and in that condition fills up more than one-third of the body-cavity: its time is four minutes. The **lateral canals** can be readily seen on the ventral surface, but I detected only one vibratile tag. There is a large crimson **eye** on the under surface of the **nervous ganglion**, which overlies the mastax so that the eye seems attached to this latter. Dr. Grenacher (*loc. cit.*) has seen two lateral rocket-headed **antennæ** on each side of the lower third of the dorsal surface.

This is an elegant and curious creature. With its toes well apart like a pair of com

passes, and its foot either thrown into one long curve or oddly bent zigzag fashion, it grubs among the sediment of the live-box; and sometimes it glides gently away by the action of the coronal wreath, with its long toes trailing gracefully behind it, just like *Scaridium eudactylotum*.

Length, $\frac{1}{80}$ inch. **Habitat.** Clear ponds and ditches, Hampstead Heath; Kew Gardens; Woolston (P.H.G.); Clifton, Birmingham (C.T.H.): not very common.

D. TETRACTIS, *Ehrenberg*.

(Pl. XXI. fig. 2.)

Dinocharis tetractis . . . Ehrenberg, *Die Infus.* 1838, p. 473, Taf. lix. fig. 2.

SP. CH. **Lorica** *vase-shaped, narrowing to the hind extremity, facetted, without spines;* **foot** *and* **toes** *very long, together more than twice the length of the trunk;* **spurs** *curved; no* **spine** *between the toes.*

This species is extremely like *D. pocillum*, differing from it chiefly in having no **spine** between the toes on the last joint of the foot. The **trunk** viewed dorsally has a somewhat triangular outline, the apex of the triangle being towards the foot, and is shorter in proportion to the foot and toes than it is in the former species. Mr. Gosse has observed in this species that the lorica runs off at the hind end into three, thin, transparent, and radiating plates, of which one is dorsal; and that this latter is not continued so far forward as the lateral plates, so that a transverse section shows no trace of the dorsal radiating one, but rather a slight depression between two gibbous swellings. This is well shown in fig. 1*c*, a transverse section through *D. pocillum*. Mr. Gosse has also seen many specimens of *D. tetractis*, in which the spurs on the penultimate joint were more or less deteriorated; so that in some they were reduced to short tubercles, or even effaced altogether. These latter specimens were precisely Ehrenberg's *D. pauper*, which can no longer, therefore, be entitled to rank as a species.

Length. Up to $\frac{1}{65}$ inch (P.H.G.). **Habitat** Clear ponds and ditches throughout England and Scotland (P.H.G.; C.T.H.): common.

D. COLLINSII, *Gosse*.

(Pl. XXI. fig. 3.)

Polychætus subquadratus (?) . . . Perty, *Z. Kenntn. kl. Leb.* 1852, p. 45. Taf. l. fig. 6*a*.
Dinocharis Collinsii . . . . . Gosse, *Intell. Observer*, vol. x. 1866, p. 269.
Polychætus spinulosus . . . . Archer, *Quart. J. Micr. Sci.* vol. viii. 1868, p. 72.

SP. CH. **Lorica** *depressed, sub-quadrangular, with serrated edges and eight dorsal* **spines;** **spurs** *straight;* **foot** *and* **toes** *short, together as long as the trunk.*

Though this Rotiferon is clearly a *Dinocharis*, it is a very singular one. The **foot** is short, the toes small, the **lorica** depressed, and a chitinous dorsal hood protects the head. The lorica is somewhat rectangular in shape, but broader in front than behind, with its fore corners rounded off, and its lateral edges serrated. At each hind corner a sharp **spine** projects, while six others rise from the dorsal surface. There is an outer pair attached to the shoulders, pointing down the back; and an inner pair, slightly decurved at the tips, rising from the central highest point of the lorica, and pointing diagonally outwards and upwards. A third pair, sharp and straight, rises from the hind end of the lorica, one on each side of the foot, and pointing outwards and upwards; while the first joint of the foot itself carries a pair of sharp chitinous **spurs**. The lorica is closed, much arched dorsally, highest in front, and flat on the ventral surface. The dense lorica, which is stippled in the central region, makes it difficult to define the internal structure; but Mr. Gosse, from whose Memoir (*loc. cit.*) this account is taken, succeeded in observing a globose **mastax**, ample **alimentary canal**, and rich ruby **eye**.

This *Dinocharis* was discovered by Dr. F. Collins in 1866, in a small pool in a wood near Sandhurst. Dr. Collins sent it to Mr. Gosse, who figured and described it (*loc. cit.*) in 1867. Dr. Max. Perty's *Polychætus subquadratus* may possibly, but not probably, be the same creature; if so, it is most inaccurately drawn and described. Mr. Archer's *Polychætus spinulosus* is undoubtedly *D. Collinsii*.

Mr. Gosse says of its habits that "it is rarely still, rooting among the sediment or swimming with a smooth gliding motion of no great speed. If I may judge of its behaviour in freedom from what is seen while under our notice, it seems to be a specially bottom-frequenting form."

Length, $\frac{1}{125}$ inch. **Habitat.** Sandhurst, Berks (Dr. F. Collins); Clifton (Mr. Brayley); Carrig and Callery districts, Ireland (Mr. T. Archer); Dundee (P.H.G.): rare.

Genus SCARIDIUM, *Ehrenberg*.

GEN. CH. **Lorica** *vase-shaped and compressed; or pear-shaped and depressed in front; very thin, transparent, smooth, without spines or projecting plates;* **head** *with a chitinous cuticle, except in front;* **eye** *single, really or apparently attached to the mastax;* **foot** *without spurs;* **toes** *very long.*

In the genus *Scaridium* the **foot** and **toes** (especially the latter) are remarkable for their great length, for the distinct **condyles**, which give them such free action, and for the powerful striated **muscles**, which enable the animal to jerk its long toes widely apart, and to strike the water violently with its foot, so as to make it an effective organ of locomotion. In both species the **lorica** is a transparent, thin, stiff skin, which appears to be continued over the foot; but its shape in the two species is very different: for, while the lorica of *S. longicaudum* recalls that of *Dinocharis pocillum*, the lorica of *S. eudactylotum* somewhat resembles in general outline that of a *Brachionus*. In each species the **eye** appears to be attached to the mastax, instead of to the nervous ganglion; this would be a very unusual arrangement, but it is possible that the appearance is due to the nervous ganglion's being closely applied to the mastax, and more than usually transparent.[1] The habits of the two creatures are similar. They swim quietly for a time, trailing the foot and toes behind them in an elegant curve; and then, with a sudden leap, they dart off into a new course.

S. LONGICAUDUM, *Ehrenberg*.

(Pl. XXI. fig. 5.)

Scaridium longicaudum . . . Ehrenberg, *Die Infus.* 1838, p. 440, Taf. liv. fig. 1.
„ „ . . . . Gosse, *Phil. Trans.* 1856, pl. xvii. figs. 64, 65.

[SP. CH. **Body** *compressed;* **front** *truncate;* **eye** *adherent to mastax; body, foot, and toes of about coequal length.*

The most remarkable peculiarity of this species is the anomalous character of the **eye**,—a large flattened capsule, with crimson pigment not quite filling it, permanently attached to the surface of the mastax, and apparently not connected, as usual, with the occipital **brain**, which, however, presses upon it from above and behind. The **trophi**, too, are very abnormal. (See my Mem., *loc. cit.*) The animal, with its long unwieldy foot and toes, reminds us, not less by its movements than by its form, of *Dinocharis*. It is active, swimming with unequal, not very swift, action, with little movement of the foot and toes. It has the habit of making sudden springs, using, apparently, for this purpose, the fore parts, *not the toes*.—P.H.G.]

[1] I suspect this to be the case in *S. eudactylotum*; but in *S. longicaudum* Mr. Gosse is confident that the eye is inseparably seated on the mastax.

Length, $\frac{1}{60}$ inch. **Habitat.** Stratford; Maidenhead; Cheltenham; Birmingham; Starmont Loch, Dundee (P.H.G.); pools and dykes: rare.

S. EUDACTYLOTUM, *Gosse*, sp. nov.

(Pl. XXI. fig. 4.)

SP. CH. **Lorica** *pear-shaped, depressed and narrowed in front;* **toes** *as long as all the rest of the animal.*

[*S. eudactylotum* was discovered in September 1881 in a small loch in Perthshire, by Mr. Hood, who sent me a tube of the water. This I found well peopled with this charming species. It is much more globose than *longicaudum*, and much more translucent, looking like an oval bubble of clear glass. The **head** is small, formed of several ciliated eminences. Among the turbid clouds, which are probably brain-matter, there are one or two oval spots, which refract the light strongly; but I cannot interpret them. As a small red **eye** always moves to and fro with the movements of the mastax, I conclude that they are organically united as in *longicaudum*. The incus and mallei are much more normal than in that species. The manubria, however, are tripartite, and the middle joint is largely and somewhat irregularly looped. The apparatus is unusually minute, obscure, and difficult. The mastax is distinctly three-lobed. There are a long œsophagus, wide **stomach**, intestine, and small **ovary** with nucleated ovarian vesicles. In one example was a small maturing egg. The longitudinal **muscles** are numerous, and unusually conspicuous, owing to the brilliant transparency. But the most remarkable feature is the **foot** of three articulations, with strongly marked condyles, and a pair of furcate **toes** of excessive length and tenuity. They are usually straight, but are sometimes a little curved outward at their tips. It is graceful and elegant in its motions. I have never seen one resting, but invariably swimming with a smooth even gliding, not at all rapid, often varied by a sudden spring or skip to one side, like its fellow *S. longicaudum*. The toes are very flexible, and highly elastic; sometimes when the animal suddenly turns, I have seen the toes bent almost double, but recovering their straightness in a moment. That the integument is a proper lorica, closed and vase-like, is undeniable; yet it is so thin and flexible that the head retracted every instant carries with it the in-turned delicate front edge, which is again everted. At the moment of eversion I have repeatedly seen what I believe to be an **antennal seta** of exceeding tenuity; but certainly no tubule or pimple.—P.H.G.]

The **lorica** is tolerably flat on the ventral surface, but on the dorsal is distinctly gibbous behind and depressed in front. Like that of *Brachionus*, it deepens down to the hinder third of its length, and then suddenly drops with two abrupt curves. Viewed dorsally (fig. 4), it can be seen that a central portion of the lower third is arched above the general surface, and kept so bent by transverse muscular fibres. The **head** on the ventral surface is scooped into a hollow above the buccal funnel, and the corona bears two hemispherical ciliated prominences. On the long œsophagus, at a little distance from the stomach, are two small stalked **glands** (fig. 4*a*) similar to those in *Pterodina* and other Rotifera. The **gastric glands** are of unusual size and form. They are Y-shaped (fig. 4), and each has its stem attached to the top of the stomach, and its outer branch continued up to, and round, the inner dorsal surface of the lorica, to which it is attached. Each inner branch hangs down, pointing inwards, towards the ventral surface, to which it is probably tied by a fine fibre. These glands are distinctly, though delicately, spotted with nuclei. The **vascular system** is best seen from the ventral surface (fig. 4*b*), where the lateral canals, surrounded by wide ribbons of delicate floccose matter, seem to adhere to a considerable portion of the lorica, keeping chiefly toward the sides. The **contractile vesicle** (fig. 4*b*) looks as if it consisted of an oval central chamber, surrounded by several smaller: an appearance probably due to the muscular fibres crossing it in a somewhat regular pattern. It is rather large, and a side view (fig. 4*a*) shows that it lies by itself at the hind end of the inner ventral surface, while the rest of the viscera

follow the arch of the dorsal. I detected four **vibratile tags** (fig. 4*b*) on each side: one near the top of the lorica one about the middle, and two on a plexus of tubes lower down. The **muscles** that pass down the foot to move it and the toes are very conspicuous and are coarsely striated; and the condyles of the toes (fig. 4*c*) are remarkable. The **nervous ganglion** (figs. 4, 4*d*) is so extremely transparent, that in can hardly be detected except by a chain of dark spots round its lower edge, which betray its presence when it moves. It is very long, cylindrical, with a rounded free end, and lies across the mastax and **eye** (fig. 4*d*). It may possibly be attached to both. Two rocket-headed **antennæ** can be seen, one on each side of the dorsal surface (fig. 4), and about one-third of its length from its base. I am indebted to Mr. J. Hood for the numerous specimens of this beautiful creature which enabled me to make drawings of it from various points of view, and to supplement the details given by Mr. Gosse.

Length, $\frac{1}{47}$ inch. **Habitat.** Pools near Blairgowrie (J.H.): very rare.

Genus STEPHANOPS, *Ehrenberg*.

[**Lorica** *cylindrical or pyriform, entire; head bearing a permanent, wide,* **circular shield**; **toe** (*or toes*) *often surmounted by a toe-like tail.*

The species which constitute this well-marked group are in general easily recognized by the beautful glassy shield which protects the head, and which, seen dorsally, instantly recalls the ring of glory which surrounds the heads of sacred persons in medieval pictures. This differs from the frontal hood in the *Coluridæ*, by being non-retractile, and having no motion apart from the whole head. Several of the species have spines affixed to the lorica or to the foot. The foot is habitually exserted, composed of joints which are stout, long, and distinct.—P.H.G.]

S. LAMELLARIS, *Ehrenberg*.

(Pl. XXI. fig. 7.)

Stephanops lamellaris . . . Ehrenberg, *Die Infus.* 1838, p. 478, Taf. lix. fig. 13.

[SP. CH. **Lorica** *pyriform, having a narrow neck, and slightly prolonged behind into three sub-parallel slender acute* **spines**; **foot** *furnished with a toe-like spine.*

The **form** is swollen and vase-like, with a marked everted rim or neck, within which the whole head has a slight motion, surmounted by its lovely round glory-shield, which equals the lorica in breadth. Under its shelter is seen the conical front with its rotating cilia, its oblique points, and its two ruby **eyes**, very wide apart. Below the rim or neck the **trophi** are conspicuous, formed on the pattern seen in *Euchlanis*. The viscera are normal, including an ample transversely-ovate **contractile vesicle**. The hind part of the lorica is deeply truncate, and the three **spines** are limited to the dorsal end. The **foot** consists of three joints, long, and strongly marked, of which the last (save the toes) carries a very slender spine seated on a tubercle on its dorsal side, not quite so long as the two toes. The foot joints are permeated with two long chain-like glands.—P.H.G.]

Length, $\frac{1}{160}$ inch. **Habitat.** A garden tub (P.H.G.): rather scarce.

S. MUTICUS, *Ehrenberg*.

(Pl. XXI. fig. 6.)

Stephanops muticus . . . Ehrenberg, *Die Infus.* 1838, p. 479, Taf. lix. fig. 14.

[SP. CH. **Lorica** *cylindric, having a distinct thick neck, and prolonged behind into a spoon-like shield, which is unarmed, as is also the* **foot.**

What I identify with Ehrenberg's *muticus* agrees better with his description and figures than with Eckstein's. Can the latter have made his drawing from two indivi-

duals, *lamellaris* and *muticus*, which he supposed one and the same? I confess I have had suspicions that these are but one species. I have had specimens in my live-box of what seemed *lamellaris*, with the three caudal spines clear enough; yet in a few minutes I could find only specimens of *muticus*, with no spines at all to be discerned, to my great bewilderment. It seemed as if the spines could at will disappear, but I cannot conjecture how. This has happened repeatedly. Except the greater development of the neck, there is little else to discriminate the two.—P.H.G.]

Length, $\frac{1}{160}$ inch. **Habitat.** Fresh waters around London; an aquarium at Torquay (P.H.G.): scarce.

S. UNISETATUS, *Collins*.

(Pl. XXI. fig. 8.)

Stephanops uniseta . . . Collins, *Science Gossip*, 1872, p. 11, figs. 9*a*, *b*.

[SP. CH. **Lorica** *ovate, its hinder end without points, but bearing a dorsal* **spine**, *very slender, straight, as long as the body;* **foot** *with a slender tail and two toes.*

The discoverer of this interesting form has furnished me with a number of examples from its original habitat: all inhabiting the leaves of a subaquatic moss. In the "Jour. Roy. Micr. Soc." 1885, Dr. Hudson has suggested the identity of Mr. Lord's species [1] with this; but I think its thick fore-parts, the curvature of its spine, and several other peculiarities, indicate their diversity. If so, we have five dorsal-spined species. The **spine** here is so attenuate that it may well be called a *seta*. According to my observations, it vibrates with the tremulous motions of the body, but has no proper separate motion. Its base is attached to a shelly knob, level with the bottom of the mastax; it is quite straight, and its point reaches the tips of the toes. The hind edge of the lorica is truncate and unarmed, as in *muticus*. There are two slender pointed **toes**, and a minute spinous **tail** at right-angles from their base.

The species affects concealment, but occasionally comes out to swim with a smooth gliding motion in the open interspaces; often subject to a momentary vibration throughout.—P.H.G.]

Length, $\frac{1}{200}$ to $\frac{1}{180}$ inch. **Habitat.** Sandhurst (Collins; P.H.G.): not rare.

S. CHLÆNA, *Gosse*, sp. nov.

(Pl. XXI. fig. 9.)

[SP. CH. **Lorica** *cylindric, forming a semicircular occipital shield, without any constriction;* **toe** *single.*

Ehrenberg's *S. cirratus* (not yet recognized with us) appears to lead to this, the sides being straight without any neck. The face is oblique, wider than any other part, beset with irregular fleshy lobes, with a retractile lobe forming a kind of chin. A great sac-like **brain** carries *one* minute **eye**, very difficult to be seen. The lorica, without any diminution in width, ends behind in three points, and resembles a short cloak reaching to the loins. From this descends a thick and long foot, whose penultimate joint carries an acute **spine** at a right-angle, which is a proper tail; thence a stout taper pointed toe, along whose middle a line may be dimly seen, suggesting two toes soldered into one. The rectum may be traced to a cloaca between the tail and the toe. Its manners are those of its fellows. In swimming, its movements, already rapid, are accelerated now and then by sudden starts, probably predatory.—P.H.G.]

Length, $\frac{1}{300}$ to $\frac{1}{150}$ inch. **Habitat.** Sandhurst: Woolston (P.H.G.)[2]; pools: rare.

[1] *Micr. News*, vol. iv. 1884, p. 146, fig. 24. The figure of this *Stephanops* has one dorsal spine, and one short spine, or tail, sloping upwards, just above the toes.

[2] There are differences in form and size between the Sandhurst and the Woolston specimens, so considerable that possibly these may be distinct species: the former much larger, more slender, the front not sensibly lobular; the whole animal yellow-tinged.—P.H.G.

Mr. J. G. Tatem ("Quart. Journ. Micr. Sci." vol. vii. 1867, p. 252, with figs.) described and figured a *Stephanops* (*S. longispinatus*) with one long dorsal spine, no posterior spines, and two short straight spines (one on each side) on both the first and second joints of the foot. Mr. T. Bolton (in 1884) published among his fly-leaves a *Stephanops* (*S. bifurcus*) with one long dorsal spine, and one short posterior spine slanting backwards and upwards, from the end of the lorica; both spines on the median line, and none on the foot. Mr. J. Hood in the same year sent me a drawing of yet another species (*S. armatus*) with one long dorsal spine, and two short posterior spines, one on each side of the end of the lorica slanting slightly upwards and outwards, and somewhat convex to the lorica. This species also had no spines on the foot. Mr. Hood's figure is given in pl. xii. of the "Journ. Roy. Micr. Soc." 1885.

Family XIII. SALPINADÆ.

[**Body** *more or less completely inclosed in a firm lorica, which is open at each end, and divided down the back by a fissure whose sides are united by membrane; two furcate* **toes** *always exposed.*

We come now to forms which are indubitably and manifestly loricate, the integument permeated by a peculiar chemical principle known as *chitine*, which imparts hardness and stiffness to it without diminishing its transparency. This substance is unaffected by alkalis, which immediately destroy all the flesh and membranous parts: a fact which is often useful to the scient, as by the addition of a minute drop of caustic potash to the cell containing a specimen to be examined, he can in an instant obtain the external form unchanged, generally clear and bright, with all the internal organs, that had marred distinct vision, dissolved away.

The animals we have now to consider are clothed in a coat-of-mail (*lorica*) more or less complete, of which the edges are sharply marked. Thus they display an evident analogy with the shelled MOLLUSCA, and one more close with the ENTOMOSTRACA, with which, in its bivalve tribe *Ostracoda*, the present family may be advantageously compared.

The lorica here consists of two lateral segments of an ovoid box, open in front and behind, for the emission of the head and the foot, the two edges parallel and approximate along the dorsal line, and either widely open along the belly, as in *Diaschiza*, or united and soldered into one there, as in *Salpina* and *Diplax*. The front is composed of ciliated prominences, not protected by an arching hood; the foot is provided with two furcate toes.—P.H.G.]

Genus DIASCHIZA, *Gosse*, gen. nov.

[GEN. CH. **Body** *compressed; the dorsal half of the trunk inclosed in a carapace, which is split medially; one* **eye** *present, usually cervical;* **trophi** *virgate, not distinguishable from those of* Furcularia; **toes** *long, blade-like, furcate.*

This well-marked group, now consisting of seven species, was wholly unsuspected a few months ago. One after another has occurred to my own observation, within the past year, and I strongly suspect that other species will yet be discovered. The genus forms a very striking link of connection between the Loricate and Il-loricate sub-orders, as will be shown, more in detail, under the remarkable species *D. semiaperta*.—P.H.G.]

D. VALGA, *Gosse*, sp. nov.

(Pl. XXII. fig. 12.)

[SP. CH. **Lorica** *decurved;* **eye** *occipital, small;* **toes** *long, slender, much decurved.*

Among filaments of *Myriophyllum*, growing in an aquarium, very thickly beset with various *Diatomaceæ*, &c., appeared in March 1885 an active, restless, little creature,

which, at first, I thought one of the common forms of the minuter *Notommatæ* or *Furculariæ*. But I presently perceived that it had peculiarities of structure, which were quite unfamiliar to me. Its figure is nearly that of a cylinder, somewhat bowed downward at each end, and a little arched along the dorsal line. A small truncate **foot** carries two slender toes, about two-thirds as long as the body, much decurved, so as to form a segment of one-fourth of a circle; these are usually carried wide apart. A large **brain** bears a red **eye**-point considerably anterior to its extremity, visible only at intervals; in subsequent specimens, however, sufficiently conspicuous.

The whole form and manners of this animal indicate its affinity with species which are il-loricate. The situation, dimensions, and structure of the manducatory apparatus are indistinguishable from those of *Notomm. lacinulata*; yet the dorsal parts are inclosed in a semi-cylindrical shell of transparent chitine, reaching about half-way down each side, with a straight edge; and cleft throughout the dorsal line, into two parallel halves, moderately separated (reminding us of a *Salpina*, or still more of my *Diplax compressa*), reaching to the end of the body, where each terminates in a point slightly over-arching. Anteriorly this bifid carapace terminates transversely at what may be called the neck, allowing the soft tissues of the head to be partially retracted for an instant, when the lateral angles of the lorica are seen as two unchanged blunt points. It is remarkable that, in a lateral view, the very front itself appears as if the integument were so stiffened with chitine as to project both above and below in slightly obtuse points (fig. 12*a*). I soon after found two individuals among conferva in a ditch at Coffin's Well, near Torquay; and still later in waters from many widespread localities. I find little variation in them. The dorsal cleft is shallow, but always visible when the animal turns.—P.H.G.]

Length. Of body, $\frac{1}{260}$ inch; of toes, $\frac{1}{320}$ inch; total, $\frac{1}{144}$ inch. **Habitat.** Torquay; Woolston; Sandhurst; Birmingham; Cheltenham; Oban (P.H.G.): not rare.

D. EXIGUA, *Gosse*, sp. nov.

(Pl. XXII. fig. 13.)

[SP. CH. *Minute;* **lorica** *flexible, constantly thrown into folds;* **eye** *cervical;* **toes** *thick at their base, less than one fourth of total length.*

On one or two occasions I had met with this little species in water sent me by Miss Saunders, from a window tank in her residence at Cheltenham. I had marked differences between it and *D. valga*, but yet set it down as that species, waiting for further light. More than five months afterwards, I was examining some of the pale impalpable floccose alga that grows thickly around the filaments of certain pond-weeds, originally from Dundee, but which had been several weeks on my table, when I saw this little thing in some number, and perceived that its peculiarities entitle it to specific rank. Though *valga* is a small species, this is not half its size; its proportions, too, are different. It is much plumper and more gibbous behind; the **toes**, instead of slender rods uniform in thickness, are long cones, tapering to acute points ,and only one-third of the length of the head and body. The investing integument is evidently very flexible, every contraction and every turn throwing it into strong folds. Yet, thin as it is, it is a true **lorica**, reaching half-way down each side, as in *valga*, and displaying the dorsal fissure quite distinctly, as one views it from behind; when it is seen to be very shallow. No other points in its economy seem noteworthy.—P.H.G.]

Length, $\frac{1}{325}$ to $\frac{1}{400}$ inch; toes alone, $\frac{1}{1300}$ to $\frac{1}{1700}$ inch; lorica, $\frac{1}{500}$ inch. **Habitat.** Algæ in fresh-water aquaria (P.H.G.): rare.

D. Hoodii, *Gosse*, sp. nov.

(Pl. XXII. fig. 15.)

[SP. CH. **Body** *gibbous and ventricose behind;* **dorsal cleft** *narrow, parallel-sided;* **eye** *cervical;* **toes** *rather short, blade-shaped, acute, decurved, one-fifth of total length.*

This little species comes near to *D. valga*, but is considerably larger, and more swollen in the posterior half of the body, whether viewed dorsally or laterally. The **toes** afford the most obvious discrimination between them. In both, each toe is a segment of a circle: in *valga* it is a slender rod of about equal thickness throughout its length, which is nearly equal to that of the lorica. In *Hoodii* it is shaped in one aspect like a carving-knife, in another like the half of the moon when three days old. As I have observed the forms of the toes in Rotifera generally to be very constant, I am disposed to rely much on them in specific diagnosis.

Only one individual occurred; and of this my observations were imperfect. I found it in the pale floccose alga, which invests aquatic plants near Dundee. In memory of this origin I honour the little *Diaschiza* with my respected correspondent's name. A few weeks after this, I was so fortunate as to find another example, in water sent me by Mr. Bolton, from Blackroot Pond, near Birmingham. In the former specimen I had not perceived any **eye**; but in this it was very conspicuous, of large size, and of somewhat pale rose-red hue, though brilliant, resembling *D. pæta* in colour, but in a less marked degree. It is cervical, occupying the extremity of an ample **brain**.—P.H.G.]

Length. Not measured, but about one and a half that of *D. valga*. **Habitat.** Loch near Dundee; pool near Birmingham (P.H.G.): rare.

D. pæta, *Gosse*, sp. nov.

(Pl. XXII. fig. 11.)

[SP. CH. **Body** *thick, widest in front;* **lorica** *with the dorsal cleft very narrow, its edges parallel and ridged;* **eye** *cervical, very large, pale;* **toes** *blade-like, recurved.*

In June 1885, soon after I had discovered *D. valga*, a little water was sent me by Miss Saunders, from Woolston, in which were a good many specimens of that species, some much smaller than I have described. In the same water, however, I found one much larger, which proved a second species of the same genus. Again was I deceived into the supposition that I was dealing with a *Notommata*, or a *Furcularia*, such as *F. gibba*, till I caught sight of the cleft down the back; and particularly, when, as the creature turned, I for a moment saw it from behind, and looked up along the furrow.

The **lorica** seems again to be a mere carapace, reaching no more than half-way down the sides, and cleft in a straight line along the back. It has an elevated **ridge** throughout; so that the cleft forms a furrow between the low walls; and these are much closer together than in *D. valga*, so that the furrow is very narrow. The dorsal posterior terminations do not run off into curved points, but make nearly right-angles. I judge the lorica to be very thin and flexible. The **toes** are slender, pointed blades, somewhat recurved, often carried parallel when the animal glides forward. The **mastax** is large, and seems formed quite on the pattern seen in *Furcularia*. Behind this is an ample **brain**, carrying at its sacculate extremity a *very large* globose **eye**, of *extremely pale*, transparent, carneous hue; this species differing thus from the former, in the position, size, and colour of the eye,—itself a well-marked and conspicuous distinction. The digestive canal is divided into stomach and intestine, both which are large and sacculate; and there is a **contractile vesicle**. The forepart of the abdominal viscera was, in this example, delicately tinged of a salmon-colour. At the cloaca, as if a minute portion of the intestine, there was protruded a little clear globose vesicle; perhaps accidental.

This species is in manners restless and recluse, seeking its food and shelter under

the skins of decaying algæ, and other aquatic plants. It seems reluctant to swim in the open water; but yet can glide along, smoothly and swiftly, when it pleases.

Three months had nearly passed, and I had met with no second example of this beautiful species, though examples of *valga* and *semiaperta* had been numerous. But then, in water from the same fruitful pond at Woolston, a specimen occurred, which seemed the counterpart of *pæta*, except that the great brain was destitute, so far as I could discern, of the pink eye, which had been the most conspicuous distinction of the species. Presently, however, another appeared; and here the whole occiput was instantly seen to be radiant with the soft, rose-red tint; the eye, in fact, or at least its pigment, occupying, just as in my first example, the whole lower part of the ample cerebral sac. Hence I infer that the rosy hue, normally pale, may sometimes become so dilute as to be practically undiscernible.—P.H.G.]

Length, $\frac{1}{110}$ inch. **Habitat.** Woolston Pond; Sandhurst, Berks: rare (P.H.G.).

D. SEMIAPERTA, *Gosse*, sp. nov.

(Pl. XXII. fig. 10.)

[SP. CH. **Body** *compressed, highest behind;* **lorica** *with the dorsal cleft closed in front, gaping behind, the ventral edges apparently approximate;* **eye** *frontal;* **toes** *long, slender, recurved.*

In describing *Furcularia gibba* (*supra*, ii. 43) I have spoken of the resemblance borne to that species by the present, a resemblance which extends to other species.

D. semiaperta bears much likeness to *D. pæta*, but is still larger; it is, too, higher behind, and the **brain** has no pink colour. There is, indeed, a well-defined oval **eye**, of *deep* red hue, but of moderate size, and situate near the front (fig. 10*b*). The brain is large, descending far down the back of the neck, quite clear, and strongly defined in outline. The locomotive cilia appear set on minute eminences over the whole rounded front, making no wheels, but visible as a simple fringe. The **trophi** are unusually large (fig. 10*d* [1]). The **lorica**, though split all down the back, has the edges of the fissure in contact at first, so that only the hinder half is open, and this but narrowly. In a succession of fair views that I had of one which was dying, looking down the back from the front of the head, not only was the gape of the lorica well seen to be but partial, but it evidently appeared that the cleft part was not elevated into a ridge, as it is in other species. The lorica-halves *appear* even to approach along the belly, as they do along the back. But I am not certain of this. Each division terminates behind in an obtuse, slightly-decurved point (fig. 10), often obliterate.

One individual of this species had two globose bladders protruding from the cloaca, as I have described in *D. pæta*. It may indicate a prevalent form of disease in the genus. In one specimen was a large dark egg, nearly matured. Another had the alimentary canal greatly distended, and of a greyish-blue hue, an unusual colour in Rotifera; but the mystery was explained by the fact that a colony of the Blue Stentor (*S. cæruleus*) was established on the same sprig of water-moss; and it became evident where the *Diaschiza* had obtained its dinner.—P.H.G.]

Length. Total, $\frac{1}{120}$ to $\frac{1}{88}$ inch. **Habitat.** Cheltenham; Woolston, numerous; Birmingham; Stormont Loch, Scotland (P.H.G.): pools, rather common.

[1] This drawing was made from a protracted and excellent observation of a recently dead specimen, completed without any reference to my published figs. (*Phil. Trans.* 1886). Yet it is seen how exactly the details agree with those figs. (35–40), and especially with 39 and 40 of the Memoir. In examining many dead specimens of *D. semiaperta*, I have obtained accurately the appearance of fig. 37; the long produced, decurved points of the incus explaining what had seemed so inexplicable *in situ*. I am, however, almost sure that these arching points proceed from the *fulcrum* between the *rami*, and are not prolongations of the wide glassy *rami* themselves.

D. TENUIOR, *Gosse*, sp. nov.

(Pl. XXII. fig. 14.)

[SP. CH. **Body** *sub-cylindrical;* **dorsal cleft** *of lorica wide throughout;* **toes** *thick, nearly straight, obtusely pointed.*

Here is a species which bears a relation to *Furcularia gracilis*,[1] similar to that which *D. semiaperta* bears to *F. gibba*. In September, 1885, while I was examining water, sent me by the courtesy of Miss Davies from Woolston Pond, my attention was arrested by first one and presently another, of what appeared indubitable *F. gracilis*. Each was either half-concealed, as it burrowed in the floccose matter, or in swift motion as it glided through the clear water; so that, while I could recognize the form and general character as accurately agreeing with drawings which I had carefully made of that species, many years before (except that these were of rather stouter build), I could get no opportunity of testing the condition of the back. Presently, however, I was so fortunate as to catch sight of the **integument** of a dead specimen of the same, perfect in form, but empty and transparent, the mastax *in situ*. By imparting currents to the water in the live-box, while the object was under my eye, I could turn it into various positions; among others, one in which I could look along the line of the back. It was distinctly double-ridged, and rather wide-cleft. The gap is of nearly uniform width from the occipital edge of the lorica to the hinder edge just over the foot. I have said that the form was stouter than of *F. gracilis*; it appeared stouter now than in the two living restless examples that had first attracted my attention. But I reflected that the dead lorica would naturally be broader than in life, because, the tegumentary membrane of the venter having been ruptured by decay, the elasticity of the dorsal shields would naturally cause their lateral expansion.

Circumstances prevented my further study of the two living specimens; and I can give no further information of the anatomy than what was to be learned from the dead body.[2] The features, however, that were visible were, from the very stillness of death, definable with precision. The **toes**, in particular, are diverse from those of any other known species, being not sensibly recurved nor decurved, but straight, or nearly, not blade-shaped, but round, rather thick, abruptly brought to a point.—P.H.G.]

Length. About $\frac{1}{120}$ inch. **Habitat.** Woolston Pond; Dundee (P.H.G.): rare.

Genus DIPLAX, *Gosse*.

(*Ann. Nat. Hist.* 2 Ser. vol. viii. Sept. 1851, p. 201.)

[GEN. CH. *As* Salpina, *but the* **eye** *is wanting, and the* **lorica** *is destitute of spines in front and rear;* **foot** *and* **toes** *long and slender.*

The two species of this genus I found both in the same water, Oldham's Pond, Leamington, and both on one day, July 13, 1850. Of the first, only one specimen occurred; the second was numerous. With a single exception of the latter, I have never again met with either. They both approach very close to *Salpina*, but the absence of spines is notable, and the toes are proportionally more attenuate and longer. The head is seated in a flexible tube, cleft at the occiput, which is capable of entire involution within the lorica. It seems an approach to the persistent neck-tube of *Dinocharis*, to which genus the present is allied by the condyles of the foot, and by the length and slenderness of the toes.—P.H.G.]

[1] I strongly suspect that Herr Eckstein's delineation of *F. gracilis* (*Sieb. u. Köll.* 1883, pl. xxvi. fig. 43) has actually been drawn from a specimen of *Diasch. tenuior*.

[2] Recently (March 1886) I have found it, in an aquatic moss sent me by Mr. Hood. It was very restless, but I saw that the trophi, viewed dorsally, were on the pattern of *Notommata lacinulata*.—P.H.G.

D. COMPRESSA, *Gosse.*

(Pl. XXII. fig. 8.)

Diplax compressa . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. Sept. 1851, p. 201.

[SP. CH. **Body** *much compressed; lateral* **outline** *of lorica nearly a parallelogram.*

The **lorica** consists of two trapezoidal plates, of which the ventral is the longest side, connected together a little within the dorsal edges, so as to leave a double ridge. The plates are bowed outward, laterally, and seem to be conjoined below. The whole lorica may be rudely compared to a cell made by two spoon-bowls soldered edge to edge. The transparent dorsal ridges can approach and recede, and are probably connected merely by elastic skin. The whole frontal region is occupied by the **brain**, which descends sac-like into the occiput, but shows no trace of **eye.** The **mastax** is small, and the trophi obscure. A digestive canal, very wide at its origin, almost opaque from granulation, diminishes, with no apparent constriction, direct to the cloaca in a straight course. The **ovary** was normal, and I saw an ample **contractile vesicle** of sluggish action. No **lateral** vessels were traced, but one **vibratile tag** was seen. Along the line which, in the lateral view (fig. 8), indicates the bottom of the dorsal cleft, there are seen three oval scars, possibly insertions of muscles for closing the valves. The **foot** consists of three lengthened joints, two of which are decidedly condyliform (as in *Dinocharis*), habitually protruded; it carries two divergent toes, straight, rod-like, acute.

The manners of the single specimen found were much like those of *Salpina*, but it swam more, rarely resting on its toes. It was found among the sediment in the phial, after several days' keeping.—P.H.G.]

Length. Of lorica, $\frac{1}{176}$ inch; total, when rotating, $\frac{1}{110}$ inch. **Habitat.** Leamington (P.H.G.): rare.

D. TRIGONA, *Gosse.*

(Pl. XXII. fig. 9.)

Diplax trigona . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. Sept. 1851, p. 201.

[SP. CH. **Body** *triangular in section; lateral* **outline** *of lorica ovate.*

There is much resemblance between this and the preceding; but the ventral side is flat, and about equal to each of the lateral sides; and the longitudinal outline of the back forms one third of a circle. The pectoral edge, which in *D. compressa* is but slightly notched, is in *trigona* indented with a broad and deep sinus (fig. 9). The neck-tube which incloses the head is only so far retractile, that, when its sides are brought together, they protrude between the lorica-edges, in form of a thin fold (fig. 9*a*). The frontal cilia are strong and bristle-like, grouped on prominences; behind which a very small **brain-sac** descends, with no visible eye. The **trophi**, of the common *Salpina* pattern, and the internal structure generally, are as in the preceding; almost always obscured by a vast aggregation of air-bubbles. A thick **tortuous vessel** runs down each side. The **toes** are very slender, straight rods, in some examples much longer than here figured. The surface of the lorica is delicately punctured.—P.H.G.]

Length. Of lorica, $\frac{1}{100}$ inch; total, $\frac{1}{90}$ inch. **Habitat.** Leamington; Stratford (P.H.G.): rare.

Genus SALPINA, *Ehrenberg.*

[GEN. CH. **Lorica** *an oblong box, furnished with spines, but widely open at each end, split down the back;* **head** *and* **foot** *protrusile;* **toes** *furcate, long, straight;* **trophi** *sub-malleate;* **eye** *single, cervical.*

A homely illustration of this common and well-marked genus may be obtained by supposing a *Notommata* or *Diglena* of long straight toes inclosed in a transparent shell. This shell, the **lorica**, may be compared to a pillow-case, open at the two ends, with one

long side (the dorsal) unsewn, whose edges remain approximate, yet separate.[1] Both ends run off into projecting points, which are grouped into four series, *occipital* and *pectoral* in front, *lumbar* and *alvine* behind; and these terms may be convenient for definition. The head can be retracted wholly within the lorica; but the **foot** only partially, and the toes never. These are moderately long, blade-shaped, acute, straight, divergent. The **eye** is usually conspicuous, single, rather large, placed on the occipital end of an ample **brain**. The **mastax** is large, globose, the **mallei** and incus well-developed, the former many-fingered. A bristle-bearing **antenna** is protruded between the occipital spines.—P.H.G.]

S. MUCRONATA, *Ehrenberg*.

(Pl. XXII. fig. 1.)

Salpina mucronata . . . Ehrenberg, *Die Infus.* 1838, p. 469, Taf. lviii. fig. 4.

[SP. CH. **Occipital spines** *two, procurved;* **pectoral** *two, wide apart, separated by a deep sinus;* **lumbar** *single, short;* **alvine** *two, recurved, separated by a wide and deep sinus; dorsal parts of the lorica minutely stippled.*

The **lorica** is somewhat three-sided, the back arched, and doubly ridged, with a narrow but deep furrow; the sides gracefully swelling; the belly nearly flat. The two **occipital spines**, antler-like, are bent forward and slightly approximate at their points, with a deep sinus between their bases. From the two edges of this sinus spring the two dorsal carinæ, arching to the middle in an elegant curve, and meeting in the conical lumbar spine. The two pectoral spines are short and nearly lateral, as are the two alvine; both pairs are mutually severed by a broad and deep excavation of the ventral surface of the lorica, while a similar sinus, less deep, bounds each of these pairs on the right and left. The flat ventral surface bulges out abruptly to form the pectoral spines. The head is very large, and is composed of many globose lobes, each of which carries a group of rotating cilia. An ample **brain** carries a small horizontal antenna, and a large cervical crimson **eye**. The **trophi** are frequently seen to protrude obliquely from the front, to nibble the floccose matters on which the animal feeds, which are, I think, exclusively vegetable. The **alimentary canal**, large and very sacculate, following a short œsophagus, carries two ovate clear **glands**, and leads (apparently without division) to the cloaca. In an experiment, it readily received carmine. An **ovary** often shews embryonic vesicles; and sometimes a great maturing egg adds to the size and to the beauty of the animal. The lorica is elastic; in looking up along the cleft I have distinctly seen the ridges approach and recede, sometimes nearly closing up and then gaping widely. The latter is coincident with retraction of the head-parts, and at the same time some of the viscera are forced up between the ridges, considerably above the level of their basal line (fig. 1).

Though active, it does not swim much. It chiefly courses up and down among the roots of the duckweed, which it affects, examining each in detail. It is not very sensitive to alarm, caring little for taps or jars upon the instrument. The toes are often expanded and closed. It is nearly colourless.—P.H.G.]

Mr. E. C. Bousfield has seen a male *Salpina* attached by its penis to a female which was probably *S. mucronata*. It seemed to him that the male organ pierced the ventral surface of the foot at the base of the first joint. This appearance was doubtless due to the male's adhering externally by the broad end of the retroverted penis. Dr. Plate[2] says that the male of *Hydatina senta* pierces the female, anywhere, with its penis. He admits that he has never seen the organ within the female's body, and that he never could find any aperture after the apparent penetration; but suggests that the cilia of

[1] The dorsal fissure is not of fixed width, but variable at the will of the animal. An example (not quite mature) of *S. brevispina*, which was sitting quite still, end-on, so as to give me an excellent sight, had its dorsal cleft rather wide open; while I looked at it, it deliberately closed up the sides to mutual contact.

[2] *Jenaisch. Zeits. f. Natur.* 1885, p. 37.

the penis make very minute punctures in the skin, and that the rod-like spermatozoa find their way through these. Such hypothesis scarcely requires serious notice; but I may mention that Mr. Brightwell, Mr. Gosse, Mr. Hood, and myself have all seen coïtus take place, in various Rotifera, at the cloaca.

Length. About $\frac{1}{100}$ inch; lorica, $\frac{1}{150}$ inch. **Habitat.** Weedy pools; duckweed; around London (P.H.G.); Sandhurst, Berks (Dr. Collins).

S. SPINIGERA, *Ehrenberg*.

(Pl. XXII. fig. 2.)

Salpina spinigera . . . Ehrenberg, *Die Infus.* 1838, p. 470, Taf. lviii. fig. 5.

[SP. CH. **Occipital** *and* **pectoral spines** *scarcely diverse from the preceding;* **lumbar** *a long, slender, acute spine, slightly recurved;* **alvine pair** *slightly divergent and decurved; sinuses separating the occipital from the pectoral, and the lumbar from the alvine, with straight bottoms.*

The species of this genus are so consimilar that little more is needful than an enumeration of the points of technical difference. These will be better discerned from the figures than from verbal description. Though minute, they are constant, and I think, therefore, specific. The most marked, here, is the production of the **lumbar point** into a true spine in which the ridges meet, and which takes a direction different from their outline. The sides have oblique corrugations; and the general surface is coarsely stippled in various degrees. The **eye** is large and pale red. It is certainly a rare form; yet I have met with it on various occasions.—P.H.G.].

Length. Of lorica, $\frac{1}{150}$ inch. **Habitat.** Pools at Battersea Rise; Hampstead Heath; Leamington; on *Ceratophyllum* (P.H.G.).

S. BREVISPINA, *Ehrenberg*.

(Pl. XXII. fig. 4.)

Salpina brevispina . . . Ehrenberg, *Die Infus.* 1838, p. 470, Taf. lviii. fig. 8.

[SP CH. **Occipital spines** *wholly wanting;* **pectoral pair** *short and straight;* **lumbar** *and* **alvine** *as in* mucronata.

The total lack of the pair of **occipital spines** to the lorica is a clear distinction of this species, the anterior extremities of the dorsal carinæ not sensibly projecting beyond the level of its truncate front, which, however, is not quite a straight line. The dorsal arch, and the lumbar joint which terminates it, are nearly as in *mucronata*, only the point is much shorter, and the sinus between it and each alvine spine is circular. The surface is delicately stippled or covered with impressed dots. The ventral plane of the lorica has not that abrupt bulging, which marks both the preceding species; the dorsal is more strongly arched than in either.

This species is sufficiently common in the fine-leafed aquatic vegetation of ponds and ditches. Its manners are precisely such as have been recently described. I do not know how to distinguish between this and the *S. reduncа* of the same author.—P.H.G.]

Length. About $\frac{1}{150}$ inch. **Habitat.** Lakes and pools: very common (P.H.G.).

S. MACRACANTHA, *Gosse*, sp. nov.

(Pl. XXII. fig. 6.)

[SP. CH. **Occipital spines** *wanting;* **pectoral pair** *short, straight;* **lumbar spine** *and* **alvine pair** *long, straight; the latter much longer than the former; the anterior and posterior ends of the ventral side of the lorica deeply excised; lorica-surface not stippled.*

The **lorica** of this fine species is ventricose; the dorsal cleft is widely gaping. The lumbar union of the carinæ forms a true spine comparatively long and slender, yet is

much exceeded by the stout straight and long alvines. For many years I knew it only by a single dead specimen found in a pool at Maidenhead in September 1851. But recently (March, 1885) I met with a healthy example on *Myriophyllum* in one of my reservoirs at Torquay, which enabled me to complete my diagnosis and delineation.

The great head is sub-lobate, beset with brushes of cilia, stout in the middle, becoming more slender on all sides. A great occipital **brain** carries a very large and brilliant red **eye**, and a rounded **antennal lobe**, bearing a few setæ. The great **mastax**, when feeding, is protruded through the mental sinus. The abdominal viscera are normal, except that the **gastric glands** seem wanting; and there appear to be two **contractile vesicles**, into which the two lateral canals open by a trumpet-shaped mouth.

The manners were similar to those of other *Salpinæ*, nibbling eagerly and perseveringly, as it crept, the vegetable surface of the milfoil, with its protruded trophi.

After it had remained in energy for several hours, I killed it, by mingling with the water in the live-box a minute drop of sol. caust. pot., whereby all the soft parts were instantly dissolved. There remained, however, uninjured, 1, the great red eye, which, in one aspect, had a quadrate form: 2, the two toes: 3, the whole manducatory apparatus. A few minute air-bubbles were scattered through the visceral cavity. I could now discern that the surface of the lorica is not at all scabrous, by which (as well as by the other peculiarities already adduced) it may well be distinguished from Ehrenberg's *S. ventralis*, to which it yet approximates.—P.H.G.]

Length. Of lorica, $\frac{1}{76}$ inch; breadth and depth, each $\frac{1}{200}$; length of toes, $\frac{1}{290}$.
Habitat. Maidenhead; Torquay (P.H.G.).

S. EUSTALA, *Gosse*, sp. nov.

(Pl. XXII. fig. 5.)

[SP. CH. **Occipital spines** *wanting;* **pectoral pair** *short, incurved;* **lumbar spine** *conical, short, arched;* **alvine pair** *very long, stout, and incurved;* **dorsal cleft** *narrow, of equal width.*

The **lorica** is gracefully ventricose, the back and sides being much arched, the belly slightly. The great alvine spines strike attention, as a conspicuous feature in all aspects; they being long, thick at their bases, and incurved to the points, which are obtuse and approach each other. The lumbar spine is the united termination of the two dorsal ridges; it is only half the length of the alvines, conical and sharp-pointed, slightly arched on the dorsal edge. The dorsal cleft, narrow and of equal width throughout, reaches to the very front edge, which then is nearly horizontal on each side, but on reaching the pectoral side, after a deep sinus, rises to a short sharp spine. The whole surface of the lorica, ventral as well as dorsal, appears stippled or punctured with minute sunken dots. But, in some examples, this is hardly perceptible; while, in others, it is coarse and conspicuous. The head, viewed laterally, is about as deep as the body; the front is made up of an intricate series of eminences (carefully delineated in fig. 5*a*); one large lobe, toward the *mentum*, is crowned with stout and long cilia, which curve forward uniformly when in vigorous motion; other lobes carry much finer, shorter, and straighter cilia. There is a thick, obtuse, **antennal lobe**, bearing a brush of fine setæ near, *but not at*, its extremity; and, within its walls, are seen curves and lines connected interiorly with a great descending **brain**, near the point of which is a round red **eye**. The internal structure is, in general, normal. But what appears peculiar is that there are (if I have not greatly erred) two coequal and consimilar contractile bladders symmetrically placed, large and conspicuous, each of which receives the dilated end of a lateral vessel.[1] And this does not seem to be a series of twisted cords, but a long slender sac, dilated here and there, where globular vacuoles are seen within.

[1] These vesicles were exactly alike, each subtrigonal, seated (optically) on each side of the circular orifice for the outlet of the foot. Each was evidently the terminus of the respiratory apparatus of its side, which, a rather wide ribbon or bag of clear tissue, containing several vacuoles, opens by a trumpet-

This large and handsome species, one of the finest of the *Salpinæ*, I was at first inclined to identify with *S. redunca* of Ehr.; but it is more than double the size of that species, and the great development of its alvine spines sufficiently distinguishes it. It may be regarded as bearing the same relation to *redunca* as *S. macracantha* bears to *ventralis*. I have seen several examples; one from the Lake at The Grove, Stanmore, the residence of my esteemed relative, Mrs. George Brightwen.—P.H.G.]

Length, $\frac{1}{86}$ inch; horizontal width, $\frac{1}{175}$ inch; depth, $\frac{1}{235}$ inch. **Habitat.** Woolston; Stanmore (P.H.G.): rare.

S. SULCATA, *Gosse*, sp. nov.

(Pl. XXII. fig. 7.)

[SP. CH. **Occipital spines** *two, slightly procurved;* **pectoral** *two, straight, acute;* **lumbar** *single, short, with a widened base;* **alvines** *longer, straight;* **dorsal cleft** *very wide, with outcurved edges.*

The **lorica** is of the usual outline, but somewhat wide, both in the vertical and lateral aspects. Of the anterior spines the pectoral are the shorter and straight, the occipital incurved. In the rear, the alvine pair the longer, and recurved; the lumbar short, straight, acute, with an abruptly widened cuneate base. From this lumbar point two dorsal ridges run up, curving outward to the occipital spines (figs. 7, 7*b*), inclosing a shallow depression, which appears covered with only membranous integument. The lorica, on the ventral surface, is quite continuous and evenly rounded. I had some protracted and satisfactory sights of the creature in various positions, particularly from a point directly in the rear, and at different angles, by which I distinctly saw the dorsal furrow. One of these views is carefully delineated at fig. 7*b*.

I know this form only from a single specimen just dead (but with the soft parts not yet decayed), which occurred, Sept 14, 1885, in water from Woolston Pond, sent me just a month before. It seems to be undescribed, yet well-marked by its broad dorsal furrow, widening forward. It has no relationship with Ehrenberg's *S. bicarinata*, from which, however (to judge by his figures,—for of diagnosis he gives none), it is sufficiently distinct. It is a small but interesting form.—P.H.G.]

Length. Of lorica, without toes, $\frac{1}{160}$ inch; transverse width, $\frac{1}{315}$ inch. **Habitat.** Woolston (P.H.G.): rare.

[I am indebted for my knowledge of a very distinct species, *S. mutica*, to Dr. Collins's Note-book of pencilled sketches, minute but carefully executed. I have enlarged his figures (Pl. xxii. fig. 3). He has added no note to this form; but his delineations were made from specimens procured from a secluded pool near Sandhurst Military College, in December 1866. He identifies the species with *S. mutica* of Herr Perty.

From these it appears that the lorica does not vary much from the normal form (as in *S. brevispina*, for instance); save that the front is straightly truncate, without any spines, that the dorsal fissure is narrow and shallow throughout, and that it slightly widens behind, where its edges terminate in two very slightly prominent lumbar points: alvines seem wholly wanting. This species looks toward the genus *Diplax*, as *sulcata* looks toward *Diploïs*, yet both appear to be true *Salpinæ*.—P.H.G.]

Genus DIPLOÏS, *Gosse*, gen. nov.

[GEN. CH. **Lorica,** *more or less depressed, ovate in outline; formed of two subequal plates, united by elastic membrane; the* **dorsal plate** *arched, ridged, and split down the middle; the* **ventral** *flat;* **toes** *straight, furcate;* **eye** *single, cervical.*

shaped expansion, into the upper obtuse point of the bladder. (See the description of the preceding species.)

Of the two noble species for which this genus is constituted, the general form and aspect suggest their location in the next family, while the technical characters fix them here. At the first glance at their elegant forms, like ample oval plates of the clearest glass, evidently broader than deep, we hesitate not instantly to pronounce them normal *Euchlanes*; but a moment's observation reveals a fissure through the back, so characteristic of the *Salpinadæ*. The affinity between *Diploïs propatula* and *Salpina sulcata* is very close.

The internal organization, so far as observed, agrees with that of *Euchlanis*.

It is possible that the *E. bicarinata* of Herr Perty and the *E. Weissii* of Dr. Leydig may belong to this genus; but I have seen no diagnosis, or figure, of either.—P.H.G.]

D. PROPATULA, *Gosse*, sp. nov.

(Pl. XXIV. fig. 2.)

[SP. CH. **Dorsal cleft** *wide before, closed behind;* **ventral plate** *considerably less in outline, furnished with three spines behind;* **toes** *very long, of uniform thickness.*

This species is broadly ovate, sometimes nearly circular, in outline, the **dorsal plate** strongly arched, and medially ridged; the ridge cleft so widely that the lorica is obliterated at its front in a vertical view, forming an acute point at each side. Each side of the fissure, from the lateral point, approaches the other in a graceful curve, till, at the hind-back, they unite at an acute angle. The posterior margin of the plate extends beyond this, forming the uninterrupted segment of a circle. The ventral plate is of similar outline, but very much smaller, and quite flat. It ends behind in three acute spines, of which the laterals diverge and the middle one projects from the general level. The **foot**, of strongly marked articulations, is protruded between the plates; the toes, of great length and tenuity, are straight, of uniform thickness throughout, with blunt points. No setæ have been detected on the foot-joints. The internal organization presents nothing distinctive, so far as it has been observed.[1]

The interspace between the lorica-plates is considerable; and this, together with the great width of the dorsal cleft, produces a curious effect, as the animal twists about, making the triple character of the lorica, with its points and angles, very apparent.

This distinct and imposing form has but recently come under my personal observation. But it is figured by Dr. F. Collins in his Note-book, from specimens obtained twenty years ago near Sandhurst Mil. Coll. Figs. 2 and 2*a* are carefully copied from his pencil sketches.[2] On two separate occasions I have found the species, at each time in water sent from the original pool, which thus is its only recognised habitat. Its motions are elegant and lively, and its appearance most attractive.—P.H.G.]

Length. Fully extended, about $\frac{1}{50}$ inch. **Habitat.** Pool at Sandhurst, Berks (Dr. Collins; P.H.G.): rare.

D. DAVIESIÆ, *Gosse*, sp. nov.

(Pl. XXIV. fig. 3.)

[SP. CH. **Dorsal cleft** *narrow, parallel-sided, open throughout;* **ventral plate** *nearly equal, with no posterior spines;* **toes** *blade-shaped.*

This species occurred in water dipped from Miller's Pond, Woolston, The **lorica** is decidedly triquetrous, the dorsal plate rising with sides slightly bulging, to what would

[1] It will be observed, however, that while in my own figure (2*a*) the gastric glands are of the ordinary form, Dr. C. has represented a pair of large pyriform sacs, each containing a vacuole, with long and slender ducts which lead from (or into) the œsophagus. These suggest the remarkable structure found in *Pterodina*, to which I refer the reader.

[2] The toes are here represented as out-curved; whereas, in the living examples I have seen, these organs were quite straight. Dr. Collins is a very accurate observer, and the length and curvature of the toes ("slightly curved") are distinctly mentioned in his MS. notes. In his transverse section, moreover, the lorica-plates are much closer together than I have seen them. Possibly, in both these particulars, there is some individual variation.

be a sharp medial line, but that it is split throughout, and so forms a narrow furrow with low walls. Though the *fissure* can be distinctly traced to the occipital edge of the lorica, I am not quite sure that the *ridge*, or *wall*, begins to rise above the dorsum-level quite so early; perhaps not till the middle of the length, and then gradually. The two strong sharp points at the hinder end of the dorsum, so conspicuous in many aspects of the living animal, are but the optical expression of the ends of the dorsal ridges seen vertically. The ventral plate is sensibly less in outline than the dorsal: it is ovate with the pectoral edge truncate; flat, thin, and glassy; at each extremity it becomes delicately membranous. The **foot** consists of three distinct joints, long, and regularly diminishing; they are habitually extruded between the plates, perhaps in a sinus of the ventral; but I am not sure of this. The toes are moderately long, slender, blade-shaped, being (very slightly) dilated beyond the middle, and then rather abruptly pointed. No setæ are visible. The condition of the **dorsal cleft** is not invariable. Sometimes it is seen to extend not more than half-way up from the tip: or even to be closed nearly to the points, expanding there rather suddenly. Possibly the lorica is elastic, and subject to the animal's will; for I have certainly seen the fissure wide throughout. The hyaline transparency of the whole, while it enhances the beauty of the creature, increases the difficulty of discerning all particulars of its structure, even those that are external; especially as, from the incessant movements and changes of axis in swimming, it is almost impossible to focus any one part in any one position. The **front** consists of a number of low prominences, each rising to an obtuse cone, and each crowned with a row of vibrating cilia. The **mastax**, an oblate sphere, presents nothing noteworthy; the **brain** descends sac-like behind it, with a round deep-red **eye** near the middle of its internal side, distinctly crowned with a refracting lens. The stomach and intestine, not separable, occupy a large space in the body-cavity, usually filled with contents of an uniform rich deep-brown hue. This greatly adds to the animal's beauty, as it constantly roves up and down the narrow cells made by the crossing filamentous leaves of *Myriophyllum* in the live-box.

In general form and appearance this species very closely resembles the larger *Euchlanes*, which all its manners and actions perfectly represent, and do not in the least remind one of a *Salpina*. It is a fine addition to our Rotiferous fauna. Since it appears new, I honour it with the name of Miss Davies, of Woolston, Hants: a lady who has long made the Rotifera her special study, and to whose courtesy I am indebted for my first knowledge of the species.

Specimens have come under my observation, not only from the extreme south of England, but, on repeated occasions, from Scotland. It is, however, rare.—P.H.G.]

Length. Extended, $\frac{1}{50}$ inch. **Habitat.** Woolston; Dundee (P.H.G.).

Family XIV. EUCHLANIDÆ.

Lorica *of two dissimilar plates, one dorsal, one ventral, united so as to form two confluent cavities, of which the upper is much the larger;* **foot** *jointed, furcate.*

Genus EUCHLANIS, *Ehrenberg.*

GEN. CH. **Dorsal plate** *with the medial portion arched;* **ventral plate** *nearly flat, usually with a flange on either side;* **eye** *single, just above the mastax.*

There are no more beautiful or perplexing Rotifera than those contained in the genus *Euchlanis*. Their large size and brilliantly transparent loricæ render them most attractive objects for dark-field illumination; and it is by this method of exhibiting them that the true structure of their loricæ can be best determined. The animal must have room enough to swim at its ease, and there must be a few bits of algæ for it to creep on. Then, as it turns while swimming, or as it works its way over and round the weeds, the creature will display all the beauties of its glassy armour; which, invisible at one moment, will flash out at another in broad plates and unsuspected surfaces.

To get a clear notion of the form of the **lorica**,[1] suppose that the shell of a tortoise has its flat base split longitudinally down the middle; and then that half of each part, on either side of the split, is bent down at right-angles to the flat base. Further suppose that a second flat oval plate, smaller than the base, is cemented to the free edges of the bent-down parts, and the resulting form will closely resemble the lorica of an *Euchlanis*. It is obvious that a small box will thus be formed below the true base of the tortoise-shell, and that its cavity will be continuous with that of the shell, and that its bottom will project on either side as a **flange**. Moreover, on the outside of this box, on either side of it, will be a long furrow, bounded by the oval plate above, the flange below, and by the side of the box. In the actual lorica of *Euchlanis* the portion corresponding to the small box, below the true shell, contains a considerable portion of the viscera; while the furrow (when the animal is viewed sidewise) often presents the edges of the two bounding planes so as to look merely like two parallel lines running from front to rear. If we further suppose that the altered tortoise-shell, with its attached second plate, is made of glass, and that it is held up so as to have the lower plate fully exposed to view, it is clear that we shall see *three* sets of **edges**. First the outside edge of the proper base of the shell; secondly, within the first and parallel to it, the smaller oval edge of the lower attached plate; and thirdly, within this latter oval, the edges of the bent portions to which the lower oval plate is attached, and which connect the upper oval plate to the lower one. All these lines can be plainly seen in the ventral surface of *E. dilatata* (Pl. xxiii. fig. 5); where *a* is the edge of the dorsal plate, *b* is the edge of the ventral plate, and *c* the edge of the connecting portion at right-angles to both. The position of the inner two of these three lines varies greatly with the different species, according to the relative sizes of the upper and lower flat plates; and so does the distance between these plates, and consequently the breadth of the longitudinal side furrows. These differences are great helps in distinguishing the species, which have been much confounded. Another assistance is the presence or absence of a sharp **notch** (Pl. xxiii. fig. 2*b*) in the occipital dorsal surface of the lorica. In some species there is no such notch, but a wide gap (Pl. xxiii. fig. 5*a*), and the dorsal portion of the lorica near the head is membranous; so that it has no constant outline when the head is retracted.

Mr. Gosse is of opinion that his two species, *E. deflexa* and *E. pyriformis*, as well as a third lately discovered by him, have no ventral plate, but have a ventral membrane instead of it. On this account, as well as on account of a peculiarity in the structure of their rami, he would separate them from *Euchlanis* as a new genus, under the name *Dapidia*. As, however, we do not agree on the first of these two points, we have thought it better to leave the creatures, for the present, with their names unaltered.

Ehrenberg has made use of delicate **setæ**, which are sometimes found on the foot, in order to separate the species; but neither Mr. Gosse nor myself thinks this a character that can be trusted. For the setæ are difficult to be seen, are liable to injury, and are certainly not constant in their presence in the same species. The internal structure of the various species is so closely alike that a description of it in one species will very nearly serve for that in any other.

E. LYRA, *Hudson*, sp. nov.

(Pl. XXIII. fig. 1.)

SP. CH. **Lorica** *long, narrow, oval, depressed;* **transverse section** *a low circular segment;* **dorsal occipital edge** *membranous;* **hind dorsal edge** *without a notch;* **ventral plate** *with a very narrow flange, of wavy outline, elliptical and broadest at the hind end;* **setæ** *absent.*

[1] Ehrenberg quite misunderstood the lorica of *Euchlanis*, which he imagined to be open down the ventral surface between the two inner lines *c*, *c* (pl. xxiii. fig. 5). This mistake, and the omission to draw or account for the line *b*, *b*, has led to endless confusion in determining the species. Dr. Cohn, however (in *Sieb. u. Köll. Zeits.* ix. 1858, p. 289), fully explained the error about the lines *c*, *c*; but missed the flange of the ventral plate with its edges *b*, *b*.

I found this large and beautiful new *Euchlanis*, in June 1885, in water sent to me by Mr. Thos. Bolton, from Sutton Park, Birmingham. It can be easily recognized by its long oval **dorsal plate**, which has not a trace of a **notch** behind, and by the curiously rounded end of the flange of its ventral plate, which, unlike that of any other *Euchlanis*, is widest at the hind end, and elliptical there in outline. As in *E. dilatata* and *E. macrura*, the dorsal plate is membranous near the head. The creature is very transparent, and it has a way of jerking its toes apart and then keeping them open, which is very characteristic. It has unusually large **foot-glands**, and shows the adhesive nature of their secretion by slowly twirling round, first on one toe and then on the other, for several minutes at a time. From the ventral surface it is easy to see the structure of the **corona**. It is truncate, and gouged out, as it were, above the buccal orifice, somewhat in the fashion of *Hydatina senta* (Pl. xiv. fig. 1*c*). A fringe of small **cilia** surrounds its outer and inner edges, and on the face of the corona itself are curves of larger cilia, whose ground plan is shown in black lines in Pl. C. fig. 10. Two **papillæ** rise from the same surface, very visible on a dorsal view, which seem to be tubular, but in which I have never detected anything like a tactile organ. Dr. Plate[1] figures the similar organs in *E. dilatata* with a triradiate passage down their length. He says that they are covered with a very delicate membrane, and suggests that they serve for respiration. The **trophi** are sub-malleate with five teeth in each uncus. The **stomach** is tied on either side by muscles, which are attached to the border of the lorica at one end and to the middle of the alimentary canal at the other. From these latter points muscular fibres pass diagonally upwards along the surface of the stomach, and by their perpetual contractions throw it into ever-varying folds; while at the same time the lateral muscles twitch the stomach from one side to the other. Yellow oil-globules, often prettily arranged in quincunx fashion, are imbedded in the thick stomach-walls; and in the intestine, which is usually most obvious, the furious motion of its lining cilia can be seen with ease. The **gastric glands** are curiously lobed on the ventral side (fig. 1*a*) and contain large nucleated cells. The **foot-glands** are very long, club-shaped, and bent over almost to the edge of the lorica; they are continued down the short three-jointed foot, and end in each toe in what appear to be three very delicate, adhering, quill-shaped vessels (fig. 1*b*), with their pointed ends near the toe's extremity. The toes are two short, stout, sword-like blades; and, so far as I could see, without **setæ**. The **vascular system** is conspicuous. Two intertwined lateral canals, hanging in bold loops just on a level with the mastax, and at the summits of the foot-glands, run down each side of the lorica to a large and normally placed **contractile vesicle**. I have seen four vibratile tags on each side: one close to the head, one at the upper loop, another at the lower, and one midway between them; doubtless there is a fifth. The **ovary** is a large cushion-like mass stretching across the venter with unusually large germs: fig. 1*a* shows a maturing ovum. The **nervous ganglion** (fig. 1) is very large, with nearly parallel sides, a scalloped front edge, and a rounded hind end, which is distinctly cellular. It stretches far below the mastax, in front of which, on its inner surface, it bears a dark-red **eye**. Two small setigerous pimples rise from the corona behind the tubular papillæ mentioned above. On the neck is another setigerous eminence, the dorsal **antenna**. I have not succeeded in finding any dorso-lateral antennæ. There are two pairs of longitudinal **muscles** for withdrawing the head, which are plainly striated; the rest of the muscular system is very similar to that already described (i. p. 8) in *Brachionus rubens*.

Length, $\frac{1}{50}$ inch. **Habitat.** A pond in Sutton Park (C.T.H.): rare.

E. DILATATA, *Ehrenberg*.

(Pl. XXIII. fig. 5.)

Euchlanis dilatata . . . . Ehrenberg, *Die Infus.* 1838, p. 463, Taf. lviii. fig. 2.
„ „ . . . . . Cohn, *Sieb. u. Köll. Zeits.* ix. 1858, p. 289, Taf. xiii. fig. 4.

[1] *Jenaisch. Zeits. f. Natur.* 1885, Taf. ii. fig. 18.

Euchlanis dilatata . . . Moxon, *Trans. Linn. Soc.* vol. xxiv. 1864, p. 459, with figs.
„ „ . . . . . Eckstein, *Sieb. u. Köll. Zeits.* xxxix. 1883, p. 385, fig. 33.

SP. CH. **Lorica** *a broad oval;* **dorsal plate** *depressed in front, arched behind;* **transverse section** (*through the highest point*) *a low circular segment;* **dorsal occipital edge** *with a broad gap, joined to the head by a membrane;* **hind dorsal edge** *notched;* **ventral plate** *flat with a broad flange of oval outline;* **trophi** *with five teeth in each uncus.*

This species, like that which precedes and that which follows it, has no occipital **notch** in the dorsal plate, but has a broad gap (fig. 5*a*), which is only visible when the head is completely withdrawn. The edge of the gap is united to the head by a softer continuation of the lorica, which effectually obliterates the gap when the head is protruded. The **lorica**, though depressed, slopes upwards a little to a point not far from the top of a posterior notch in it, and then drops abruptly as if pinched in on either side of the notch. The ventral plate is nearly as wide as the dorsal, and a ventral view shows the edge of its flange running parallel to the edge of the dorsal plate just within it. A side view shows the two edges as two parallel lines near together, and drawn along the animal's side from end to end. Ehrenberg says that there are no **setæ** on the foot, but both Dr. Moxon and Herr Eckstein draw a pair of pedal setæ, and I have met with specimens bearing setæ in no other respect differing from those that lacked them. Dr. Cohn (*loc. cit.*) gives a full description of the **male**. It is a reduced copy of the female with a **sperm-sac** and **penis** taking the place of the alimentary canal and mastax, which as usual are entirely wanting, Dr. Cohn has seen the wand-like **spermatozoa** " swarming " in the sperm-sac.

Length. Female, $\frac{1}{70}$, male, $\frac{1}{96}$ inch. **Habitat.** Clear ponds and ditches: common.

E. MACRURA, *Ehrenberg.*

(Pl. XXIII. fig. 6.)

Euchlanis macrura . . . Ehrenberg, *Die Infus.* 1838, p. 463, Taf. lviii. fig. 1.

SP. CH. " *Closely resembling* E. dilatata; **lorica** *a narrower oval;* **toes** *somewhat longer;* **trophi** *with seven teeth in each uncus; a pair of recurved* **setæ** *on the foot.*"

I have met with an *Euchlanis*, whose figure is given in fig. 6, which had all the above characteristics given by Ehrenberg, but I doubt whether *E. macrura* is a good species, as none of the corresponding characters seem constant in *E. dilatata*, except the number of teeth in each uncus; and, unfortunately, I found several specimens, of what I should otherwise have termed *E. macrura*, with only five teeth in each uncus.

Length. About $\frac{1}{70}$ inch. **Habitat.** Clear ponds and ditches: not uncommon.

E. TRIQUETRA, *Ehrenberg.*

(Pl. XXIII. fig. 4.)

Euchlanis triquetra . . . Ehrenberg, *Die Infus.* 1838, p. 461, Taf. lvii. fig. 8.
„ „ . . . . . Hudson, *Mon. Micr. J.* viii. 1872, p. 97, pl. xxviii.

SP. CH. **Lorica** *oval, with a high flat median plate at right-angles to the dorsal surface;* **transverse section** (*through the highest point*) *triangular;* **dorsal occipital edge** *notched;* **hind dorsal edge** *notched;* **ventral plate** *concave, and* (*with its flange*) *two-thirds of the width of the dorsal plate;* **trophi** *with five teeth in each uncus.*

This most beautiful species is often to be found among the confervoid growth on the walls of old ponds. Its **lorica** rises in a high thin plate, and is not unlike a delicate glass dish-cover set over an inverted glass dish somewhat narrower than itself. The vertical plate, that thus rises like a crest from the dorsal surface, is very flexible and elastic, and can be easily bent aside by the compressorium without injury. The ventral plate is curved downwards all round its edge, so that the lateral furrow between the two plates is wide; and, as shown in fig. 4*b*, its flange stretches barely half-way across the base of

the dorsal plate. The outline of the dorsal portion of the lorica, when seen directly from the front or rear (fig. 4*c*), is triangular; the **section**, so obtained, having a base just twice its height. There is a well-marked occipital **notch** (fig. 4*b*) in the dorsal plate, through which a short, stout, dorsal **antenna** usually protrudes. Dr. Grenacher has detected two dorso-lateral antennæ close together "lying near the crest of the lorica." Ehrenberg says that there are no **setæ** on the foot; but I have never failed to find two when using dark-field illumination. The rest of the structure requires no further notice, as it is a tolerably close repetition of that of *E. lyra*.

This is one of the choicest of microscopic objects, when shown in a dark field; especially when it is quietly gliding over and round a few tangled algæ. Its strange armour is now invisible, and now blazes out as it catches the light; while the ruby eye, the daintily-tinted stomach studded with glittering drops on canary-coloured quiltings, the ruddy intestine softened by the tremor of its ceaseless cilia, and the restless head crowned with an ever-varying halo of flashing setæ, form a picture that once seen can never be forgotten.

There is a variety of *E. triquetra*, with a lower **vertical plate**, which I have met with now and then; and which, on several occasions appeared to have but one long **seta** on the foot. Possibly this is Leydig's *E. uniseta* (Pl. xxiii. fig. 3).

Length. Up to $\frac{1}{45}$ inch. **Habitat.** Clear ponds and ditches: not uncommon.

E. DEFLEXA, *Gosse*.

(Pl. XXIV. fig. 1.)

Euchlanis deflexa . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 200.

[SP. CH. *Outline of* **lorica** *ovate;* **ventral gape** *wide, equal, with deep walls;* **toes** *broad, blade-shaped; lateral horns of* **incus** *straight.*

This is a large and very beautiful species. It is not to be distinguished at first sight from a true *Euchlanis*, but the **carapace**, which is highly arched, turns in at the lateral edges, and after proceeding for a space horizontally, *i.e.* across the ventral surface, is bent down at a right-angle to a considerable width and then terminates, as if we might suppose the ventral plate to have been originally flat and continuous; then to have been slit down the middle, and each side to have been bent down at a line midway between the slit and the outer margin. Thus the abdominal cavity is enlarged, and the viscera are protected only by the common integument which is stretched across from edge to edge. This being flexible, a variation of contained space is allowed, for development of eggs, for distension of the alimentary canal, &c., which, in *Euchlanis*, is obtained by the flexibility of the skin that connects the two plates. The lorica is almost circular behind, where a very minute central notch admits the two sides to overlap in the slightest possible degree. The **foot** issues, of course, from the ventral hiatus; it bears two toes, which are thin, flat, and wider in the middle part. The penultimate joint of the foot proper has on its dorsal side a curved projection, which arches over a deep excavation. It carries two pairs of long **setæ**, one or both of which are sometimes wanting. Each toe has a corrugated **mucus-gland** (?) running through it. The broad head is composed of many (ten ?) transparent globate lobes; the front is divided into several pairs of lobes, which carry bundles of cilia. The three strong lines which (with the front) form a square, reaching behind the **mastax**, are puzzling, but I believe they represent the wide, clear brain. The sacculate **stomach** is enormous, with two **gastric glands**; and two glands, beside, are attached to the mastax: there is a small, distinct intestine in which the epithelial cilia may occasionally be seen; a great **ovary**, with embryonic vesicles, and sometimes one (or more) dark ovum maturing. The **branchial tubules**, two or more, contorted and very loosely twisted, carrying four **vibratile tags** on each side, open by *two distinct mouths* on each side, into an ample **contractile vesicle**, just before the cloaca, whose periods are very irregular, even in the same individual: now emptying once in two minutes, then several times per minute. Many **muscles** are seen, some indubitably

striate. An **eye-spot** which appears to be unconnected with the brain, is situate nearer the pectoral than the dorsal side.

I found this species in 1849 in ponds around London, and have seen it often since. It has sometimes occurred so large that even with the naked eye I have had no difficulty in distinguishing the head from the foot.—P.H.G.]

I once found among a number of specimens of *E. deflexa* a perfectly empty **lorica**, belonging to this species, and fortunately standing up vertically, so that it turned round and round on its pointed end, as on a pivot (Pl. xxiv. fig. 1*c*). I was thus enabled to see with the utmost distinctness that it was *closed everywhere* except a large opening in front, where the head had protruded, and a small one behind, that had given a passage to the foot. The **ventral plate** (fig. 1*c*; *v*), as I term it—the **ventral membrane** as Mr. Gosse considers it—had no **flange**, but seemed to me quite as stout and stiff as (not to say stiffer than) the other ventral parts of the lorica. Whatever it was, whether chitinous plate or membrane, it had remained with the rest of the lorica while the softer tissues of the animal had disappeared.

Length, $\frac{1}{60}$ to $\frac{1}{40}$ inch; breadth, $\frac{1}{100}$ inch. **Habitat.** Pools and lakes (P.H.G.: C.T.H.): widespread.

E. PYRIFORMIS, *Gosse*.

(Pl. XXIII. fig. 2.)

Euchlanis pyriformis . . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 200.

[SP. CH. **Outline of lorica** *constricted in the middle;* **ventral gape** *narrow, widest in front, with shallow walls;* **toes** *narrow, rod-shaped; lateral horns of* **incus** *over-curved.*

The peculiar narrowing of the edge which gives to this species a pear-shaped outline is caused by the edge of the upper plate being curved right under on each side, this edge being formed by two surfaces thinned off to great tenuity, so as practically to become but one layer at some distance from the edge. The under sides then proceed inwards till they nearly meet, when they are bent downwards into shallow walls, just as in *E. deflexa*, which recede from either to form projecting lateral points at the front; while behind they merge into a shallow groove and small sinus, at the end of the upper plate. Along this the **foot** is extruded, which usually has two **setæ**, a prominence and notch, as in the preceding, and two long toes, quite straight, slender, of equal width, except that they are abruptly pointed. The **brain** and whole internal organization scarcely differ from those just described; but the four slender horns that stand up from the sides of the **incus** are curiously bent over outwardly in the form of hooks. The **eye** is small, as in the preceding. In both species the beauty is much enhanced by a line of minute corrugations, running parallel with, and a little within, the margin of the lorica, like the "milling" around the edge of a new coin. **Muscles** in much profusion, longitudinal, transverse, and oblique, are to be defined in this very fine species.

I obtained it first at Battersea Rise, only the day before my discovery of *E. deflexa*. Few specimens occurred, and it has always been a rarity with me. It swims with swiftness and grace; is of sprightly manners; is beautiful and attractive, and being large and brilliantly transparent, is well suited for study.—P.H.G.]

The **transverse section** (fig. 2*a*), was obtained by viewing the animal, which I have drawn in fig. 2, directly in front; it is taken through the turned-in portions of the dorsal plate. It shows that at these spots, the **flange** of the ventral plate (according to my interpretation of the lorica), almost touches the dorsal edge. These curiously bent portions varied somewhat in different specimens; but all my examples had four **setæ** on the foot. The hind portion of the **nervous ganglion** was darker, denser, and more obviously cellular than the fore-part, from which it was separated by a wavy outline. Its front edge was also scalloped like that of *E. lyra*.

Length. Up to $\frac{1}{40}$ inch; of lorica, $\frac{1}{62}$ inch; of toes, $\frac{1}{195}$ inch. **Habitat.** Ornamental waters (P.H.G.); garden pond, Clifton (C.T.H.): rare.

Family XV. CATHYPNADÆ.

[**Body** *inclosed in a* **lorica**, *open at each end, of two plates; the* **dorsal** *more or less elevated; the* **ventral** *nearly flat, the two divided by a deep lateral longitudinal sulcus, covered with flexible membrane;* **toes** *two, or one, always exposed.*

This is a well-marked, easily recognised, and compactly coherent group, the two divisions of the lorica, and their connection, readily identifying its members, notwithstanding the diversity in toes. The appearance, viewed from behind, reminds one of a pair of bellows, if we only imagine the upper board arched instead of flat; the leathers representing the lateral sulci. The toes, in two of the genera, are two, furcate; in the others there is but a single toe: yet the form, position, and use of these organs are so exactly identical, and yet so peculiar, that the genera cannot be dissociated. An ample brain, descending into the occiput, carries a single eye, usually conspicuous. The trophi are large, the mallei much more developed than the incus, virgate.

All the genera are marked by a common habit, which is not found elsewhere. One will rest on the tip of its toe (or toes), and having bent down the whole body, remain motionless, and as if asleep, for a long interval, the whole fore-parts retracted. Then it will seem to awake, and languidly swing round the body, first to the one side, and then to the other, without letting go its moorings, and without protruding its head; and then, perhaps, go to sleep again. Or it may rouse itself into activity, and begin to grope away among the floccose, or glide deliberately off, soon coming again to anchor.

Five species were known to Ehrenberg, who placed the two with furcate toes in the genus *Euchlanis*, with which, however, they have no close affinity.—P.H.G.]

Genus CATHYPNA, *Gosse*, gen. nov.

[GEN. CH. **Lorica** *sub-circular horizontally, usually much arched vertically;* **lateral inangulation** *wide and deep;* **toes** *two, furcate.*

The characters by which the species of this genus are distinguished are sometimes minute, and even obscure, yet constant; the shape assumed by the toes, and especially by the extreme points of these organs, demanding attention. In one group they are narrow, parallel-sided, like a carpenter's rule; in another, much widened in the middle, with the sides curving to the point: the former I call *rod-shaped*, the latter *blade-shaped*. The former, too, do not taper gradually to the tip, but are abruptly narrowed with a right-angle, so as to make a sensible shoulder, whence the point descends as a marked claw. And this may be only on one edge, or on both edges; the toe being one-shouldered or two-shouldered.—P.H.G.]

C. LUNA, *Ehrenberg*.

(Pl. XXIV. fig. 4.)

Euchlanis luna . . . Ehrenberg, *Die Infus.* 1838, p. 462, Taf. lvii., fig. 10.

[SP. CH. **Dorsal and ventral plates of lorica** *sub-equal, occipital edge crescentic;* **toes** *rod-shaped, two-fifths as long as lorica, clawed; the* **claw** *one-shouldered, one-fifth as long as toe.*

The lorica, broadly ovate in horizontal outline, ending in front by a crescentic excavation, and in rear by a small sinus between two points, and the toes, very narrow, parallel-edged, generally carried in contact, with short, sharp claw-tips, may easily serve to identify this common species. The dorsal and ventral plates are of nearly the same form and curvature; high and deep behind, they come into contact in front, at least at the lateral edges, which project in two acute points. During the long retractations of the fore-parts, the lorica may be considered shut by this contact. When activity is resumed, the plates separate, and a broad head protrudes, the front of which is truncate,

with two equidistant incisions, at each of which appears a bristle (fig. 4). The rotating cilia are set along the edge. A mastax of very ample dimensions, with a pair of long mallei, but rather small incus, is always conspicuous. Behind this the occipital brain carries an eye, usually large and brilliant. A great saccate stomach, without sensible œsophagus, with large gastric glands, and followed by a separate intestine, passes obliquely across the dorsal region; and the ovary, as usual, occupies the ventral.[1] In the adult, the surface of the lorica is smooth, and the whole animal is transparent and colourless.

Though individuals swim actively now and then, yet the habitual sluggishness and inertia of the species cannot fail to attract attention. As described, it will balance itself, by the hour, on its united toe-tips, with an occasional lazy swaying to and fro; or even loosen this feeble hold, and allow its body to sprawl away at right-angles to the food-surface, free in the water, the foot being bent up to the belly.—P.H.G.]

Length. Total, $\frac{1}{125}$ inch; of lorica, $\frac{1}{175}$ inch. **Habitat.** Fresh waters (P.H.G.): common everywhere.

C. RUSTICULA, *Gosse*, sp. nov.

(Pl. XXIV. fig. 6.)

[SP. CH. **Lorica** *regularly ovate, with the frontal opening very narrow;* **dorsal surface** *coarsely tesselated;* **ventral plate** *nearly flat;* **toes** *blade-shaped.*

This fine species is very hyaline, notwithstanding that the broadly-oval and arched surface is cut into facets. These are not very regular, nor very distinctly marked, having the appearance of folds in leathery skin. They appear to be limited to the carapace. This is turned-in along each side, with a sharp lateral angle meeting the edge of the ventral plate, similarly turned-in, as is clearly seen when the creature is viewed from behind (fig. 6*b*). The union is doubtless completed by a flexible and extensible membrane.

The head is included between firm plates, which, seen vertically (fig. 6), appear as two lateral projecting points, between which the front, of many conical lobes that carry vibratile cilia, works to and fro. The brain and its lozenge-shaped eye are normal; and so are the great trophi, the stomach with trigonal gastric glands and distinct intestine, and the ovary. A contractile vesicle is sometimes conspicuous, but no details of the respiratory nor of the muscular systems have been defined. A rather thick and short foot, rounded laterally, bears the two toes, which are articulated with round condyles. They are moderately thick blades of fusiform outline, when seen laterally, thinner towards the base, and rather bluntly pointed.

I first met with this form, in July 1885, in the sediment of water in which aquatic weeds had been sent from the north of London. Subsequently other examples occurred, in water from Caversham and Woolston, and from near Dundee, in December.

The earlier specimens were even more clumsy and sluggish than ordinary, moving waywardly from side to side, as if not quite under control, adhering all the while by the toes. Hence I called it *rusticula*. This, when too late, I would have changed; for some were much more attractive, transparently beautiful, with the eye large and of a lovely rose-pink hue, and so sprightly in manners as to be worthy of a more courtly designation. In these, too, the digestive canal was distended with food of a clear rich orange-brown hue. These were Woolston specimens. Scottish examples bred freely and increased in my phials.—P.H.G.]

Length, $\frac{1}{150}$ inch. **Habitat.** Pools throughout England and Scotland (P.H.G.): common.

[1] In one example the ovary was fastened, by two threads with swollen enlargements, to each side of the lorica, near the middle; and the gastric glands were also tied to the same points (fig. 4). Long threads (muscular ?) with like enlargements were seen to pass from the foot-bulb to near the same points, if not higher.

C. SULCATA, *Gosse*, sp. nov.

(Pl. XXIV. fig. 5.)

[SP. CH. **Lorica** *broadly ovate, much elevated;* **anterior edges** *straight;* **ventral plate** *much smaller in outline than dorsal, both strongly fluted;* **toes** *blade-shaped.*

The general form and appearance of this species may cause it to be easily confounded with *luna*, especially when viewed from the side. The arched carapace comes to a sharp edge all round, bending far-in abruptly; then bending outward again with a like angle, and coming to a like edge, to form the ventral plate. This, when seen sidewise (fig. 5*a*), seems to be of the same dimensions as the dorsal; but when seen direct from below it is much less all round (fig. 5*c*), except in front, where the pectoral edge is parallel with the occipital, both being transversely straight, but bounded, as usual, by two small lateral points. Both surfaces are coarsely and deeply fluted; the incised lines of the dorsal passing round and beyond the inbent edge. The bulbous foot projects slightly through an excavation in the dorsal plate's thickness: it is kidney-shaped; in its hollow the toes are articulated. The lorica is, by the graving of its surface, rendered so opaque that the internal organs are not easily defined. There is, however, a small but conspicuous crimson eye in the occiput, and, by inference, a brain. The mastax is so large that, when the head is withdrawn, it occupies fully one-third of the visible area, at the middle of the lorica. Below this appears the ample stomach, dark with digesting food, and (in the condition just named) pushed far up above the mastax on either side.

This well-marked species I obtained in a number of examples, both alive and dead, haunting aquatic moss, in water sent me by Dr. Collins from his historic pool at Sandhurst. For awhile I thought I had got hold of the *Euchl. lynceus* of Ehrenberg, but examination of his text and figures forbade the identification. It is of the usual manners. It often swims smoothly and swiftly, continuing the exercise for long periods without rest, the toes usually carried behind, in mutual contact; yet at intervals anchoring, retracting the head and foot, and assuming still repose, broken, now and then, to sway wildly in all directions, on its glued toes, as on a pivot, *more E. lunæ.*—P.H.G.]

Length. Extended, $\frac{1}{180}$ inch; of lorica, $\frac{1}{350}$ inch; of toes, $\frac{1}{750}$ inch; width of lorica, $\frac{1}{433}$ inch. **Habitat.** Pool at Sandhurst, Berks (P.H.G.): uncommon.

Genus DISTYLA, *Eckstein.*

[GEN. CH. **Lorica** *of the form of a long ellipse, open and membranous before, closed behind, depressed, higher before than behind;* **lateral inangulation** *feeble;* **toes** *two;* "*selvage-like thickenings of the lorica around the foot.*"

Herr Eckstein has described and figured two species of this genus, whose toes bear the same relation to each other as those of *C. luna* and *rusticula*. The genus is closely linked with the preceding; yet the lengthened and flattened form, the habitual protrusion of the head, and the more constant activity of the species distinguish it. Only one of Herr Eckstein's species has occurred with us, but I add (doubtfully) another.—P.H.G.]

D. GISSENSIS, *Eckstein.*

(Pl. XXIV. fig. 8.)

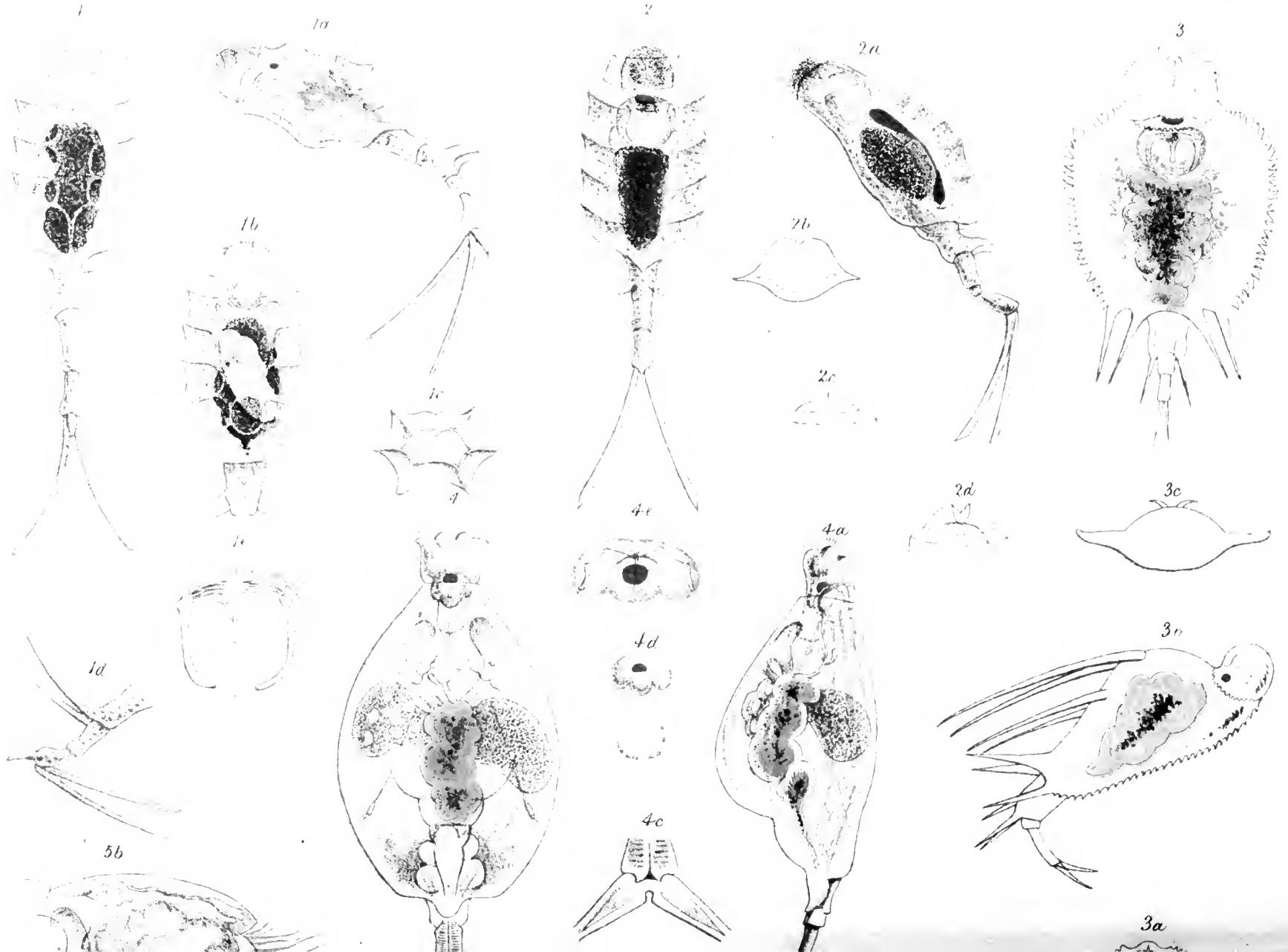
Distyla Gissensis . . . Eckstein, *Sieb. u. Köll. Zeits.* xxxix. 1883, p. 383, pl. xxvii.

[SP. CH. **Lorica** *round behind, broadly truncate in front, with short lateral points;* **toes** *rod-shaped, thick, obscurely two-shouldered, claws small;* **brain** *simple.*

The outline is that of a narrow ellipse abruptly cut-off a little before the middle, so that the lorica, at its truncate front edge, is scarcely diminished in width. It becomes,

PLATE XXI.

1.	Dinocharis pocillum	dorsal view	H
1*a*.	„ „	side view	H
1*b*.	„ „	ventral view	H
1*c*.	„ „	transverse section	H
1*d*.	„ „	variety; foot	H
1*e*.	„ „	trophi	G
2.	Dinocharis tetractis	dorsal view	G
2*a*.	„ „	side view	G
2*b*.	„ „	transverse section	G
2*c*.	„ „	head; cap closed	G
2*d*.	„ „	head; cap open	G
3.	Dinocharis Collinsii	dorsal view, the armature omitted	G
3*a*.	„ „	dorsal view, showing spines	G
3*b*.	„ „	side view	G
3*c*.	„ „	transverse section	G
4.	Scaridium eudactylotum	dorsal view	H
4*a*.	„ „	side view	H
4*b*.	„ „	ventral view	H
4*c*.	„ „	junction of foot and toes	H
4*d*.	„ „	mastax and brain	H
4*e*.	„ „	mastax, trophi, and eye	G
5.	Scaridium longicaudum	dorsal view	G
5*a*.	„ „	side view	G
5*b*.	„ „	head, showing mastax, trophi, and eye	G
6.	Stephanops muticus	dorsal view	G
6*a*.	„ „	side view	G
7.	Stephanops lamellaris	dorsal view	G
7*a*.	„ „	side view	G
8.	Stephanops unisetatus	dorsal view	G
8*a*.	„ „	side view	G
9.	Stephanops chlæna	dorsal view	G
9*a*.	„ „	side view	G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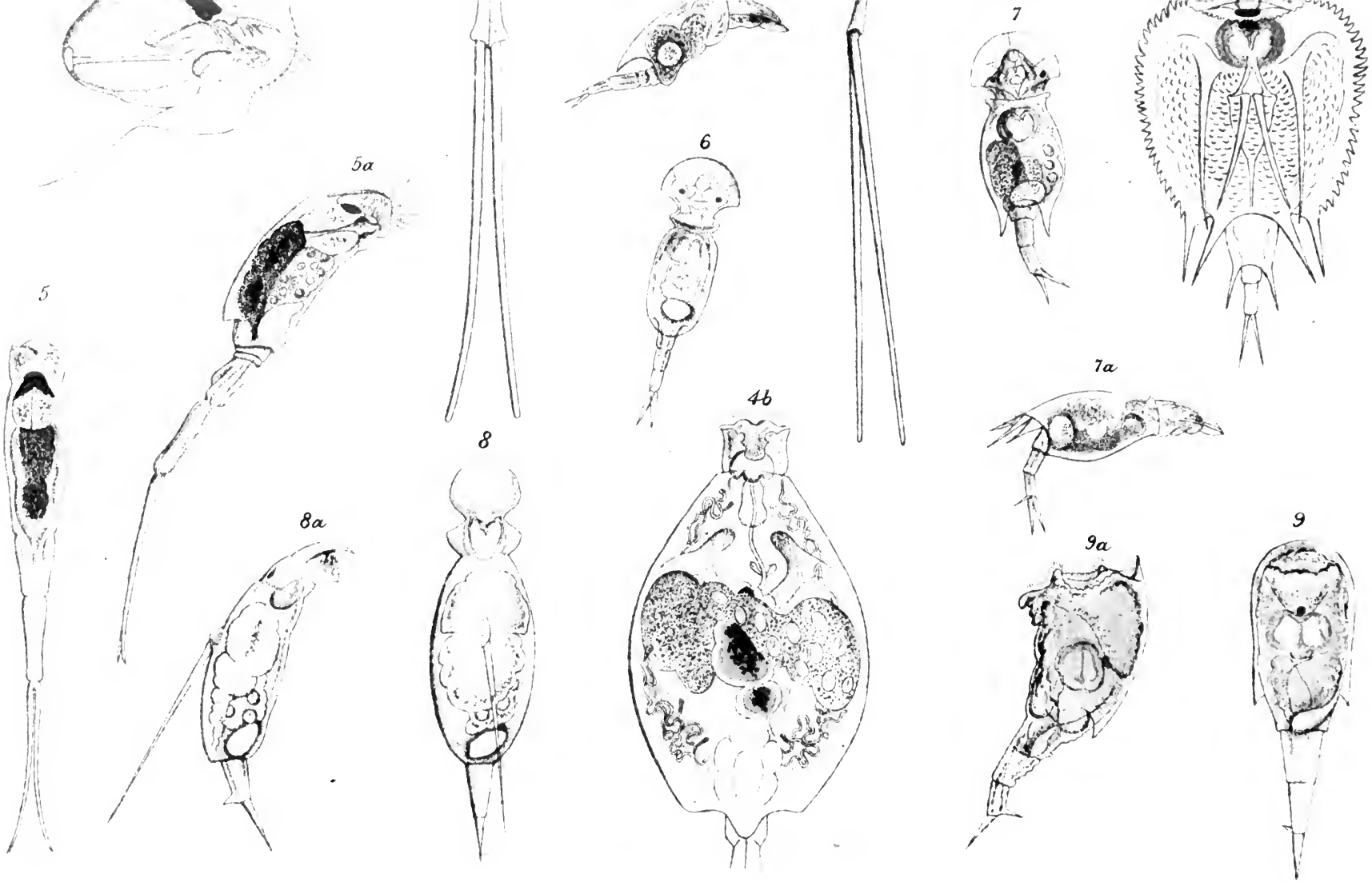

Figs 1 to 1e, 4to 4d, C.T.Hudson
the rest, F.W.Hosse

ad viv. del

Hanhart imp

DINOCHARIS; SCARIDIUM; STEPHANOPS.

1 D POCILLUM. 2 D TETRACTIS 3 D COLLINSII 4. SC.EUDACTYLOTUM
5 SC LONGICAUDUM. 6. ST MUTICUS. 7 ST LAMELLARIS. 8 ST.UNISETATUS 9 ST CHLENA

PLATE XXII.

1. Salpina mucronata . dorsal view . . . . . G
1*a*. „ „ . side view . . . . . G
1*b*. „ „ . lorica, oblique view . . . . . G
2. Salpina spinigera . . dorsal view . . . . . G
2*a*. „ „ . . side view . . . . . G
2*b*. „ „ . . transverse section, dorsal half . . . G
3. Salpina mutica . . dorsal view . . . . . G
3*a*. „ „ . . side view . . . . . G
4. Salpina brevispina . side view . . . . . G
4*a*. „ „ . . lorica, dorsal view . . . . . G
4*b*. „ „ . . lorica, side view . . . . . G
5. Salpina eustala . . dorsal view . . . . . G
5*a*. „ „ . . side view . . . . . G
6. Salpina macracantha . dorsal view . . . . . G
6*a*. „ „ . side view . . . . . G
6*b*. „ „ . trophi, side view . . . . . G
7. Salpina sulcata . . dorsal view . . . . . G
7*a*. „ „ . . side view . . . . . G
7*b*. „ „ . . rear view . . . . . G
8. Diplax compressa . . side view . . . . . G
8*a*. „ „ . . dorsal view . . . . . G
8*b*. „ „ . . transverse section . . . . . G
9. Diplax trigona . . dorsal view . . . . . G
9*a*. „ „ . . side view . . . . . G
9*b*. „ „ . . transverse section . . . . . G
10. Diaschiza semiaperta . side view . . . . . G
10*a*. „ „ . lorica, dorsal view . . . . . G
10*b*. „ „ . head and eye . . . . . G
10*c*. „ „ . trophi . . . . . G
11. Diaschiza pæta . . side view . . . . . G
11*a*. „ „ . . dorsal view . . . . . G
12. Diaschiza valga . . dorsal view . . . . . G
12*a*. „ „ . . side view . . . . . G
13. Diaschiza exigua . . dorsal view . . . . . G
13*a*. „ „ . . side view . . . . . G
14. Diaschiza tenuior . . dorsal view . . . . . G
14*a*. „ „ . . side view . . . . . G
15. Diaschiza Hoodii . . dorsal view . . . . . G
15*a*. „ „ . . side view . . . . . G


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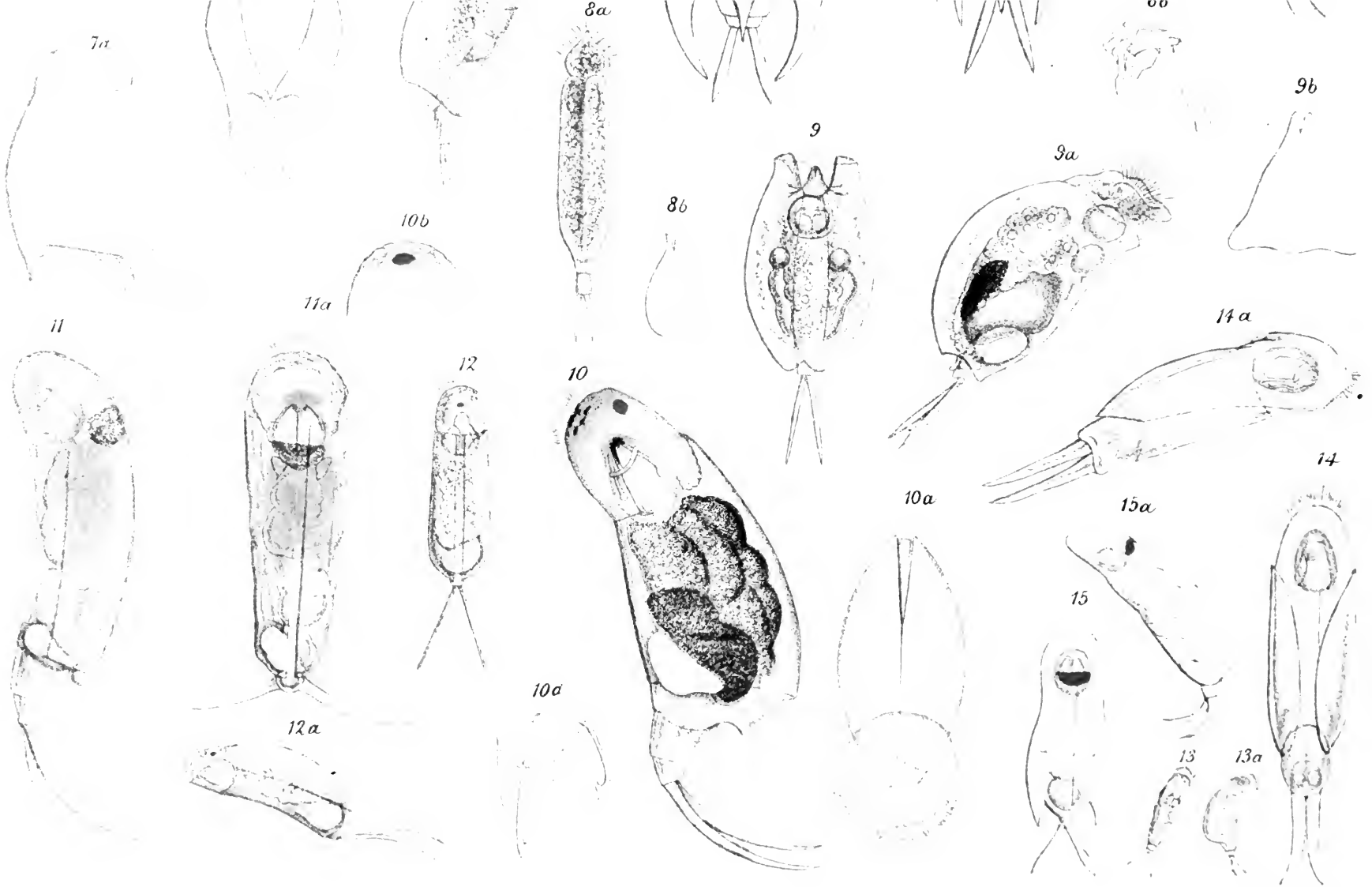


; DIPLAX ; DIASCHIZA.

METICA 4 S BREVISPINA 5 S EUSTALA [illegible] ME [illegible] A

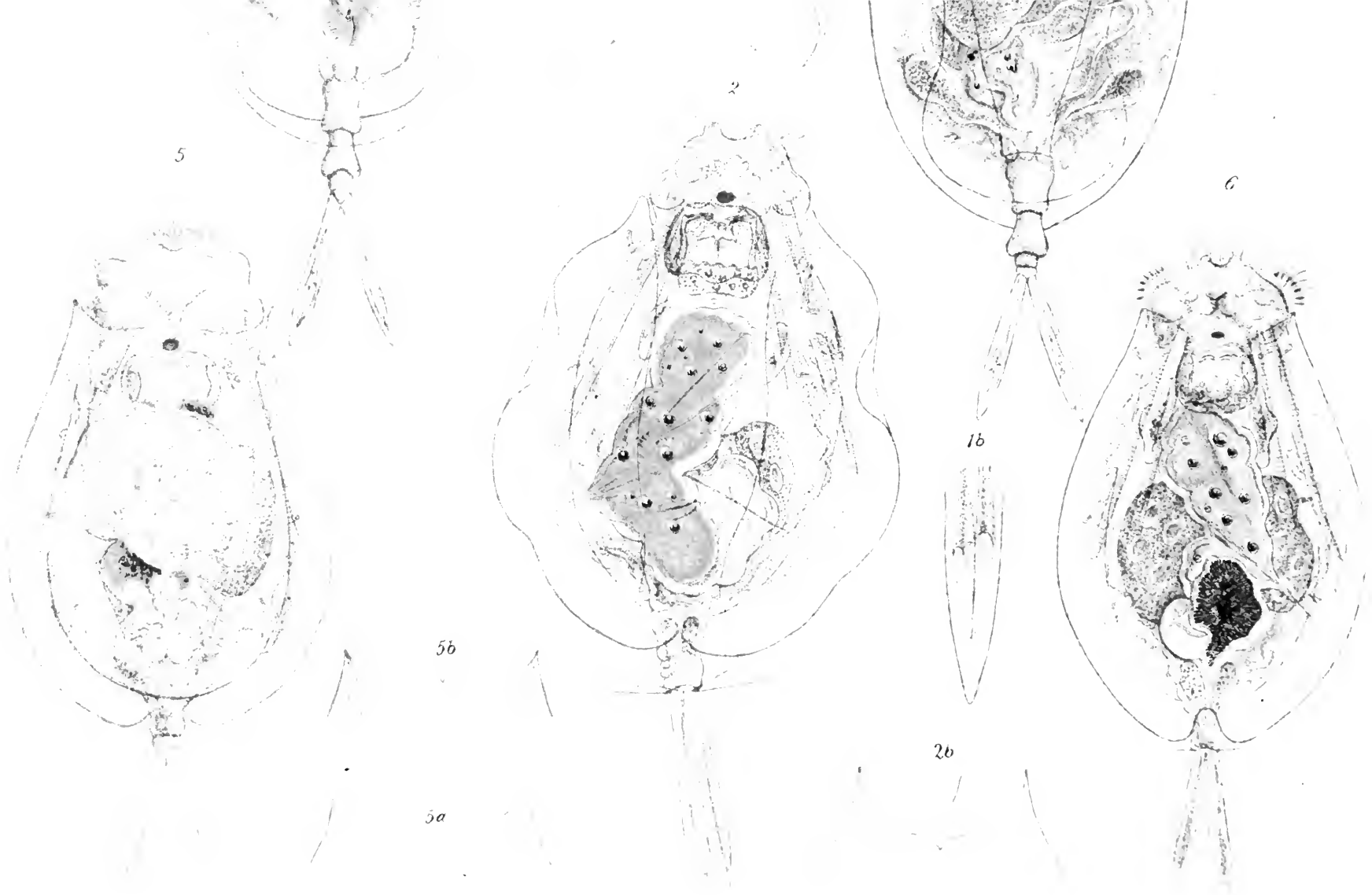
[illegible] A SEMLAPERTA HIDA [illegible] DIAMET A

[illegible] UA 14MA MINUOR IS MA [illegible]

PLATE XXIII.

1.	Euchlanis lyra . . .	dorsal view	H
1*a*.	„ „ . . .	ventral view	H
1*b*.	„ „ . . .	foot, and contained vessels	H
2.	Euchlanis pyriformis . .	ventral view	H
2*a*.	„ „ . .	transverse section	H
2*b*.	„ „ . .	front-edges of lorica	H
3.	Euchlanis uniseta (?) . .	side view	H
4.	Euchlanis triquetra . .	dorsal view	H
4*a*.	„ „ . .	side view	H
4*b*.	„ „ . .	ventral view of lorica	H
4*c*.	„ „ . .	transverse section	H
5.	Euchlanis dilatata . .	ventral view: *a*, edge of dorsal plate; *b*, edge of the flange of ventral plate; *c*, edge of the portion connecting the dorsal and ventral plates, and at right-angles to both .	H
5*a*.	„ „ . .	dorsal front-edge of lorica	H
5*b*.	„ „ . .	ventral front-edge of lorica	H
6.	Euchlanis macrura . .	dorsal view	H


4
4c
3
4a
4b
1
1a
2a



C.T.Hudson ad nat. del.

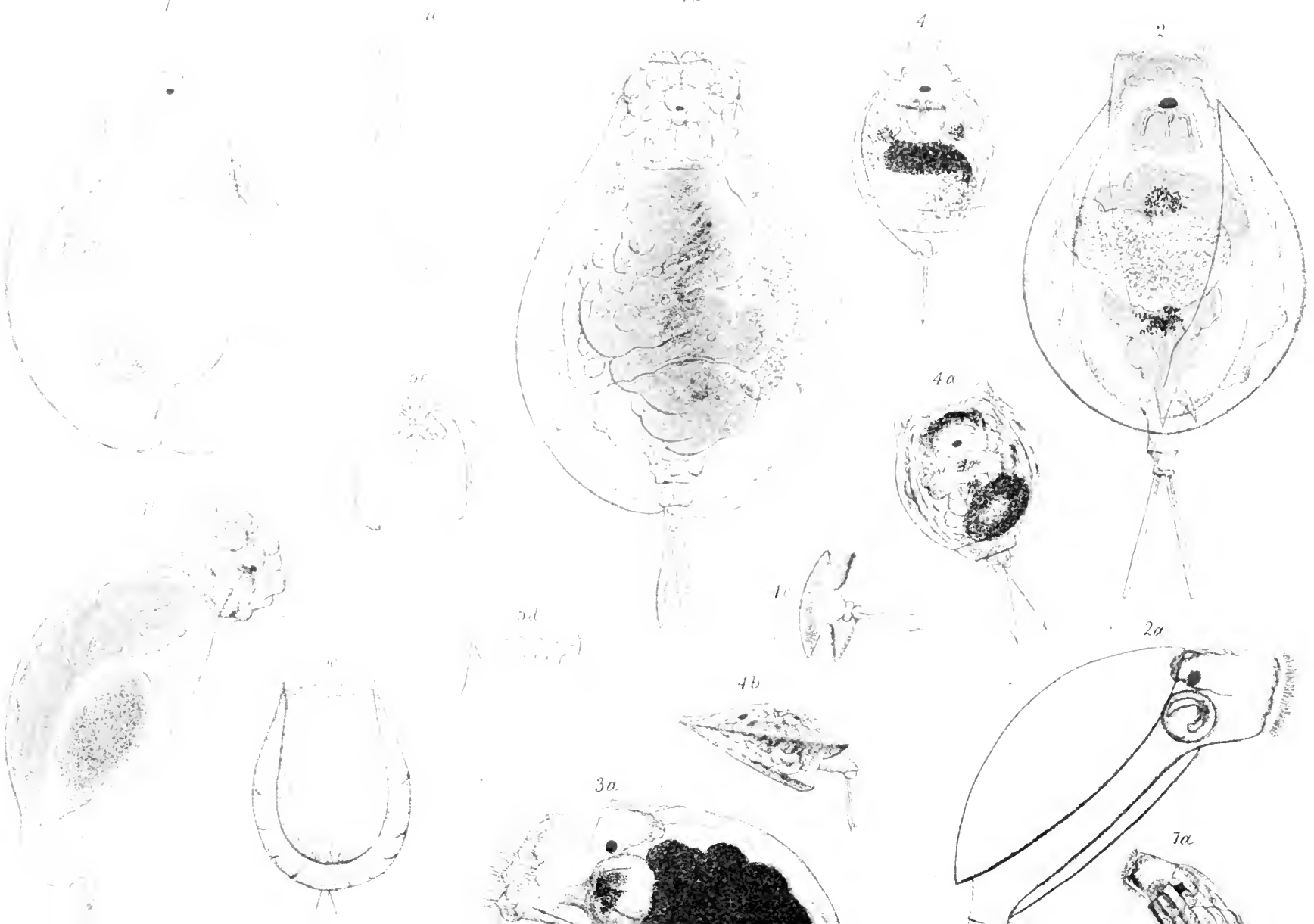
Hanhart imp.

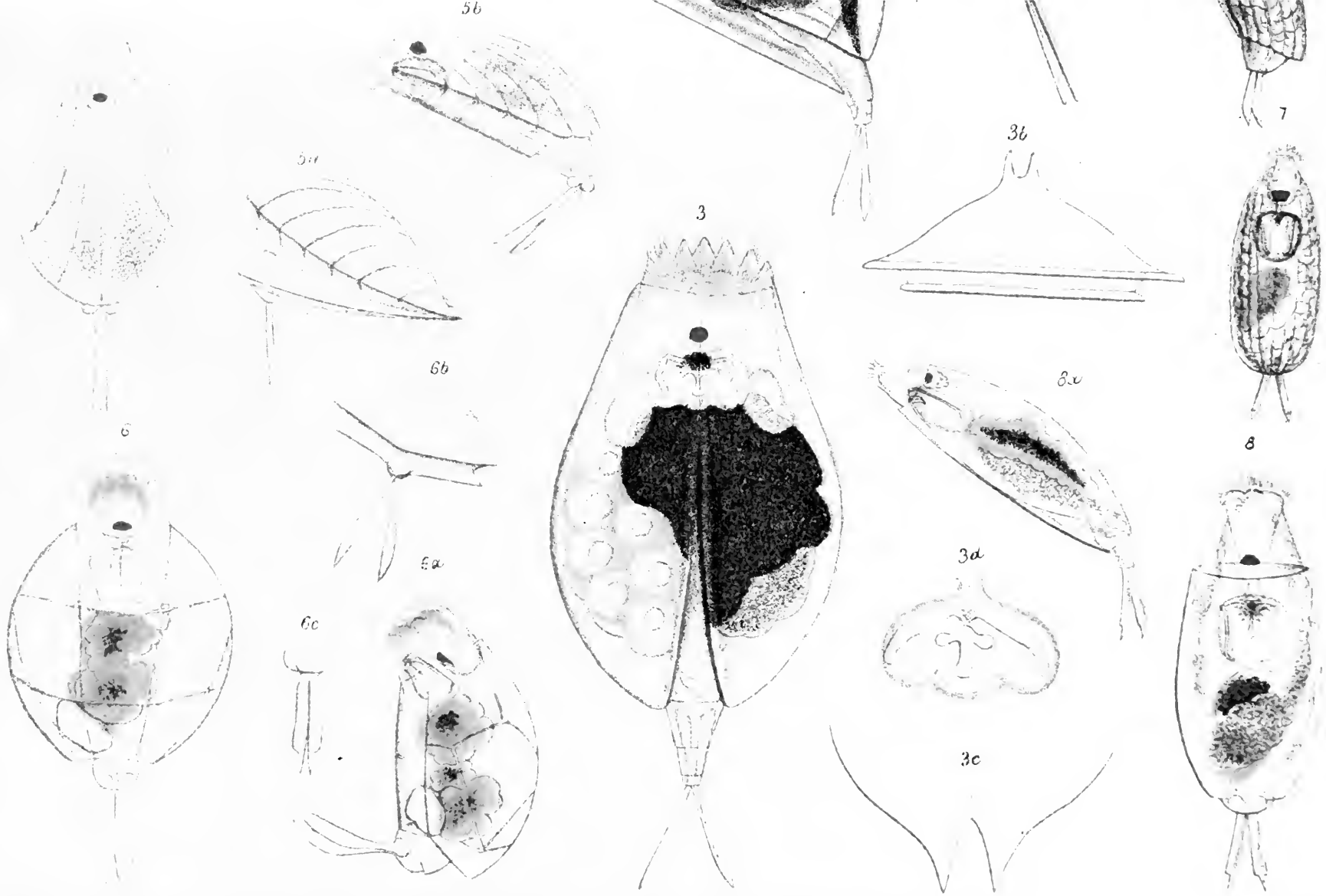
EUCHELANIS.

1 E LYRA 2 E PYRIFORMIS 3 E UNISETA 4 E TRIQUETRA 5 E DILATATA 6 E MACRURA

PLATE XXIV.

1.	Euchlanis deflexa	ventral view	G
1*a*.	„ „	dorsal view	G
1*b*.	„ „	side view	G
1*c*.	„ „	empty lorica, ventral view	H
2.	Diploïs propatula	dorsal view	G
2*a*.	„ „	side view	G
3.	Diploïs Daviesiæ	dorsal view	G
3*a*.	„ „	side view	G
3*b*.	„ „	transverse section	G
3*c*.	„ „	hind end of lorica, dorsal view	G
3*d*.	„ „	trophi	G
4.	Cathypna luna	dorsal view, head extended	G
4*a*.	„ „	dorsal view, head retracted	G
4*b*.	„ „	side view, head retracted	G
4*c*.	„ „	rear view	G
5.	Cathypna sulcata	dorsal view	G
5*a*.	„ „	side view, head retracted	G
5*b*.	„ „	side view, head extended	G
5*c*.	„ „	lorica, ventral view	G
5*d*.	„ „	edge of lorica	G
6.	Cathypna rusticula	dorsal view	G
6*a*.	„ „	side view	G
6*b*.	„ „	rear view	G
7.	Distyla flexilis	dorsal view	G
7*a*.	„ „	side view	G
8.	Distyla Gissensis	dorsal view	G
8*a*.	„ „	side view	G


1
1a
4
2
4a
1c
2a
4b
3a
7a



EUCLANIS, TEPHOS, CATEYPNA, EUSTYLA

PLATE XXV.

1.	Monostyla cornuta	dorsal view	G
1*a*.	„ „	side view	G
1*b*.	„ „	transverse section	G
2.	Monostyla lunaris	dorsal view	G
2*a*, 2*b*.	„ „	side view	G
2*c*.	„ „	rear view	G
3.	Monostyla quadridentata	dorsal view	G
4.	Monostyla bulla	dorsal view	G
4*a*.	„ „	side view	G
4*b*.	„ „	rear view	G
4*c*.	„ „	front of lorica	G
5.	Monostyla Lordii	dorsal view	G
6.	Metopidia lepadella	dorsal view	G
6*a*.	„ „	side view	G
6*b*.	„ „	transverse section	G
7.	Metopidia triptera	dorsal view	G
7*a*.	„ „	side view	G
7*b*.	„ „	front view	G
8.	Metopidia oxysternon	ventral view	G
8*a*.	„ „	side view	G
8*b*.	„ „	lorica; ventral view	G
8*c*.	„ „	lorica; dorsal view	G
8*d*.	„ „	transverse section	G
8*e*.	„ „	head; side view	G
8*f*.	„ „	trophi	G
8*g*.	„ „	pectoral notch of lorica	G
8*h*.	„ „	hind end of ventral plate, showing orifice for the foot	G
9.	Metopidia acuminata	dorsal view	G
9*a*.	„ „	side view	G
9*b*.	„ „	lorica; ventral view	G
9*c*.	„ „	transverse section	G
10.	Metopidia rhomboides	dorsal view	G
10*a*.	„ „	side view	G
10*b*.	„ „	transverse section	G
11.	Metopidia solidus	dorsal view	G
11*a*.	„ „	ventral view, head retracted	G
11*b*.	„ „	side view	G
11*c*.	„ „	rear view	G
11*d*.	„ „	front of lorica	G
11*e*.	„ „	hind end of lorica	G
11*f*.	„ „	stomach	G
12.	Colurus dactylotus	dorsal view	G
12*a*.	„ „	side view	G
13.	Colurus pedatus	side view	G
13*a*.	„ „	foot and toes	G

however, very thin and flexible, so as to be subject to much inversion in retraction. The head, very freely extruded, is thick and large, a truncate cone, with a slight *auricle* at each lateral angle, and a central bladder-like lobe, which is retractile. The whole head, which is very mobile, projects between two pointed shelly shields. In death, the head being abnormally extruded, these appear as stout oval (or lozenge-shaped) shields, quite separate from the lorica. The foot, of one apparent joint, is bulbous and kidney-shaped; to it are jointed the toes, which are much stouter and shorter than in *Cathypna luna*. They terminate in similar small acute claws, but the shoulders are less sharply angular. It is very thin, viewed laterally (fig. 8*a*). The dorsal plate comes down to a blunt edge on each side, with feeble duplication; the hinder ventral parts, inclosed in membrane, being small, and much overlapped by the clear thin edge of the lorica. A very favourable sight of one, as it *deliberately* turned-up endwise (so slowly, indeed, that I could carefully focus it as it moved), showed that the ventral plate is co-extensive with the dorsal; but is very thin at the edge, sloping upward toward the middle half; this forms a downward arch to contain the viscera.

Herr Eckstein describes the brain in *D. Ludwigii*, as divided into three long sacs, like as in *Copeus centrurus* and *C. Cerberus*. In the present species there seems to be a broad base rather abruptly diminished in width, but forming only one sac, which carries a great crimson ovate eye, at its very point.

I have received the species rather plentifully in water from Mr. Hood; and more sparsely from Mr. Bolton: the former averaging much larger size. Its manners are much more sprightly than those of *Cathypna*. I have also found it (with lorica very flexible and expansible) in spring, in a domestic aquarium of my own, which had remained unchanged for more than a year.—P.H.G.]

Length, $\frac{1}{150}$ to $\frac{1}{100}$ inch; width, $\frac{1}{350}$ to $\frac{1}{250}$ inch. **Habitat.** Bracebridge Pool, Birmingham: rare. Starmont Loch, Dundee: abundant (P.H.G.).

D. FLEXILIS, *Gosse*, sp. nov.

(Pl. XXIV. fig. 7.)

[SP. CH. **Lorica** *narrow, nearly parallel-sided, corrugated, flexible, plicate.*

I am not by any means sure that this is entitled to specific rank; nor, if it is, whether it ought to be placed in the genus *Distyla*. It may be but the immature condition of some other species, such as *C. sulcata*. Yet the condition, *at birth*, of the lorica of *M. cornuta*, appears to forbid the conclusion that flexibility and corrugation are marks of immaturity in this family. A lorica is evidently present, soft and flexible, covered with irregular wrinkles; marked also with a series of longitudinal folds, scarcely amounting to flutings. The eye is large, rectangular, bright rose-red, seated on the inner side of the brain, close to its point. The other organs are normal.

Its manners are lively, often wild, searching the edges and surfaces of the water-moss which it haunts, and often creeping within them. It sometimes anchors by its toes, and appears to go to sleep, just like its brothers and cousins.—P.H.G.]

Length. Expanded, $\frac{1}{200}$ inch. **Habitat.** Sandhurst, Berks (P.H.G.): rare.

Genus MONOSTYLA, *Ehrenberg*.

[GEN. CH. *As* Cathypna, *but that there is only a single toe.*

This group, consisting of numerous species, is so exactly the counterpart of *Cathypna*, *except for the toe*, that one can scarcely avoid the conclusion that this is, structurally, of slight importance. The details of the form, the habits (as the use of the toe as a pivot, and the frequent and long-continued inertia), and even the specific variations in the shape of the toe, all are so accurately the reflection of what has been described as to

suggest that *Cathypna* is *Monostyla* with the toe cleft through the middle, or that *Monostyla* is *Cathypna* with its two parallel toes soldered into one.—P.H.G.]

M. LUNARIS, *Ehrenberg.*

(Pl. XXV. fig. 2.)

Monostyla lunaris . . . . . Ehrenberg, *Die Infus.* 1838, p. 460, Taf. lvii., fig. 6.

[SP. CH. **Lorica** *broadly ovate, the dorsal plate round and greatly elevated, the ventral nearly flat; both in front projected into wide, triangular, flattened points, between which the edge is deeply excavate;* **toe** *straight, rod-shaped;* **claw** *protruded between two slender spines.*

The gibbous lorica descends abruptly before it is produced into the wide clear triangular lobes in front. And there seems no noticeable difference in outline, either of the lobes or of the intervening sinus, between the dorsal and the ventral plates. For, in retraction, these are very firmly appressed, with a *common* outline; so that no change of position, and no focusing, makes the eye cognizant of more than a single, somewhat thickened, crescentic line. The general figure is so elevated that it is more than half a sphere, if we neglect the inangulation of the lateral sulcus, which, in this species, is not deep. The foot-bulb appears to lie in a hollow of the ventral plate; it is wide and kidney-shaped behind, where the straight-edged, rod-like toe is articulated. This terminates in a slender acute claw, not with a rectangular shoulder; but with a pair of fine points, between which the claw is, as it were, imbedded. Herr Eckstein describes certain appearances, which he interprets of the thickened lorica-structure, for strengthening the foot against the violent strains endured as the animal throws itself to and fro. He also depicts certain pale-red specks and excessively fine lines, going upwards from the claw, which he would connect with the nervous system, as well as with the mucous glands. "The rotatory organ is simple, but almost retired, so that only a slight elevation with a single seta projects out of the lorica. When it is extended, we discern two great lobes, which overlap the lorica-edge on each side, overreaching each other dorsally, but ventrally running off into the buccal orifice" (*Ibid.*).

A specimen in my possession, anchored by the toe to the glass of the live-box, threw itself vigorously into all possible positions, for twenty-four hours, without once removing;[1] all that time, so far as observed, active in this special way, but close shut-up. The movements, indeed, though constant, were not incessant, but very forceful, spasmodic, and sudden. In general the animal is clear and colourless: of this specimen, the whole body was stained of a yellow-brown hue, like sherry wine, so deep, while yet clear, that no definition of viscera was possible. Yet the red eye was now and then defined, and, under direct sunlight, came out very rich, and of a deep crimson hue. The great triangular lobes of the lorica, being very thin, were quite colourless and glass-like.—P.H.G.]

Length. When extended, $\frac{1}{160}$ to $\frac{1}{140}$ inch. **Habitat.** Woolston; Sandhurst; Thames, near Reading; Snaresbrook (P.H.G.): mostly in pools: not uncommon.

M. CORNUTA, *Ehrenberg.*

(Pl. XXV. fig. 1.)

Monostyla cornuta . . . . . Ehrenberg, *Die Infus.* 1838, p. 459, Taf. lvii. fig. 4.

[SP. CH. **Lorica** *ovate, moderately depressed, the front shallowly incurved;* **toe** *somewhat blade-shaped, the* **claw** *without a distinct shoulder.*

This species is very much like *M. lunaris*, so as, when retracted, scarcely to be distinguished from it except that the anterior dorsal edge of the lorica is *slightly* less incurved. It is smaller, and rather more oval in outline; in the act of extruding the

[1] During the latter part of the time, however, it became very sluggish, and less willing to move and jerk about.

frontal disk, and when it is extruded, there is an appearance of two lateral, slender, incurved horns, and between them two spots which look like a pair of ill-defined eyes; neither of which we see in *lunaris*. But these are not what they seem: the horns are the optical effect of the somewhat thickened and stiffened edges of the extruded head-mass, which, in the process of contracting and expanding, incline to each other, resembling conical knobs; and the spots are only the summits of certain fleshy eminences, which bear vibratile cilia. There is a true eye-spot of large size and crescent form, and of pale-red hue, seated on the inner side of the brain-mass, that hangs behind the mastax.

The ventral plate has its pectoral margin quite straight; it is considerably less than the dorsal along each side, while commensurate with it behind. There is a square hollow in it for the reception of the foot-bulb, which is somewhat kidney-shaped. The toe, viewed vertically, is more blade- than rod-shaped, for the outer margins bulge outward in a greater or less degree, the widest part generally (but not invariably) near the point. This point has often the semblance of a claw; but this is illusory, for there is no true angled shoulder. The trophi are of the normal form, but of unusual length. It is a very common species, and from its sluggish habits, combined with its minuteness, the observer is apt to pass it by with contemptuous neglect.—P.H.G.]

Length. Of lorica, $\frac{1}{250}$ inch; total, extended, $\frac{1}{150}$ inch. **Habitat.** Still waters (P.H.G.): common everywhere.

M. BULLA, *Gosse*.

(Pl. XXV. fig. 4.)

Monostyla bulla . . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii., 1851, p. 200.

[SP. CH. **Lorica** *a pointed oval;* **dorsal** *and* **ventral plates** *both gibbous, and nearly co-equal;* **toe** *rod-shaped in vertical aspect, with a two-shouldered* **claw**, *but decurved and gradually tapering in lateral aspect.*

This species I found in a small pool on Hampstead Heath, in August 1850, and, soon after, in the lake of Richmond Park, abundant. Lately it has occurred in water from Woolston, and from Caversham. The yellow hue is not, as I first supposed, invariable. Some are quite colourless, except for the digesting food. The great rotundity of the ventral plate; the regular decurvation of the tapered toe; and the deep narrow sinus in both the occipital and the pectoral fronts of the lorica,—these are the true distinctions. The oval outline is so acute in front that the sinuses are bounded only by two obtuse points. The gibbous dorsum ends behind with an oblique retrocession, showing laterally a great rounded foot-bulb. The head projects in two receding lobes, ciliated on their inner surfaces, just as in *cornuta*. The mallei are certainly two-fingered. The animal burrows among Charæ, Confervæ, &c.—P.H.G.]

Length. Expanded, $\frac{1}{110}$ inch; of lorica, $\frac{1}{175}$ inch. **Habitat.** Pools (P.H.G.).

M. LORDII, *Gosse*, sp. nov.

(Pl. XXV. fig. 5.)

[SP. CH. **Dorsal plate** *of lorica tesselate, its hinder end excavate, the excavation forming three sides of a square;* **toe** *rod-shaped;* **claw** *shouldered.*

This is a rare species, bearing much the same relation as *Cathypna rusticula* does—each to its congeners. Indeed, they are so much alike as to be easily confounded till the foot is seen to be two-toed in that case, one-toed in this. It in general resembles *M cornuta*, but is much more transparent. The single toe is more slender in proportion to its length, and much longer in proportion to the whole animal; it is a straight parallel-sided rod, with a minute acute claw apparently forming a separate joint. If this is the case, we should perhaps consider this joint as itself the toe, and the long rod as the penultimate joint of the foot. The shoulder is double, viewed vertically, but single and much rounded, viewed laterally. The outlines of the toe, however viewed, are always a little uneven; suggesting that the surface is irregularly pitted. The lorica

is ovate, not so pyriform as in *cornuta*. The edges of the upper and lower plates come closer together; for the anterior two-thirds the edge of the dorsal plate is about level with that of the ventral, but much exceeds it in length. The dorsal is straightly truncate behind, with the margin on each side, following the ovate outline and descending much farther, so as to form two points. The dorsal surface is somewhat coarsely tesselated, like that of *Cathypna rusticula*, but with the pattern slightly different (Pl. XXIV., fig. 6). The whole surface appears as if irregularly crumpled, interfering with distinct definition in spite of the transparency. The head is a low truncate cone, produced into a number of slight frontal eminences, on which the locomotive cilia are arranged in tufts or bundles. These do not appear to create sensible vortices in the surrounding water.

This species is, I conjecture, the fig. 22 of Mr. J. E. Lord ("Microsc. News," June 1884, page 146), as *M. cornuta* is his fig. 21. I therefore distinguish it with his name. I have met with it myself, on rare occasions recently, among decaying vegetation in the water of Woolston Pond, and abundantly in water kindly sent me by Miss Saunders.

Length, $\frac{1}{200}$ to $\frac{1}{160}$ inch. **Habitat.** Woolston; Newbury; Dundee (P.H.G.): rare.

There is a form,—of which I am almost inclined to make a separate species,—in general like *Lordii*, but remarkable for the excessive length and slenderness of the toe, which almost equals the length of the lorica. It may be but an extreme *var.* of the present form. Yet the lorica seems to lack the square excavation behind, and to be more pyriform in outline, running off in front into broader lobes, as in *lunaris*. This I have found in water sent me by Mr. Bolton from Sutton Park.—P.H.G.]

M. QUADRIDENTATA, *Ehrenberg.*

(Pl. XXV. fig. 3.)

Monostyla quadridentata . . . Ehrenberg, *Die Infus.* 1838, p. 459, Taf. lvii., fig. 5.

[SP. CH. **Lorica** *nearly circular, greatly depressed, especially behind;* **front** *deeply cleft, with two horn-like spines decurved and expanding at their tips.*

The horns well distinguish this form. During retraction these are drawn together, and made even to cross each other (fig. *c*). Besides these, and outside them, the dorsal plate projects into a broad-based triangular point on each side; while the pectoral margin forms a flexible membrane, very deeply cleft in the middle, and further deepened at will. The hind part is exceedingly flattened, merging into the foot, of which the last joint is cubical, with a central notch. Here is articulated the toe, rod-shaped, but that the outline of each side, instead of being straight, is strongly waved: an appearance which may possibly indicate the waves of a tenacious mucus. At one-fifth from the tip a double shoulder, rounded rather than rectangular, leaves the usual acute claw. The head protrudes (fig. *b*), much as described in *cornuta*. Of the **trophi**, the mallei (fig. *d*) are remarkable for a conspicuous horn projecting upward from each angle. The **gastric glands** are large; there is a large separate **intestine**, and also an ample **contractile vesicle**.

Several examples have occurred to my observation. In one I was witness to a curious phenomenon. A large shelled Infusory, *Arcella vulgaris*, was within the *Monostyla*, though how it had managed to force its way in, I cannot imagine, for it almost filled the cavity of the lorica. Its fleshy processes were protruding in front, and, by the death of the *Arcella*, unable, I suppose, after it had devoured its host, to get out, these processes gradually lengthened inordinately. It was a curious sight.—P.H.G.]

Length, $\frac{1}{110}$ to $\frac{1}{95}$ inch; of lorica, $\frac{1}{166}$ to $\frac{1}{140}$ inch. **Habitat.** Barking; Stratford; Maidenhead; Hampstead (P.H.G.); among duckweed, in pools and ditches: rare.

Family XVI. COLURIDÆ.

[**Body** *inclosed in a* **lorica**, *usually of firm consistence, variously compressed or depressed, open at both ends, closed dorsally, usually open or wanting ventrally;* **head** *surmounted by a chitinous arched plate or* **hood**; **toes** *two, rarely one, always exposed.*

The arching **hood** over the front, looking, in a lateral view, like a thin hook, movable, and so distinguished from the "glory-crown" of *Stephanops*, always conspicuous, is the most notable mark of this family, in which I propose to unite the mostly flat *Metopidiæ* with the high-backed *Coluri*. As no subdivision above *species* exists in nature, but all (as Genera, Families, Orders, and Classes) are arbitrary collocations, made simply to facilitate the study of the species, which alone is natural history; it follows that the more constant, and the more obvious, the characters on which we found our Divisions, the better. Hence I would not choose the form of the trophi, the presence or position of the eye-specks, or the distribution of the cilia, for distinction—*if I could get others*; because all these are found, in practice, so very difficult to determine. The existence of eyes in some *Coluri* and *Metopidiæ*, for instance, is so very uncertain and indeterminable, that I incline to agree with Dujardin in rejecting some of Ehrenberg's genera. The distinction between *Lepadella*, *Metopidia*, and *Squamella*, is more than doubtful; while in *Metopidia* and *Colurus*, individuals of indubitably the same species are found, some displaying eye-specks, and others in which no search detects them.—P.H.G.]

Genus COLURUS, *Ehrenberg.*

[GEN. CH. **Body** *subglobose, more or less compressed;* **lorica** *of two lateral plates, open in front, united on the back, gaping behind, and (in general) wholly so up the belly; frontal* **hood** *in form of a hook, not retractile;* **foot** *permanently extruded, of distinct joints, terminated by two furcate* **toes**.

A very familiar group, of minute dimensions, agreeable form, and sprightly action, the *Coluri* give the impression of being, while sub-circular in lateral outline, very thin in transverse diameter. This, however, is an illusion, arising from their being most frequently presented to the eye in the lateral aspect. When we do catch a glance at one in turning or swimming, we see that the body is moderately broad, ventricose, and even globose in the middle. The **lorica** consists of two glassy shells, each a segment of a hollow sphere, which are, normally, soldered edge to edge, at the fore-back, and begin to gape at the loins, the cleft then passing round behind, usually widening for emission of a stout foot, and passing up the belly to the front, by which time it has generally become as wide as the body itself. So constructed it may be imagined to be highly expansile, and in fact we observe that its width is constantly increasing and diminishing. The fore edges of the two plates, in the retraction of the head, are appressed so close as to seem but one lamina; but separate for the protrusion of the head with its rotating cilia. The **hood**, a decurved plate, often broad but sometimes narrow, of hyaline delicacy, is not retractile, but is seen when the lorica is shut up, resembling a semi-crescentic hook. The **foot** consists of three strongly marked joints bearing straight, acute, slender toes, often thrown wide apart, but, in some cases, so uniformly adherent that it is difficult to see whether they are two or one. The whole foot is often stretched behind; but much more commonly it is projected forward under the belly, through the ventral gape. The presence, the position, and even the number of eyes, seem subject to much variation.

Most of the known species are lacustrine in habit, but some are exclusively marine.

It is a characteristic habit of the species of the genus, particularly of *C. obtusus*, to elevate themselves to the utmost on the toe-point as on a pivot, and then awkwardly tumble over, as if they had not power to maintain their balance. The *Monostylæ* perform in somewhat similar style, but though their posturings and gyrations are wild, they seem to have better control over them.

In general, the species cannot be discriminated, while in life and activity, without extreme difficulty; their differences are so very slight, their dimensions so minute, and their restlessness so incessant.—P.H.G.]

C. DEFLEXUS, *Ehrenberg*.

(Pl. XXVI. fig. 1.)

Colurus deflexus . . . Ehrenberg, *Die Infus.* 1838, p. 476, Taf. lix. fig. 9.

[SP. CH. **Lorica**, *viewed dorsally, broadly ovate, bluntly pointed before, produced behind into two acute spines, separated by a wide, deep sinus: viewed laterally, the outline is the quadrant of an oval: the venter cleft from end to end;* **foot** *robust, with two short, slender, acute toes.*

If I rightly identify the species, there is little difference of aspect between this and *bicuspidatus*. In this the posterior spines are said to point slightly below, in the other slightly above, the horizontal line. Yet as this depends on the angle at which the animal is viewed, which is every instant varying, the distinction is evanescent, and, I fear, worthless. Yet, on careful study, this, which is by much the more robust species, is seen to have the two halves of the lorica severed all round, except in the middle of the back. The fore edges of these halves, deeply truncate, but a little out-curved, are firmly pressed together in retraction; and the effect of this appression, when seen from above, is the dividing line of the blunt cone, which is seen minutely opening and closing every moment. A **muscle-band** passes, in relaxed curves, from the front of each of the appressed sides to the surfaces of the retracted organs seen in a confused heap far down, evidently for the purpose of pulling out the trochal apparatus when required.

A large pale crimson **eye** seated on an ample **brain**-sac; a **mastax** of the *Euchlanidan* pattern; a cylindrical **stomach** succeeded by a wide intestine; an **ovary** often containing a nearly developed **egg**; and a small **contractile vesicle**; are usually seen. But in the middle of the back, just under the lorica, are two curious organs, each apparently an agglomeration of minute, clear vesicles, perhaps of air, perhaps of oil, observed long ago by Ehrenberg. He declared them inexplicable; and I cannot supply the explanation.

When, after a self-inflicted imprisonment, it may be of hours, the *Colurus* opens its closed cheek-plates, a trochal mass of conglobate lobes, fringed with wreaths of cilia, is thrust out, by whose vibration the creature smoothly but rapidly shoots away. The frontal **hooked-plate**, which, even in the inert state, has been discernible by the delicate, thin, curved line of its edge, moves to and fro, and under very favourable circumstances we may see that its inferior surface is fringed with vibratile cilia. I judge it to be an organ of touch; Herr Eckstein's opinion to the contrary notwithstanding.—P.H.G.]

Length. Of lorica, $\frac{1}{260}$ inch; from hook to toes, $\frac{1}{172}$ inch. **Habitat.** Ponds and ditches; quite common (P.H.G.).

C. BICUSPIDATUS, *Ehrenberg*.

(Pl. XXVI. fig. 2.)

Colurus bicuspidatus . . Ehrenberg, *Die Infus.* 1838, p. 476, Taf. lix. fig. 7.

[SP. CH. *Almost exactly those of* C. deflexus, *except that the* **lorica** *is not cleft either dorsally or ventrally; but only excavate behind, slightly on the dorsal, deeply on the ventral side.*

I have seen only a few examples of this form, all from Sutton Park, Birmingham. It is, I presume, Ehrenberg's *bicuspidatus*, his figures showing a **lorica** undivided beneath. In examples long under examination, I became quite certain that neither the dorsum nor the venter was cleft; but a narrow sinus, reaching to more than one-third of the lorica in length was excavated up the flat ventral plate, and a very slight one out of the dorsal end. Through this orifice the foot is thrust, of rapidly diminishing joints,

and what appears a single, slender, acute toe. At least I could not, with close watching, detect any sign of its division. In the dorsal view the frontal **hood** (fig. 2) appears not as the segment of a sphere, but somewhat indented in front. It ever moves backward and forward, as protruded and retracted. The venter appears quite flat, the semi-globose dorsal plate rising abruptly from it with a sharp angle. In one, as it turned slowly, I saw distinctly the form. If we suppose one-third of an egg to be removed longitudinally, and replaced by a flat plate, we shall gain a fair idea of the general outline.

This is certainly an uncommon form. My acquaintance with it is limited to a very few examples, obtained from Woolston Pond, and Sutton Park, Birmingham. Its manners are peculiar. It swims constantly, never resting to grope, as other species do, but sailing deviously and deliberately about; now and then quickening its pace; almost constantly with the venter at the glass of the cell; so that whereas I obtained plenty of ventral views, I got few dorsal, and scarcely one good lateral.—P.H.G.]

Length. Extended, $\frac{1}{300}$ inch; transverse width $\frac{1}{650}$. **Habitat.** Woolston; Birmingham (P.H.G.); very rare.

C. UNCINATUS, *Ehrenberg*.

Colurus uncinatus . . . Ehrenberg, *Die Infus.* 1838, p. 475, Taf. lix. fig. 6.

[SP. CH. **Lorica**, *viewed dorsally, broadly ovate, truncate before, produced behind into two short spines: viewed laterally, the outline is rondo-triangular, high in the middle of the back, the posterior spines short, blunt, and abruptly set-on;* **venter** *widely cleft throughout;* **toes** *two, short, slender, acute. Lacustrine.*

The **lorica** is turgid, the back not ridged but smoothly rounded; its ventral gape parallel-edged, the edges apparently bent downward (as in *Euchlanis deflexa*), making an angle with the swell of the sides, the anterior portion lengthened into a short tubular neck. The **hook** is narrow and spoon-shaped. The internal structure is obscure, partly from its sphericity; yet the **mastax**, **stomach**, intestine and cloaca, the **ovary** and the **contractile vesicle**, can be defined. It is usually of minute dimensions, and, though widely spread, rather rare. I have known it since 1849.—P.H.G.]

Length. Lorica, from $\frac{1}{320}$ to $\frac{1}{260}$ inch. **Habitat.** Clapton; Battersea; Bath; (P.H.G.).

C. OBTUSUS, *Gosse*, sp. nov.

(Pl. XXVI. fig. 3.)

[SP. CH. **Lorica** *ovate in all aspects, the posterior ends rounded without any points, ventrally cleft throughout, gradually expanding for the foot-orifice, the fissure reaching round to the back, both before and behind;* **foot** *small, with two minute slender, expanding toes. Lacustrine.*

This little unrecognised species, which I find not uncommon, is clearly marked by the blunt ends of the **lorica**. The lateral plates are separate for above three-fourths of their circumference, being soldered together with a sharp suture, only in the very middle of the back, and generally much compressed. The **foot** and toes together are about one-third as long as the lorica; the toes, like setæ for tenuity, with no shoulder, are often separate. The internal economy is normal; including the common bubbles in the back; two colourless refractile globules have been seen on the brain, which may be **eyes**. Its manners are sluggish, swimming laboriously, with jerks.—P.H.G.]

Length. Without foot, $\frac{1}{500}$ to $\frac{1}{375}$ inch. **Habitat.** Near London; Woolston; Leamington; Dundee (P.H.G.): not uncommon.

C. CAUDATUS, *Ehrenberg.*

(Pl. XXVI. fig. 6.)

Colurus caudatus . . . . . Ehrenberg, *Die Infus.* 1838, p. 476, Taf. lix. fig. 8.

[SP. CH. **Lorica**, *in dorsal aspect, pear-shaped, widest behind;* **dorsal hind sinus** *shallow, between very short terminal points, not at all produced;* **ventral cleft** *close, abruptly becoming a semi-circular foot-orifice;* **toes** *slender, frequently expanded; foot and toes three-fourths as long as lorica;* **eyes** *two. Lacustrine.*

There are several species which may, almost equally well, serve as the *caudatus* of Ehrenberg, to distinguish which requires minute examination. The above characters are carefully noted from many observations, and need not be repeated. The free expansion of the long **toes**, unusual in this group, is noteworthy. The frontal **hook** is normal, and I have repeatedly seen two **eyes** just beneath it. On the ventral surface the *abrupt* expansion of the fissure from a linear cleft to a broad round opening for the emission of the wide basal foot-joint, should be noticed.—P.H.G.]

Length. Total $\frac{1}{300}$ inch. **Habitat.** Birmingham; Woolston (P.H.G.): weedy pools.

C. AMBLYTELUS, *Gosse*, sp. nov.

(Pl. XXVI. fig. 5.)

[SP. CH. **Lorica**, *in dorsal aspect, broadly ovate, the hind ends rounded, without projecting points;* **ventral cleft** *gaping, widening before and behind;* **toe** *single, long, with a medial depression;* **foot** *and* **toe** *two-thirds as long as lorica;* **eyes** *cervical. Marine.*

This species also may be very readily confounded with *C. caudatus*, but the characters above given, though minute, seem to distinguish it satisfactorily and constantly. The **lorica** is arched, so that its dorsal outline forms about one-fourth of a circle, split at its occipital end, and also for a little way above the foot; the two lateral extremities being rounded. When the animal in its turnings shows the ventral side, even though slightly, we seem to see sharp points to the lorica; but this is an illusion, for the points are but the ends of the curved plates *seen edgewise*; another turn, and they at once become again obtuse. On the ventral surface, which is nearly flat, the edges of the two plates are either wide apart or very closely approach each other, or may even overlap, but recede on each side of the foot, so as to leave the orifice nearly circular. The single long slender **toe**, running off to a fine point, has a medial mark throughout, as in those *Metopidiæ*, &c., which keep the toes ordinarily appressed; but I have never seen a separation, and the most delicate focusing with high powers fails to divide the fine point. The usual **hood** is displayed. The **mastax** and its trophi are normal. The **brain**, large and turbid but undefined, occupies the occiput; and two minute red **eyes**, rather close together, are situate on it cervically. The other interior organs are as ordinary. One oil-globule (sometimes two) occupies in general the middle of the back, and is conspicuous.

This species seems exclusively marine. I have found it somewhat numerous among algæ, collected by Mr. Hood from tide-pools at low-water at Taymouth, near Dundee, and also in Torbay. It is very restless, ever roaming, yet mainly affecting the conferva, at which it nibbles constantly; when swimming it shoots along with smooth rapidity. The form is plump and round, the blunt corners low-descending; the body hyaline and colourless, the taper toe stretching far behind.[1]—P.H.G.]

[1] I am very confident that other species of this long-toed group exist, in both our fresh and salt waters. But though I have some drawings and notes, I have not as yet materials sufficient for satisfactory diagnosis.—P.H.G.

Length. From hood to ends of lorica, $\frac{1}{260}$ inch; foot and toe, $\frac{1}{520}$ inch; total, $\frac{1}{173}$ inch. **Habitat.** Marine pools at low tide (P.H.G.).

C. DACTYLOTUS, *Gosse*, sp. nov.

(Pl. XXV. fig. 12.)

[SP. CH. **Lorica** *wide in front, shallowly tubular behind, without points;* **foot** *very short but wide;* **toes** *thick, large, and curved. Marine.*

A somewhat thickset form. The **lorica** is ovate, viewed dorsally, with a broad anterior gape, out of which what seems another shelly valve projects, connected by an involute joint with the lorica (as seen in fig. 12*a*), a sort of **hood**, protecting the ciliate front and answering to the usual hooked plate, but of very different form. The front consists of several fleshy eminences (fig. 12) bearing vibratile cilia.

The lorica ends behind in a short truncate tube, through which the foot finds exit. This is exceedingly short and inconspicuous, though broad; the toes are furcate, thick at their base, blunt-pointed, and slightly decurved, when seen laterally (fig. 12*a*).

I have seen but a single example, in sea-water from tide-pools near Taymouth.—P.H.G.]

Length, $\frac{1}{175}$ inch. **Habitat.** Marine pools (P.H.G.).

C. PEDATUS, *Gosse*, sp. nov.

(Pl. XXV. fig. 13.)

[SP. CH. **Lorica** *cleft behind, ending in two square points;* **foot** *stout, long;* **toes** *minute, straight. Marine.*

Two examples of this little insignificant species occurred in water sent by Mr. Hood, from the Tay Firth marine pools. They were both in the same live-box as *C. dactylotus*. The thick foot-joints and the very small toes forming a small cone, when closely appressed as they usually are, will distinguish the species from all others. It is somewhat less than its congener just named. I detected nothing in it worthy of record besides.—P.H.G.]

Length. About $\frac{1}{160}$ inch. **Habitat.** Marine tide-pools; rare (P.H.G.).

C. CŒLOPINUS, *Gosse*, sp. nov.

(Pl. XXVI. fig. 4.)

[SP. CH. **Toe** *very long and slender, consisting of a narrow plate laid within a similar, but wider plate, and closely appressed to it. Marine.*

In the form of the **toe** we have here an example, quite unique in this genus, of the structure which characterises the genus, hence named *Cœlopus*, in the Rattulidæ. The toe consists first of an extremely long, tapering, hollow, thin plate of transparent chitine, such as would be presented by the bowl of a glass spoon, if drawn out to excessive length and tenuity. Then suppose a similar plate of glass, but narrower throughout, to be laid in the hollow of the former, fitted exactly to it, and reaching its taper point far before the other. What is the relation of the one spine to the other, and of both to the body; what their functions, what their movements, separately or conjointly, I know not. I have met with but one example, and that a dead and nearly empty lorica. The occurrence of such is often of great value. It is true that it may give little or no information of the internal structure, and, of course, none of manners. But of the external form and its appendages, composed of undissolved chitine, we can often obtain views of beautiful clearness, given with a minute precision that we can seldom hope for from a living animal. For the object is perfectly still, and remains so as long as we choose, while it is generally feasible to make it revolve in various directions by producing mechanical

currents in the water, and so to examine its appearance in other aspects. Thus was this creature delineated, and I vouch for its accuracy so far as the details are given.

The **lorica** *seems* (I can say no more) to be widely severed on the ventral aspect, and to end in rectangular points behind. The frontal **hook** appears normal.—P.H.G.]

Length, to tip of spine, $\frac{1}{163}$ inch; of which the spine is about one-fourth. **Habitat.** Among confervæ in tide-pools in the Firth of Tay (P.H.G.); rare.

Genus METOPIDIA, *Ehrenberg.*

[GEN. CH. **Lorica** *usually depressed, entire, with an opening at each end for the emission of the head and foot; frontal* **hood** *in form of a hook;* **foot** *and* **toes** *as in* Colurus; **eyes** *usually two.*

For reasons already given I include in this genus, not only the species so named by Ehrenberg, but also his genera *Lepadella* and *Squamella*; thus agreeing in principle with Dujardin ("Infus." p. 632) while I cannot accept his details. They seem to fall into the same natural family as *Colurus*; for though the prevailing plate-like form seems at first sight to differ greatly from the compressed *Coluri*, yet this form is not invariable, *M. oxysternum* and *M. triptera* presenting notable exceptions; while in the arched frontal hook there is a remarkably conspicuous feature in common. Some of the species are among the most familiar of Rotifera.—P.H.G.]

M. LEPADELLA, *Ehrenberg.*

(Pl. XXV. fig. 6.)

Metopidia lepadella . . . Ehrenberg, *Die Infus.* 1838, p. 477, pl. lix. fig 10.

[SP. CH. **Lorica** *oval, much depressed, evenly rounded above; its* **ventral plate** *shorter behind than the* **dorsal**, *and slightly excavate.*

That Ehrenberg's *Lepadella ovalis*, *Squamella bractea* and *S. oblonga*, and *Metopidia lepadella* are but species of one genus, I cannot doubt, and even the *specific* differences between them are very evanescent. The number, and even the visibility, of the **eye-specks** vary in individuals, and cannot be trusted for diagnosis. The present is a common form in most fresh waters. The **lorica** in its dorsal outline, both longitudinal and transverse, is a segment of a circle, and the ventral is straight. Seen from above it is oval, pointed at both ends, and yet truncate; the ventral plate round behind, and so considerably shorter, and slightly emarginate for the emission of the foot. The frontal **hood** agrees with that in *Colurus*, slightly protrusile, and is used for raking the rubbish among which it feeds. The ciliate face is almost prone, and the trophi can be brought to its surface.

I think I have seen the **male**; a minute creature, in form a very long cone, tapering to a point, with two slender toes; in front, quite truncate, with a sharp horn projecting from its forehead. No organization was visible within, save two conspicuous clear vesicles, side by side in the middle of the body, not at all like oil-globules, being irregularly oblong: nor accidental, being found in each of a large number of individuals, seen at different times. A pair of fine lines ran far down the two sides of the body, and in the hinder part was a large angular web of thin yellowish tissue. Else the whole seemed structureless and of hyaline clearness. It contracted into a shorter oval figure.—P.H.G.]

Length. Of lorica, $\frac{1}{300}$ inch. **Habitat.** Fresh waters everywhere (P.H.G.).

M. SOLIDUS, *Gosse.*

(Pl. XXV. fig. 11.)

Metopidia solidus . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 201.

[SP. CH. **Lorica** *nearly circular, depressed, with a low rounded ridge above;* **ventral plate** *commensurate with the* **dorsal** *behind, but deeply excavate;* **dorsal** *having a submarginal line of corrugation.*

This charming species, though in technical characters very similar to the preceding, is yet readily distinguished when once it is known. It is very much rarer, averages nearly twice its size, while its outline, in retraction, far more nearly approaches a circle. This, with its crystalline brilliance, recalls the lovely *Pterodinæ*, of which it is no unworthy rival; and its resemblance to them is much augmented by a delicate line of corrugations, which run round just within the margin, like the "milling" within a shilling. It was this feature that suggested the specific name, and no allusion to the adjective *solidus*. The arch of the **lorica** is much lower than in *lepadella*, especially towards the edge, while down the middle there runs a very low, rounded ridge. The fore and hind excavations are nearly as in *lepadella*. Besides the frontal **hood**, there is another clear disk which appears to protect the rotating cilia, and a transparent bulb is placed on each side of this, within each of which is seen a minute red **eye**, so that these organs are widely separated.

Some curious facts connected with digestion were illustrated by mixing a little carmine with the water. Particles were readily imbibed, and soon appeared as a red cloud in the fore part of the **stomach**. Presently this pellet passed into the upbent viscus at the bottom, which I supposed the intestine; and a second pellet, swallowed at the same instant, took the vacated place. After an hour, the whole alimentary canal had assumed the appearance of fig. 11*f*, the supposed intestine being only a lobe or pocket of the stomach. The pellet No. 1 now moved rapidly down to the cloacal extremity of the twofold viscus, but, instead of being discharged, it swiftly passed up (as between the dotted lines) to its first position at the base of the stomach; then returned to the cloacal end, and quickly again mounted; repeating these movements several times, till at length it coalesced with the second pellet. All the while the whole interiors of both chambers were full of an incessant quivering from the action of epithelial cilia. From all this, it really seems as if something analogous to rumination occurred in these minute creatures. The **gastric glands** and the **lateral canals** are very abnormal; and the contractile vesicle is sometimes ample, sometimes totally wanting.—P.H.G.]

Length, $\frac{1}{150}$ inch. **Habitat.** Walthamstow; Leamington; Birmingham; Woolston; Dundee (P.H.G.).

M. ACUMINATA, *Ehrenberg*.

(Pl. XXV. fig. 9.)

Metopidia acuminata . . . Ehrenberg, *Die Infus.* p. 477, Taf. lix. fig. 11.

[SP. CH. **Lorica** *ovate, ending behind in an acute point; occipitally deeply notched between projecting spines; the edges very thin.*

Besides the above peculiarities there is little to mark this obscure little species, which yet is amply distinct. When seen sidewise it has much likeness to a *Colurus*, save that its form is flatter; and the decurved frontal **hood** is more conspicuous. It is an eager and persevering feeder, raking with its hood-edge among the floccose.—P.H.G.]

Length. Of lorica, $\frac{1}{300}$ to $\frac{1}{340}$ inch. **Habitat.** North London; Leamington; Sandhurst (P.H.G.); very scarce.

M. OXYSTERNUM, *Gosse*.

(Pl. XXV. fig. 8.)

Metopidia oxysternon . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 201.

[SP. CH. **Lorica** *an ovate box of tesselated surface; with a thin ridge running down the* **dorsum**; **venter** *with a similar medial ridge terminating abruptly in mid-length.*

This is a very curious form. It is a depressed rhomboid-oval, with a rather high and thin arched ridge running down the back from the bottom of a deep frontal sinus. The ventral surface is also ridged as far as the mid-length, where the ridge ends, like the sternum of a bird. Then the surface is deeply excavated, and again projects, forming a prominent sheath for the emission of the foot. The whole **lorica** is cut into facets, as

in *Noteus* and in many *Anurææ*, and all minutely shagreened. The head is deep, forming three lobes, all ciliated. In retraction the two sides of the lorica close on each other, leaving within a large clear space, exactly as in many *Coluri*, to which a further resemblance is borne by the position and direction of the foot and toes; the former inclined forward, and the latter bent abruptly backward. A rather small **brain** carries an **eye** as large as half the **mastax** (possibly two suffused, since in some specimens two are observed), pale but rich, transparent rose-red. In rotating a narrow, parallel-sided, truncate lip is seen thrust out in front, as in *M. triptera*. The **trophi** are on the plan common in the *Euchlanidæ*, and neighbouring families.

I first obtained the species in an ornamental water near London in 1849; recently in a ditch at Coffinswell, near Torquay, and in water from the Black Loch, Dundee, in company with *Œcistes Stygis* and *Œ. brachiatus*. It is of lively manners.—P.H.G.]

Length, $\frac{1}{175}$ inch. **Habitat.** London; South Devon; Dundee (P.H.G.): rare.

M. RHOMBOIDES, *Gosse*, sp. nov.

(Pl. XXV. fig. 10.)

[SP. CH. **Lorica** *rhomboid-ovate in outline;* **dorsal surface** *tectiform, lower behind, ending in an obtuse point;* **ventral surface** *flat.*

This seems to come between *oxysternum* and *triptera*. The **œsophagus** is long, and often thrown into curves. The **gastric glands** are peculiar, being placed at the ends of two long threads, probably tubular, which are seated on the corners of the stomach, the globular glands themselves being affixed to the lining of the lorica.—P.H.G.]

Length, $\frac{1}{195}$ inch. **Habitat.** North London (P.H.G.): very rare.

M. TRIPTERA, *Ehrenberg.*

(Pl. XXV. fig. 7.)

Metopidia triptera . . . . . Ehrenberg, *Die Infus.* 1838, p. 478, Taf. lix. fig. 12.

[SP. CH. **Lorica** *nearly circular, as viewed dorsally, dilated into three wide, but thin,* **wings**, *one dorsal and two lateral.*

The aspect of this tiny living jewel, viewed dorsally, is almost exactly that of *M. lepadella*, and so it is if viewed sidewise. But an instant turn, or a slight change of level, and the broad **planes** come into view, with an effect that surprises. Each of these is, speaking loosely, a semi-oval, formed of two thin glassy plates, soldered into one for about half their width, then diverging to constitute, with the like structure of the vertical plate, a sub-cylindrical sheath, in which the organs and viscera are inclosed. The **foot** finds its exit by a sinus excavated out of the lower part of the cylinder, whose fore end is truncate for the extrusion of the head. This is surmounted by a broad chitinous **hood** descending in front to a sharp edge (as usual hook-like in lateral perspective), quite distinct from the tripterous lorica, within which its base is slightly retractile. It is conspicuous in all aspects. From above, the ciliate front, with its minute crimson **eyes**, one at each extreme lateral joint, is clearly discerned through its transparency.

It is a most exquisite little creature, of crystal brilliance, and sprightly in manner, without being swift. It swims little, but scrapes and pokes in the parasitic floccose. Here, as it turns and twists deviously about, we see constantly changing aspects of the three shining planes, whose surfaces and edges are ever crossing each other, all visible through each other, from their perfect translucency. Thus, though the difficulty of resolving the organic details of the active atom is augmented rather tantalisingly, one cannot but be charmed by the beauty and variety displayed. I have seen one, slowly gliding in a straight line, go on revolving on its axis, bringing the six surfaces into view in quick succession, with a striking effect. On another occasion one came sidling up to a noble *Euchlanis*. The contrast, and yet the resemblance, was curious; the one could have lain comfortably within the ample mastax of the other.—P.H.G.]

Length, $\frac{1}{288}$ inch. **Habitat.** Sandhurst (Collins); Woolston; Dundee (P.H.G.): rare.

M. BRACTEA, *Ehrenberg.*

Squamella bractea . . . Ehrenberg, *Die Infus.* p. 480, Taf. lix. fig. 16.

[SP. CH. **Lorica** *oval, much depressed, its front deeply excavated especially on the pectoral side;* **dorsal plate** *ending behind in two minute projections;* **ventral** *deeply excavate;* **eyes** *four.*

The differences perceptible between this and *lepadella* are exceedingly small; the four minute **eyes**, set in square, are very rarely discerned; but I have seen them. One deposited an **ephippial egg**, clothed with very long spines, while under my observation. P.H.G.]

Length. Of lorica, $\frac{1}{300}$ inch. **Habitat.** Pools and infusions; common (P.H.G.).

Genus MONURA, *Ehrenberg.*

[GEN. CH. *As Colurus, but the toe is a simple style.*

It is mainly in deference to the great Prussian zoologist, that I retain the generic distinction between this and the preceding group. With the recollection that in *C. leptus* I can discern no trace of a medial depression in the toe, that in *C. amblytelus* there is the depression, which I have never seen separated, that in *C. caudatus* there is the depression apparently as inseparable, which, yet, on occasion, palpably opens and expands; to build a genus exclusively on this condition of the toe is most precarious.—P.H.G.]

M. COLURUS, *Ehrenberg.*

(Pl. XXVI. fig. 7.)

Monura colurus . . . . Ehrenberg, *Die Infus.* 1838, p. 474, Taf. lix. fig. 4.

[SP. CH. **Lorica** *ovate, much compressed, highest at the front, with the hind ends rounded;* **eyes** *two, approximate. Marine.*

Viewed vertically this animal has the **form** of a mussel, gaping widely all along the venter and around each extremity, with no sensible change of outline for the emission of the foot, and hinged only along the middle of the dorsum. In a lateral view the **lorica** forms the half of a very long ellipse, flattened ventrally, obtuse behind, thence gradually rising till it is highest at the front, whence it descends in a bold curve to rejoin the belly side. Thus the outline is markedly different from that which is characteristic of *Colurus*, though the difference depends on minute peculiarities.

The round anteriors of the valves are, often and long, firmly appressed (fig. 7*a*), the whole head and viscera being far withdrawn, and a wide hyaline space left, within whose edge a very delicate corrugation marks the line of mutual contact. At intervals the valves part, and a head is protruded, armed with long and coarse cilia, and overarched by a conspicuous frontal **hood**. This has the unusual appearance of a wide veil of exceeding tenuity, strengthened by an acute taper hook of chitine running through its medial line. Under the base of this organ are seen two brilliant crimson **eyes**, moderately near each other. Slight indications of a manducatory apparatus are seen, and occasionally the globose form of the mastax; but all so evanescent as to defy definition. A large sacculate **stomach**, divided by constriction from a still ampler intestine; an **ovary** and a small **contractile vesicle**, with the cloaca at the dorsal base of the foot, are all normal. The **foot** itself is prominent, moderately thick, of three long, well-marked joints; the **toe**, a single, long, acute style, thick at base, and suddenly diminishing in its dorsal outline, has the remarkable peculiarity of being as flexible and elastic as whalebone. The extruded foot and toe are two-thirds as long as the lorica.

I first met with this species, congregating in great numbers around my marine

aquarium, in September 1854. Its manners agreed with those of the larger *Coluri*, shutting itself within its valves, and that so stubbornly, as to die rather than open them. Lately I have received specimens from Mr. Hood, found in marine tide-pools in the Firth of Tay; and have taken many in Torbay.

Length. Of lorica, $\frac{1}{350}$ inch; of foot and toe, $\frac{1}{520}$ inch; total extended, $\frac{1}{250}$ to $\frac{1}{200}$ inch. **Habitat.** Marine pools in Forfarshire and Devonshire; domestic aquarium (P.H.G.).

Very recently specimens of what I suppose *M. dulcis*, Ehr., have been sent me, from fresh water, by Mr. Lord of Rawtenstall. The lorica is acute, instead of obtuse, behind.—P.H.G.]

Genus MYTILIA, *Gosse*, gen. nov.

[GEN. CH. **Body** *ovate;* **lorica** *as in* Colurus, *but the head and neck habitually protruded, as well as the whole foot; no frontal* **hook**.—P.H.G.]

M. TAVINA, *Gosse*, sp. nov.

(Pl. XXVI. fig. 8.)

[SP. CH. **Eyes** *two, frontal, wide apart. Marine.*

The **lorica** is essentially similar to that of *Colurus* (though the facies of the animal is quite different), being a shell of two lateral valves, like that of a mussel, unbroken on the dorsum, descending on each side, and open all along the venter. Behind they are patent, where the thick foot emerges; but their edges approach, or even overlap, as in *Pterodina*, at the pectoral front. A massive head, and an equally thick, distinct neck, both about equal to that part of the trunk that adjoins them, are normally projected from the lorica, and not, as in *Colurus*, concealed between the valves. As there is, moreover, no trace of the **hood**, or hooked plate, that shields the face in kindred forms, the difference of aspect is very marked, and one of the Illoricate forms is involuntarily suggested.[1] This is augmented by the circumstances, that the **foot** is long and thick, especially at its base, that it tapers *there* gradually from the thickness of the trunk, and that it is habitually carried in the line of the body. Whereas, in *Colurus* and *Monura*, it is much smaller than the visible body, is usually projected at a sensible angle, and appears to come out between the ventral edges of the valves. The lorica, too, is of much less depth in proportion to its length; for, whereas, in *Colurus* the depth to the length may be about 2 : 3, in *Mytilia* it is about 2 : 5. It is obliquely truncate at the hind margin, the lateral edges diverging thence till they meet at the pectus. The body, which is arched on the dorsum, diminishes along the lumbar line, and forms a minute conical projection, representing a true tail, behind which the cloaca opens, whence the foot proceeds, in a similar ratio of diminution and in the same line, for a considerable length, terminating in two stout pointed toes, often jerked widely apart. Each is permeated by the usual **mucus-gland**, long, thick, and clavate. The internal structure is with difficulty defined. The extreme restlessness of the creature, combined with its minuteness, renders an examination during life almost impossible; and, after death, the outlines of the delicate organs become blurred, and soon obliterated. I believe I have perceived, on repeated occasions, and in many specimens, two minute **eye-specks** at the front, rather wide apart. The **mastax** is comparatively large, and the trophi normal (as in fig. 8*c*). But the whole interior is almost opaque from granulation, and so, very difficult to penetrate.

It is a pretty little creature, sprightly and attractive, with much in its manners and ways that reminds us of its kindred *Coluri*, one of which, *C. amblytelus*, is its constant

[1] I cannot avoid a lurking suspicion that under Ehrenberg's figure of *Distemma marinum* may have lain *Mytilia tavina*, notwithstanding discrepancies.

associate. The species is another of the discoveries of Mr. Hood, of Dundee. He finds it in sea-water, and has sent me many specimens in vigorous health.—P.H.G.]

Length, $\frac{1}{180}$ to $\frac{1}{140}$ inch; width and depth equal, about $\frac{1}{433}$ inch. **Habitat.** Tide-pools at the mouth of the River Tay (J.H.); and in Torbay (P.H.G.).

Genus COCHLEARE, *Gosse*, gen. nov.

[GEN. CH. **Lorica** *not half the length;* **foot** *long, annulate;* **toes** *two, furcate.*

The two species which I include in this genus are minute and inconspicuous, but peculiar. The **lorica** is quite a subordinate feature, the parts behind this greatly developed into what appears a very stout and long **foot**, of many annulose joints, terminated by two minute toes, on which the creature usually elevates itself, and turns as on a pivot. Both the species are lacustrine.—P.H.G.]

C. STAPHYLINUS, *Gosse*, sp. nov.

(Pl. XXVI. fig. 9.)

[SP. CH. **Lorica** *hemispheric.*

The integument is wrinkled irregularly, and scarcely firm enough to be called a **lorica**. It is nearly circular in outline, arched dorsally, and flat ventrally, abruptly attenuated to the stout and long **foot** of four distinct joints, ending in what looks like two acute toes soldered together, frequently turned up in a threatening manner. **Eyes** and internal organs dim and uncertainly discerned. I have found but one specimen, in a dyke near Stratford, in 1851.—P.H.G.]

Length, $\frac{1}{195}$ inch; width, $\frac{1}{390}$ inch (P.H.G.).

C. TURBO, *Gosse*, sp. nov.

(Pl. XXVI. fig. 10.)

[SP. CH. **Lorica** *three-sided.*

The form of the **lorica** may not be constant, yet the facies of this differed so much from that of the preceding, that, until we have more knowledge, it is well to treat them as distinct. The flexible lorica is nearly parallel-edged, but rises to a dorsal angle, like a roof; yet each of the sloping lateral surfaces consists of two planes, very slightly inclined to each other. The head appears as if it had a broad **hood** like that of *Stephanops chlæna*, but flexible, for sometimes a lobe of it flaps inward. The front is formed of two half-cones, ciliated on their inner faces, which approach and recede at will, making two vortices. A large occipital **brain** bears a red **eye** near its point. The **toes** are distinctly furcate.—P.H.G.]

Length, $\frac{1}{200}$ inch; width, $\frac{1}{750}$ inch. **Habitat.** Black Loch, near Dundee (P.H.G.).

Family XVII. PTERODINADÆ.

Lorica *entire, various;* **corona and ciliary wreath** *those of the* Philodinadæ; **trophi** *malleo-ramate;* **foot** *wholly retractile, transversely wrinkled, jointless, toeless, ending in a ciliated cup;—or* **foot** *absent.*

This is a singular group of Rotifera. Unlike all other loricate free-swimmers, *Pterodinadæ* possess a corona of a Bdelloïdic, and trophi and foot of a Rhizotic type. The corona is that of *Philodinadæ*, the trophi are those of *Melicerta*, while the foot (when present) would be very like that of *Œcistes serpentinus*, but for its extremity. The two genera of which the family consists differ in the shape of the lorica, and in the foot.

In *Pterodina* the lorica consists of two delicately thin, and nearly flat plates, soldered together at their edges; in *Pompholyx* it is continuous, flask-shaped, and without edges. In the former the ventral plate is perforated for the emission of a long, wrinkled, toeless foot; the latter is footless.

Genus PTERODINA, *Ehrenberg*.

GEN. CH. **Lorica** *entire, greatly depressed, of two oval, but nearly circular plates soldered together at their edges;* **foot** *wholly retractile, transversely wrinkled, jointless, toeless, ending in a ciliated cup.*

The species of this genus differ from each other chiefly in the flexibility, shape and adorning of the lorica. In all, the **corona** consists of two circular lobes, whose ciliary wreaths, seen from above, present as perfect an appearance of two revolving wheels as in *Philodina* or *Rotifer*. The cylindrical **foot** is encircled by deep constrictions, which cease abruptly at some distance from its free end, and is remarkable not only from its being the foot of a fixed Rotiferon, but also from its ending in a richly-ciliated hemispherical cup. There are, too, some other points common to all the species, that deserve notice. The **salivary** (?) **glands** on the œsophagus are very numerous, and the **gastric glands** are of unusual length and shape. They are attached to the junction of the œsophagus and stomach by long tapering stalks; and, crossing the lorica transversely, are fastened to the dorsal surface by their broad ends. Between these attached ends of the gastric glands, and the lowest portion of the head, lie curiously-scalloped **foliations** (of a delicately blue-tinted substance) of which it is difficult to say whether they are continuous with the gastric glands, or are expansions of the lobed masses investing the base of the head, or are something analogous to the floccose ribbons which in so many Rotifera surround the lateral canals. They are very conspicuous in *P. patina*, but only faintly visible in *P. valvata;* and the upper portions of the lateral canals, with the attached vibratile tags, lie across them.[1] The **contractile vesicle** appears to be absent. The longitudinal **muscles** are coarsely striated, and the two **eyes** are distinct, colourless, transparent spheres resting on ruby pigment. I failed to find any dorsal **antenna**, but the dorso-lateral antennæ lie with their rocket-shaped heads close to the surface of the lorica near its edge at about one-third of the semi-circumference from the top.

P. PATINA, *Ehrenberg*.

(Pl. XXVI. fig. 11.)

Pterodina patina . . Ehrenberg, *Die Infus.* 1838, p. 517, Taf. lxiv. fig. 4.
„ . . Eckstein, *Sieb. u. Köll. Zeits.* xxxix. 1883, p. 401, Taf. xxvii. fig. 59.

SP. CH. **Lorica** *inflexible, nearly circular, stippled just within the edge, especially on its upper third;* **bosses** *absent from the lorica;* **gastric glands** *with broad, lobed ends.* **Lateral foliations** *very conspicuous.*

This is the common species; but, though no rarity, Müller has rightly described it as "Animalculum crystallinum, splendore nulli secundum"; for it is a lovely creature. The dorsal and ventral plates are pressed close together into a glassy **shield** of marvellous thinness. The former is more or less roughened round the edge; and, about the level of the mastax, this roughening spreads inwards to some distance. Occasionally, too, I have met with specimens in which there were faint traces of bosses, at irregular intervals, within the edge; but usually these are absent. A side view enables one to see that the ventral plate bulges out along the longitudinal axis, so as to form half of a hollow cone, whose broad end is forward, and whose point lies on the ventral surface at

[1] Mr. Gosse differs from me concerning the use of the "gastric glands"; the presence of the vibratile tags; the structure of the foliations; and, generally, concerning the Branchial System in *Pterodina*. His account of this structure will be found in the Appendix.

a distance of about one-third of the axis from the edge of the lorica. From the broad front opening the head protrudes; and here the cone is slit down a little, and the flaps rounded off, to give the head a freer passage. When the head is withdrawn, the flaps are drawn by muscles close together, up to the under side of the dorsal plate. Just below the pointed end of the conical hollow, there is a circular opening in the ventral plate, through which the foot can be protruded or withdrawn. The **gastric glands** are very conspicuous. They are unusually long pear-shaped bodies, stretching from the top of the stomach at right-angles to the animal's length, and having their broad heads fastened to the inner lining of the lorica. Round these points of attachment spread out wide **foliations** of a filmy substance, curiously and deeply scalloped, and passing upwards towards the head, and outwards nearly to the edge of the shield. It is not easy to see either the **lateral canals** or the **vibratile tags**, as they are often obscured by other organs. Lately, however, I succeeded in holding a *P. patina* firmly down in a clean drop of water, without hurting it; and, as its head moved backwards and forwards, I could see one of the thick, striped, longitudinal muscles bend aside, and permit a view of two vibratile tags, as well as of the lateral canals to which they adhered. The former lay about midway between the gastric gland and the bottom of the head; while the latter sloped upwards and inwards, towards the funnel in which the head moved, and were cut off abruptly below by the edge of the gastric gland, at about its middle point: I could see no trace of a **contractile vesicle.** Two pear-shaped glands are attached by long stalks to the œsophagus just below the mastax, and lower down is a cluster of similar glands crowding round the spot where the œsophagus enters the stomach. The **stomach** and intestine lie usually side-by-side, and distinctly separate. The latter no doubt discharges through a cloaca at the root of the foot, on its dorsal side, just where it issues from the circular opening in the ventral plate.[1]

Length. Of lorica, $\frac{1}{135}$ inch. **Habitat.** Clear ponds and ditches: tolerably common.

P. VALVATA, *Hudson.*

(Pl. XXVI. fig. 13.)

Pterodina valvata . . . . . Hudson, *Mon. Micr. J.* vol. v. 1871, p. 25, pl. lxxii.

SP. CH. **Lorica** *capable of being folded down on each side, nearly circular, smooth;* **bosses** *studding the edge at regular distances;* **gastric glands** *very long, club-shaped, with rounded ends.* **Lateral foliations** *inconspicuous.*

I found *P. valvata* at Abbot's Pond, near Clifton, in the summer of 1871. It was in great abundance, and in company with *P. patina*; and in captivity it increased so amazingly, that the glass sides of my aquarium were frosted with the adhering Rotifera. The **lorica** is remarkably transparent, and is ornamented within its edge with ten bosses, which add greatly to its beauty. When the two species are present together, the difference between them is recognized at a glance; for, delicate as *P. patina* is, *P. valvata* far surpasses it in filmy transparency. While watching some of the new *Pterodinæ*, I was surprised to see one of them sailing by with its lorica folded down (fig. 13*a*) like the flaps of a Pembroke table:[2] its outline was so altered that it scarcely seemed the same animal. This curious infolding of the lorica is due to the contraction of two conspicuous transverse muscles, which do not necessarily act together; as a friend, who was watching with me, saw some specimens with only one side folded at a time.

The **gastric glands** have not such broad heads as those in *patina*, and are altogether

[1] Herr Eckstein (*loc. cit.*) says that the foot is not an organ of prehension, but is the intestine, the ciliated cup being the cloaca. He does not, however, state that he has ever seen the fæces discharged through the foot; and, indeed, such a statement would seem incredible. Mr. Gosse, however, has witnessed the fæcal discharge, and says: "As well as I could see, it takes place at the upper side of the orifice through which the foot protrudes, projected in a strong current, and not immediately diffused."

[2] [As a rule the folding of the valves is somewhat rarely performed. I have observed, probably, hundreds at various times, and I think I have not seen half-a-dozen folded.—P.H.G.]

narrower. The **foliations** are so slight as to permit the **lateral antennæ** with their nerve-threads to be easily seen. Their rocket-shaped extremities lie close to the lorica, not far from its edge, and between the first and second bosses on either side: they are therefore, in an unusually forward position. The **lateral canals** can also be traced, in many convolutions, from the lower part of the head, to the point where they are abruptly cut off by the gastric glands. In young specimens, in which the ovary is a small, transverse, pyriform sac, and so does not obscure the view, they are seen again below the gastric glands on either side of the stomach; and, passing behind it, appear to end below it on either side, in small pear-shaped expansions. I could never find any **contractile vesicle**; but, under favourable conditions, I have seen three pairs of vibratile tags: one a little above the heads of the gastric glands, one on a level with the middle of the stomach, and one not far from the pear-shaped sacs in which the lateral canals seem to end.

Length. Lorica, $\frac{1}{120}$ inch. **Habitat.** Abbot's Pond, Clifton (C.T.H.): not common. Abundant near Torquay (P.H.G.).

I met once with an empty lorica (Pl. XXVI. fig. 17) which I suppose to be that of Ehrenberg's *P. elliptica*. It came from a pond in Sutton Park, Birmingham.

P. MUCRONATA, *Gosse*, sp. nov.

(Pl. XXVI. fig. 15.)

[SP. CH. **Lorica** *usually circular; dorsal plate furnished with an acute mucro projecting from its front. Lacustrine.*

In April 1885, associated with *P. patina* and *P. valvata*, which were swarming in one of my window reservoirs, I first met with this very pretty form. It never became very numerous; but, in the course of a few weeks, during which I was paying special attention to the genus, I met with more than thirty examples. The thought occurred that it might be the young condition of one of its larger fellow-species; and, if so, *valvata* would be the more probable. Yet I have found the young of *valvata* no larger than *mucronata*, but with no trace of the mucro: and I have seen a nearly mature egg in *mucronata*, which, though not conclusive, augments the probability of adult condition. On the other hand, slight unevenness of frontal outline is not rarely discernible in adult specimens of both the larger species. The matter is still *sub judice*; but for the present *mucronata* seems worthy of specific rank.

The **lorica** has not only the intra-marginal granulation of its fellows, which gives them so elegant a resemblance to a new silver coin, but is shagreened or studded with close-set rugosities over the entire surface of the dorsal plate, so delicate, however, that the hyaline transparency is not interrupted. What I consider the **branchial organs** are small; the efferent lobe, answering to the pyriform (**gastric gland**), is generally inconspicuous, and the afferent tubes are clustered in form of a cone around the base of the sub-horizontal muscle. I have not satisfactorily observed the existence of **eyes**. The pair of diagonal **muscles** is unusually well-developed. The lorica has about two-thirds of the diameter of *valvata*.—P.H.G.]

Length. About $\frac{1}{180}$ inch. **Habitat.** A domestic aquarium (P.H.G.): rare.

P. CLYPEATA, *Ehrenberg*.

(Pl. XXVI. fig. 14.)

Pterodina clypeata . . . Ehrenberg, *Die Infus.* 1838, p. 518, Taf. lxiv. fig. 6.

[SP. CH. **Lorica** *elliptical, truncate at each end;* **coronal disks** *widely separated. Marine.*

I first formed acquaintance with this attractive species in July 1850, in sea-water from the Essex coast; and lately it has been sent me in abundance by Mr. Hood from

the Firth of Tay. I have been able to preserve it in health for many weeks in phials of sea-water. Its ovate outline well distinguishes it from lacustrine forms; and this outline is subject to some variation by the action of a stout transverse muscle-band across the venter, drawing together the two sides; the medial length of the ventral plate being membranous and flexible, and the pectoral edge being cleft and overlapping. It is well suited for illustrating the **branchial system.** The plexus of the anastomosing afferent tubes is wide and particularly clear, and seems to be distributed on all sides of the great funnel. And the union of these can be readily traced into a large sac, which (placed on the ventral surface) presently bends dorsum-wards into a great pyriform vessel (as in *P. valvata*) on each side, and so pours its deoxygenated water by a slender duct into the œsophagus. The **abdominal viscera** are rather small. The long and flexible **foot** appears to be furnished with a central piston which protrudes and retracts its ciliated end; this is endowed with considerable power of adhesion.—P.H.G.]

Length. Head and foot extended, $\frac{1}{86}$ inch. Width, $\frac{1}{225}$ inch. **Habitat.** Among confervæ in tide-pools; mouth of the Naze, and of the Tay (P.H.G.): not rare.

P. TRUNCATA, *Gosse*, sp. nov.

(Pl. XXVI. fig. 16.)

Pterodina elliptica . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 203.

[SP. CH. **Lorica** *ovate, somewhat pointed behind, the occipital edge abruptly truncate and slightly notched, the pectoral widely cleft. Lacustrine.*

I know this from a single specimen only, which I took in the autumn of 1850, in the expanse of water locally known as the Black Sea, at Wandsworth. My study of it is imperfect; for though it rotated freely, I was called away before my observation had proceeded far, and when I returned it was retracted and soon died. The **eyes** are small, remote, and almost colourless. The extrusile **foot**, the **trophi**, the **digestive** apparatus, the pair of diagonal **muscles**, and (so far as seen) the plexus of **branchial tubules** on each side, were all generally normal.—P.H.G.]

Length. Of lorica, $\frac{1}{195}$ inch. **Habitat.** A lake near London (P.H.G.): very rare.

Genus POMPHOLYX, *Gosse.*

[GEN. CH. **Lorica** *entire, bottle-like;* **foot** *wanting; two frontal* **eyes**; **corona** *double behind, united before; eggs attached after extrusion. Lacustrine.*

Two species, so far as we know, compose this genus; both small, obscure, and rarely seen. The one was found by myself in 1850; the other by Mr. Bolton in 1884.—P.H.G.]

P. COMPLANATA, *Gosse.*

(Pl. XXVII. fig. 1.)

Pompholyx complanata . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 203.

[SP. CH. **Lorica** *two-sided, nearly circular, with rounded edges; occipital edge obtusely pointed, pectoral edge notched.*

The **form** is that of a round flat scent-bottle. The **corona** is composed of two disks, resembling those of a Bdelloïd, but united in front, with a deep occipital sulcus, wherein an **antenna** protrudes. The **eyes** are placed one on each side of this sulcus, large, globular, ruby-red, and highly refractile. The **jaws** and **alimentary canal** seem of the *Pterodina* pattern, but the minuteness of the animal precludes definite observation. The **cloaca** appears at the end of the lorica, as a round orifice, with a slightly raised edge around it. Yet the great size of the egg suggests either that this orifice must be expansible, or that there must be a separate duct.

In manners it resembles the *Pterodinæ*; but it revolves as it goes like the *Anuræa*.

It is somewhat slow of motion. The medial line of the venter is a salient angle; and this has a curious effect as the creature revolves.—P.H.G.]

Length. Of lorica, $\frac{1}{300}$ inch. **Habitat.** Pond at Lower Clapton (P.H.G.).

P. SULCATA, *Hudson.*

(Pl. XXVII. fig. 2.)

Pompholyx sulcata . . . Hudson, *J. Roy. Micr. Soc.* 1885, p. 613, pl. xii. figs. 7, 8.

SP. CH. **Lorica** *entire, divided into four convex lobes, by four longitudinal furrows.*

The **lorica** of this species is very unlike that of Mr. Gosse's *P. complanata.* In the latter the dorsal and ventral surfaces are so compressed that they are slightly concave, while in the former both these surfaces are sharply convex, and so are the connecting lateral surfaces. A transverse section, consequently, consists of four segments of circles, as shown in fig. 2*b*. It is easy to obtain this view, as well as a good sight of the corona with its two wheels and red **eyes**, for the animal is fond of swimming upright close to the cover-glass, or of exploring the bottom of the live-box, head downwards. I had little opportunity for studying the creature, but I noticed that the lorica had an aperture in its lower, pointed, and somewhat curved extremity.

I am indebted to Mr. Bolton for this pretty little Rotiferon, which he discovered in company with *Conochilus dossuarius* in the summer of 1884.

[A curious habit which this genus has in common with *Brachionus* is that of carrying the **eggs**, after they are successively discharged, until the young burst the shell. These are nearly circular (absolutely so as often presented to the eye), very large in proportion to the animal, each connected by a highly elastic thread to the hindmost part of the lorica, between its two terminal points. This thread can be lengthened or shortened at the will of the animal, and this in a surprising manner; for by very careful observation I perceived that, in elongating, the slender elastic thread was *actually projected*, the egg of course being inert, and nothing pulling or even touching it. And to a surprising extent; for I have seen the thread to equal in length the longer diameter of the egg.

The front edge of the **lorica** rises to a rounded projection dorsally, and two of less elevation laterally; these latter appear to be separated by a shallow sinus pectorally. The **mastax** is small, the **trophi** formed on the pattern seen in *Pterodina*, an *incus* with small *fulcrum* and quadrantiform *rami*, and with obsolescent *mallei*. I have seen retraction of the anterior parts to such an extent that the foot of the incus was very nearly at the bottom of the visceral cavity.—P.H.G.]

Length, $\frac{1}{220}$ inch. **Habitat.** Near Birmingham (T.B.): rare.

Family XVIII. BRACHIONIDÆ.

[**Lorica** *box-like, open at each end, generally armed with anterior and posterior spines;* **foot** *long, excessively flexible, wholly retractile, wrinkled, ending in two toes.*

Genus BRACHIONUS, *Ehrenberg.*

GEN. CH. **Lorica** *without elevated ridges, gibbous both dorsally and ventrally;* **foot** *very flexible, uniformly wrinkled, without articulation, toes very small. Lacustrine and marine.*

This genus contains Rotifera mostly of large size and of showy appearance, being inclosed in glassy shells of regular outline, adorned with symmetrical projections, and always presenting a broad surface to observation. They have been favourites with observers from the dawn of microscopy; and they are still. Fortunately most of the species are common and easily accessible. The form of the foot is peculiar; it is a long

and thick muscular tube, very transparent, covered with minute and close wrinkles, full of muscles, which admit of rapid protrusion and retraction, and of motion in all directions, with amazing flexibility (so that I have actually seen it tied in what, for the moment, looked like a knot!). The toes,—so small and apparently feeble,—have considerable power of grasping. They are sometimes used as a pivot on which the animal revolves. The mutual relations of the sexes are very distinct; as I have shown in detail in my Memoir "On the Dicœcious Character &c." (*Phil. Trans.* 1856). The female carries the excluded eggs attached to her body till they are hatched.

The distinction of the species rests mainly on the number, dimensions, and relations of the spines. Yet recent observations on *B. pala* throw doubt on the validity of such characters.—P.H.G.]

B. PALA, *Ehrenberg.*

(Pl. XXVII. fig. 3; and Pl. XXVIII. fig. 3.)

Brachionus pala	Ehrenberg, *Die Infus.* 1838, p. 511, Taf. lxiii. fig. 1.
,, *amphiceros* . .	,, *Die Infus.* 1838, p. 511, Taf. lxiii. fig. 2.
,, *polyacanthus* . .	Cohn, *Sieb. u. Köll. Zeits.* Bd. xii. 1863, Taf. xxii. fig. 4.
,, *amphiceros* . .	Plate, *Jenaisch. Zeits. f. Natur.* 1885, p. 65, Taf. ii. figs. 22–24.

SP. CH. **Lorica** *thin, smooth, transparent; with four, long, sharp,* **occipital spines.**

B. pala has a colourless, smooth and transparent **lorica**, armed with four long spines in front, but unarmed and rounded off behind. The lorica is flexible, and generally dragged-in a little on either side, round the attachments of the long dorsal muscles. The opening for the foot is a mere slit, through a pap-like protuberance at the end of the lorica; and its sides can be brought close together when the foot is withdrawn. The animal's internal organization is very like that of *B. rubens*, which has already been so fully described in Chapter I. that, beyond a reference to Pl. A, vol. i., and Pl. XXVII. fig. 3, only a few points require notice. The **mastax** is very large; and so are the transparent vesicles which are seated on it on the ventral side, and may possibly be salivary glands. By transmitted light they show only two curved lines (their outer bounding walls) rising from the mastax to the head. The **gastric glands** are stalked, as in *B. rubens*, but the stalks are generally hidden behind the broad triangular ends of the glands.[1] The **vascular system** is very conspicuous, and the five tags on each side can be readily found. I once obtained an admirable view of the top of a vibratile tag, which was pointing up the microscope. It was not at all like that of *Euchlanis dilatata* given by Dr. Plate, and taken from the same point of view. Dr. Plate figures the summit of the tag as an oval with pointed ends. I found that of the lowest tag of *B. pala* to be a thin straight edge, like that of a chisel. If there be an aperture there, it must be extremely narrow. As the animal moved, the tag turned too, so as to present also the two characteristic appearances given in Pl. XIII. fig. 3*b*.

Along with the undoubted specimens of *B. pala* were a good many of what appeared to be Ehrenberg's *B. amphiceros*, with two short thorn-like spines on the lumbar regions, and two others still smaller, one on each pap-like protuberance by the foot (fig. 3*c*). Ehrenberg says that *B. amphiceros* differs from *B. pala* in its smaller size, in having no coronal styles, in having four sharp posterior spines on the lorica, in lacking side muscles in front, and in having four vibratile tags instead of three. Moreover he says that he could not find a dorsal antenna. Now I carefully examined these specimens with four posterior spines, and found them to be of the same size as *B. pala*, with styles on the corona, with side muscles in front, and possessing a large dorsal antenna. In fact they were the exact counterparts of *pala*. I may add, too, that both those which had, and those which had not posterior spines, showed, under favourable circumstances, five vibratile tags on each side. Nor is this all: for I found some specimens with two

[1] The lower ends of these glands are tied to threads, which are attached to the loriea just above the heads of the lateral antennæ, and at their other extremities to the stomach. Mr. Gosse discovered and drew this arrangement, as well as the lateral antennæ themselves, in 1850.

lumbar spines but none on the foot-paps (fig. 3*d*), and others with spines on the foot-paps but none on the lumbar regions (fig. 3*c*); and, in all, the size and structure were the same. From this I conclude that Ehrenberg's *B. amphiceros* is only a variety of *B. pala*. [As is also, I have little doubt, my *B. öon* ("Ann. and Mag. N. H." Sept. 1851.—P.H.G.] The lateral, or lumbar-spines are very variable, and occasionally reach an extravagant length, as shown in Pl. XXVIII. fig. 3, where they are nearly as long as the body of the lorica. In this specimen the spines were hollow nearly to their ends, and were, in fact, true prolongations of the body-cavity. They were, too, as flexible as the lorica, so that they could be brought all four together at the tips, or even crossed.

Length. Lorica, $\frac{1}{75}$ inch. **Habitat.** Ponds and ditches: common.

B. DORCAS, *Gosse.*

(Pl. XXVIII. fig. 4.)

Brachionus dorcas . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 203.
„ „ . . . „ *Phil. Trans.* 1857, pl. xv. figs. 15–19.

[SP. CH. *As* B. pala; *but the* **occipital spines** *longer and more slender; and the antlers curved forward;* **pectoral edge** *undulate, with a central notch.*

This, too, may possibly prove only a variety of *pala*; but the appearance of the antlers struck me as unique; particularly the elegant sinuous curvature, like that of the horns of the Gazelle Antelopes, which suggested the specific name. I had ample opportunities of studying it in both sexes, and in all ages, from Forest-school Pond at Walthamstow, in 1850; but I have not met with it since. The figures, in which I have delineated its anatomy in detail, will render much description needless. I could find no **contractile vesicle** in any specimen, but distinctly traced the lateral canals of each side to a *common* termination at the cloaca. An excellent sight of one of the vibratile tags, endwise, showed these organs to be attached by a very minute papilla, and to be flattened on two opposite sides (as at fig. 4*d*). The parent carries her eggs after exclusion.—P.H.G.]

Length. Of lorica, $\frac{1}{60}$ inch; width, $\frac{1}{98}$ inch. **Habitat.** Walthamstow (P.H.G.): rare.

B. URCEOLARIS, *Ehrenberg.*

(Pl. XXVII. fig. 6.)

Brachionus urceolaris . . . Ehrenberg, *Die Infus.* 1838, p. 512, Taf. lxiii. fig. 3.

[SP. CH. **Lorica** *with six straight* **occipital spines** *and a deep sinus in the middle; the* **pectoral edge** *rising slightly to the middle, which is slightly excavate: orifice for the foot bounded by two papillæ.*

We have now species whose front is armed with six spines, usually low, but variable in height. In the present each **spine** is the origin of a shelly ridge, which runs for some distance down the lorica. Viewed dorsally, its outline is that of an elegant rounded cup; but, laterally, the occipital spines, and the gibbous dorsum descending below the flatter venter, destroy the resemblance. A round, or sub-square, orifice gives emission to the very agile wrinkled foot, as rapidly retracted. The lorica is somewhat scabrous. The internal organization is that common to the genus. The **lateral canals** begin at the highest point of the head-funnel, at the bases of the lateral spines. They pass down into close contact with the **gastric glands**, each of which is of great size and of retort-shape,[1] and each canal has at that contact a dilatation into an oblique plexus. Before it reaches its end, it is tied to the lorica, and makes an abrupt angle, to join the contractile vesicle *at the very neck* of its discharge.

Females carry, attached to the base of the foot, many small eggs which produce **males**, or few large eggs which produce females. (*Phil. Trans.* 1856, pl. xv. figs. 3–5;

[1] In one specimen the gastric glands evidently merged into the substance of the lateral canals.

where the species is named *rubens*.) The **eye** consists of three cells of ruby crimson, from the edges of each of which, under sunlight, brilliant reflection is seen.—P.H.G.].

Length. Of lorica, $\frac{1}{8}\frac{1}{8}$ inch; total, foot and head extruded, $\frac{1}{5}\frac{1}{6}$ inch. Width $\frac{1}{1}\frac{1}{0}$ inch. **Habitat.** Ponds and ornamental waters near London; Birmingham (P.H.G.): rather uncommon.

B. RUBENS, *Ehrenberg.*

(Pl. XXVII., fig. 5; and Pl. A.)

Brachionus rubens . . . Ehrenberg, *Die Infus.* 1838, p. 513, Taf. lxiii. fig. 4.

[SP. CH. *Nearly as the preceding, but the* **occipital spines** *have the form of saw-teeth, sloping inward; and of the* **pectoral edge** *the central elevation is more marked.*

I have strong doubts whether *B. urceolaris* and *B. rubens* are specifically distinct. Very different individuals may, indeed, readily be presented; but a series do certainly run into each other. Considering them for the present as distinct, I refer to the figs. on Plate A, and its explanation, in which it has been selected for illustration as typically representing the organization of the whole class. In examples which we may call more characteristically *rubens*, we may see the **gastric glands** in a very peculiar condition; each consisting of two sacs, quite distinct, each separated by a long duct, and the inner one leading by a duct to the œsophagus, while the outer is manifestly united with the **lateral canal.** Then the canals themselves form several distended sacs with necks, just before they enter the contractile vesicle, which is here unusually small, for the genus.—P.H.G.]

Length and **Habitat.** As the preceding.

B. MÜLLERI, *Ehrenberg.*

(Pl. XXVII. fig. 7; and Pl. XXX. fig. 8.)

Brachionus Mülleri . . . Ehrenberg, *Die Infus.* 1838, p. 513, Taf. lxiii. fig. 5.
„ *hepatotomus* . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 203.

[SP. CH. *The* **occipital spines** *reduced to low saw-teeth, much wider than high, with their outer edges sinuate; the* **pectoral line** *nearly straight, notched into round lobes. Marine.*

This is a very fine, elegant, and attractive species; and its marine habitat at once distinguishes it. I obtained it on the Essex coast six-and-thirty years ago; and recently Mr. Hood has sent it to me in abundance from tide-pools in the Firth of Tay, and Mr. Brightwell from Norfolk. It is a good traveller and lives long in small phials. I have had it in abundance in my own marine aquarium.

Each **gastric gland** is a great sac divided nearly to its base, so as to appear two; and these vary greatly in shape and in relative size. They are very distinctly connected with the lateral canals. Both male and female eggs are carried, and males are produced in abundance. The middle of the body in this sex is occupied by the **spermatic sac,** a great pyriform vessel connected by a bottle-like neck with the head-mass. On pressure this sac is seen to be full of bodies having a vermicular motion; and, on the pressure being continued, it bursts, freeing about thirty spermatozoa of unusual size, each being $\frac{1}{3}\frac{1}{0}\frac{1}{0}$ inch long, a slender body merging into a long whip-like tail which maintains a quivering undulatory motion for several minutes after exclusion.—P.H.G.]

Some fine specimens sent to me by Mr. J. Hood enabled me to make a drawing of the ventral aspect of this *Brachionus* (Pl. XXX. fig. 8), and to add a few notes to the above. The transparent **vesicles** which embrace the buccal funnel, and, resting on the mastax, reach up to the head, are here unusually large and conspicuous. The **lateral antennæ** can be readily seen protruding the tips of their heads from a dent in the lorica on either side just below the gastric glands: they are here, as is often the case, attached also to the floccose investment of the lateral canals, and their nerve-threads are obvious.

On the dorsal surface it is easy to bring into view the four bases of the **muscles** which work the foot; and which show as four spots nearly in a line crossing the lorica where it first begins to lessen in width.

Length. Lorica, $\frac{1}{100}$ inch; width, $\frac{1}{140}$ inch. **Habitat.** Sea-water. Essex and Norfolk coasts; Firth of Tay (P.H.G.; C.T.H.): common.

B. Bakeri, *Ehrenberg.*

(Pl. XXVII. fig. 8.)

Brachionus Bakeri . . . Ehrenberg, *Die Infus.* 1838, p. 514, pl. lxiv. fig. 1.
„ „ . . . Gosse, *Phil. Trans.* 1857, pl. xv. figs. 11, 12.

[SP. CH. **Occipital spines** *six, the intermediate pair almost obliterate; the* **pectoral line** *nearly level, undulate; behind two large* **lateral spines**, *and two smaller bounding the orifice for the foot. Lacustrine.*

This species has been dedicated to an early English microscopist; and it is both named and figured in Adams's great work on the Microscope, published just a century ago. It is a common species, and from its elegant form and ample breadth very attractive. Individuals differ much in the length, stoutness, and direction of the **spines**; the hind lateral pair being sometimes bent inward. The **ventral surface** is marked with minute granules, which are arranged in a pattern of some regularity. The **gastric glands** are again large, retort-shaped, with long necks, and are in contact, if not in union, with the lateral canals, which open into a small **contractile vesicle** at its *cloacal* end.—P.H.G.]

Length. Of lorica, $\frac{1}{92}$ inch: width, $\frac{1}{135}$. **Habitat.** Fresh waters around London, and widely spread (P.H.G.): rather common.

B. angularis, *Gosse.*

(Pl. XXVII. fig. 4; and Pl. XXX. fig. 9.)

Brachionus angularis . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 203.
„ „ . . . „ *Phil. Trans.* 1857, pl. xv. figs. 13, 14.

[SP. CH. **Occipital spines** *reduced to slight undulations, with a slight (usually) rounded sinus in the middle;* **pectoral edge** *nearly straight*; **hind extremity** *with two short, blunt processes;* **outline** *more or less angular.*

The **figure**, jutting out into blunt angles, though characteristic, is not absolutely invariable; for I have seen a specimen whose dorsal outline was as regular as that of *urceolaris*. I first found it in the pond at Walthamstow in 1849; then in the ornamental water at Kensington Palace; and on many occasions since; often associated with *B. pala*. The parent carries both male and female **eggs** to the hatching. The **male** I have described and figured elsewhere. I have seen the sexual *coitus*. The internal structure presents nothing notable. It is of lively, restless manners.—P.H.G.]

The highly-arched dorsal surface of the **lorica** is not only facetted (as I have shown in Pl. XXX. fig. 9) but is carved out into curious hollows that are well seen in Pl. XXVII. figs. 4, 4*a*, which drawings I made from an empty lorica of unusual beauty. The ventral plate is quite overlapped by the dorsal, which hangs down all round it; so that the ventral surface, taken as a whole, is concave, although its middle portion is convex. Nothing is easier than to clip the creature gently by its sides, so as to be able to look into the ventral hollow; and then, with dark-field illumination, and the binocular, the true shape of this curious lorica can be seen at a glance. A side view shows also the very stout, wide-based dorsal **antenna**; which, as usual, plays in the hollow between the occipital spines. The lateral antennæ are well worth notice. The tip of each rocket-shaped head lies at an aperture in the lorica (Pl. XXX. fig. 9) which has, raised round it, a small chitinous ring; through which the brush of setæ can be seen to protrude

(Pl. XXX. fig. 9*a*). This is a little advance on the structure in *Noteus quadricornis*, in which Rotiferon two distinct circular perforations, with smooth edges slightly raised above the general level of the lorica, give passage to the antennal brushes.

Length. Of lorica, $\frac{1}{200}$ inch. **Habitat.** Near London; Birmingham; Dundee (P.H.G.); Clifton (C.T.H.); pools of fresh water: not uncommon.

Genus NOTEUS.

GEN. CH. **Lorica** *facetted, and covered with raised points; gibbous dorsally, flat ventrally;* **foot** *obscurely jointed;* **toes** *moderately long;* **eyes** *wanting.*

N. QUADRICORNIS.

(Pl. XXVIII. fig. 5.)

Noteus quadricornis . . .	Ehrenberg, *Die Infus.* 1838, p. 503, Taf. lxii. fig. 1.
,, ,, . . .	Leydig, *Ueb. d. Bau d. Räderth.* 1854, p. 53, fig. 41.
,, ,, . . .	Eckstein, *Sieb. u. Köll. Zeits.* Bd. xxxix. 1883, p. 394.
,, ,, . . .	Plate, *Jenaisch. Zeits. f. Natur.* Bd. xix. 1885, p. 65.

The **lorica** of this handsome creature, the sole species of the genus, consists of two saucer-like plates; the dorsal one convex, facetted, and stippled; the ventral concave all round the edge but bulging in the middle, stippled and not tesselated. The front of the ventral plate is a concave circular segment with a minutely serrated edge, and the front of the dorsal plate has a similar, but unserrated, edge, with its outline broken by two projecting strips of the lorica which curve gradually over the head. At the hind end, the lorica is armed with two long, and nearly straight spines, widely separated by a straight edge set with a row of minute dots. The passage for the foot is a deep funnel-shaped cavity at the bottom of the ventral surface, covered by a loose flexible skin attached to its lower, inner edge, and also to the foot. The **head** is something like a broad and very thick basin. Seen from above, it shows the sides as circular lobes, connected on the dorsal side by an arched ridge. Its central hollow is small, and is laid open on the ventral surface by a V-shaped gap. The edges of the gap bear stout cilia, and there is a fan of similar cilia on the centre of the arched ridge connecting the circular lobes. On each side of the corona, apparently on the edges of the circular lobes, is a pimple bearing one or two styles. The rest of the corona is edged with ordinary cilia. The **foot** has three feeble false joints, and two rather long and sharp toes, which have the usual power of adhering to glass; though the two dusky objects running down its whole length are, I think, muscles for moving the toes, and not secreting glands. The **mastax** has a high position, and the **trophi** are weak examples of the sub-malleate type. The **gastric glands** are of unusual size and shape. They spread out like fans up into the extreme front corners of the lorica, and appear to be thin and delicately corrugated. They are joined to the apex of the stomach by long ducts. Just below the mastax there are small pear-shaped, and probably glandular, bodies attached by their stalks to the œsophagus. The **contractile vesicle** is large, and the lateral canals and vibratile tags are very conspicuous; the canals edging the lorica all round down to the base of each hind spine. In the individual shown in fig. 4, a narrow ovary had one ovum beginning to form near its smaller end; and below this ovum lay, in wrinkles, the empty pointed end of the ovisac. The **side muscles** for moving the head, a pair on each side, are unusually stout and obvious; the others are much as in *Brachionus*. A small heart-shaped **nervous ganglion**, with its broad end downwards, lies on the occiput between the frontal horns; and, seated on it, sloping downwards, is the conical sheath of the short **dorsal antenna**, whose tip just emerges at the base of the gap in the lorica between the horns. Dr. Plate (*loc. cit.*) has seen two

lateral antennæ protruding from small orifices on the dorsal surface of the lorica: one on each side, between the edge and the five-sided facets on the centre of the back.[1]

This is a bottom-haunting creature; and, in my experience, not a very common one. When captured it betrays its presence by its slow gliding motion, trailing foot, and white lorica: a whiteness due to the minute dots of chitine with which it is frosted. Happily the lorica is very thin, so that it is easy to see the viscera, in spite of the ridges, facets, and frosting.

Length. Of lorica, $\frac{1}{72}$ inch. **Habitat.** Ponds and ditches, near London, (P.H.G.); Clifton (Mr. Brayley; C.T.H.); Birmingham (Mr. Bolton junior): not very common.

Family XIX. ANURÆADÆ.

[**Lorica** *box-like, broadly open in front, behind open only by a narrow slit; usually armed with* **spines**, *or elastic setæ;* **foot** *wholly wanting.*

The genus *Anuræa* of Ehrenberg, already extensive, and now augmented by many new species, ought to constitute a distinct family, very different in form, structure and habit from the *Brachionidæ;* and including several genera. The body is inclosed in a compact box-like **lorica**, open in front and rear. They have no **foot**, and therefore are incessant swimmers, never resting. The **trophi** differ from those of the *Brachionidæ* in that the *manubria*, though usually clubbed, never take the expanded semi-circular shape. The **cilia**, too, are not set around a two-flapped corona, but on three large eminences, each of which terminates in a globose lobe, crowned with stout setæ. One **eye** is conspicuous, cervical. They are both marine and lacustrine.—P.H.G.]

Genus ANURÆA, *Gosse, nec Ehrenberg.*

[GEN. CH. **Lorica** *an oblong box, open widely in front, narrowly in rear; dorsal surface usually tesselated*; *the* **occipital edge** *always, the anal sometimes, furnished with spines; the* **egg** *after extrusion is carried attached to the lorica. Lacustrine.*—P.H.G.]

A. CURVICORNIS, *Ehrenberg.*

(Pl. XXIX. fig. 9.)

Anuræa curvicornis . . . Ehrenberg, *Die Infus.* 1838, p. 505, Taf. lxii. fig. 5.

[SP. CH. **Lorica** *oblong, rounded behind, tesselated, armed with six* **occipital spines**, *of which the middle pair are procurved; no spines behind.*

Of the **tesselations**, the medial row alone is perfect, of five facets; the posterior three are hexagons, the next square, the foremost an incomplete hexagon. From the lateral angles other ridges proceed laterally, forming other polygons, which are usually evanescent. Of the **spines**, the central pair (antlers) are strong, and curved forward, sometimes mutually approaching, sometimes receding. The lateral pairs are short, straight and pointed. From the outmost pair descends a prominent ridge on each side, making a sharp lateral edge to the lorica (fig. 9*a*). The **eye** is very large and brightly conspicuous; the **mastax** is a wide oblate spheroid, with mallei and incus well developed. A wide sacculate **stomach** follows, crowned with normal **gastric glands**, and descending with no distinct constriction to the hind end of the lorica, where there is a small orifice, through which I have seen the rectum protruded for a short distance, and then retracted. There is an ample contractile **vesicle**. The three main lobes of the **rotatory organ** are large and prominent when in action, each bearing a great round fleshy papilla, besides a smaller one on each side; each carries a divergent fan or brush of stout setæ. The

[1] I missed these in the living animal, but, afterwards, found the apertures (fig. 5*a*, *a'*) easily in an empty lorica, in the spots mentioned by Dr. Plate.

cilia produce vortices, but not wheels. A curved tubular **antenna**, with terminal bristles, issues from the sinus between the antlers.

This pretty species occurred by myriads in one of my garden pans near London in the autumn of 1849; and I met with it again in the watering pond on Hampstead Heath; but I have no record of it since. A great *Bursaria*, as well as *Asplanchnæ*, feeds voraciously upon it. It swims giddily, to and fro, with some swiftness.—P.H.G.]

Length, $\frac{1}{200}$ inch. **Habitat.** Near London; Birmingham (P.H.G.): not rare.

A. HYPELASMA, *Gosse.*

(Pl. XXIX. fig. 6.)

Anuræa fissa . . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 202.

[SP. CH. **Lorica** *without spines, consisting of two plates, the* **dorsal** *arched, the* **ventral** *flat, commensurate; and widely cleft through its medial line.*

When I obtained this species, in 1850, I could not satisfactorily determine the character of its **ventral plate**; but subsequently, on many occasions, and with great precision, I saw that it is a thin flat plate, of the full width, apparently connected with the dorsal only by membrane. It is, moreover, divided down the middle by a fissure of varying width; I have even seen the pectoral edges of the fissure overlapping. These peculiarities, combined with the straight transverse **occipital edge**, might almost entitle this species to generic separation. The **egg** is (proportionally) of vast size, nearly half as large as the whole animal; and not symmetrical, for, from the side at one end, projects a nipple, by which it remains attached to the parent. One I saw hatched. The young escaped at the part where the pedicle was, head foremost, rotating freely. It was exactly like the parent, and fully three-fourths of its size. There is evidently an anal orifice, whence frequently protrudes a very delicate membrane (doubtless the rectum), with its end expanded and recurved (fig. 6). When the rotating front is retracted, there are seen two shelly lobes rising from within the lorica, which approach to contact, and thus protect the head (fig. 6*a*). The internal structure is normal. Some specimens were thickly infested with a minute Infusorium (*Colacium*?).—P.H.G.]

Length, $\frac{1}{220}$ inch. **Habitat.** Near London; Leamington; Stapleton Park, Yorkshire; Dundee; Torquay (P.H.G.): rather common.

A. TECTA, *Gosse.*

(Pl. XXIX. fig. 10.)

Anuræa tecta . . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 202.

[SP. CH. *Nearly as* curvicornis, *but more pointed; and the* **tesselations** *are larger, and arranged on each side of a mesial dorsal ridge, which gives to the back the form of a vaulted roof.*

Of this pretty little species I have slight record. The arrangement of its facets sufficiently distinguishes it. It is high and nearly circular in transverse section. One that I saw carried a large egg-shell.—P.H.G.]

Length, $\frac{1}{200}$ inch. **Habitat.** Near London; Birmingham (P.H.G.): rare.

A. ACULEATA, *Ehrenberg.*

(Pl. XXIX. fig. 4.)

Anuræa aculeata . . . . . Ehrenberg, *Die Infus.* p. 508, Taf. lxii. fig. 14.
„ *brevispina*. . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 202.

[SP. CH. **Lorica** *oblong-square in outline, slightly arched dorsally, flat, or concave, ventrally; the normal* **occipital spines** *six, of which the antlers are procurved; each of*

the two posterior angles produced into a slender straight spine of varying length; **surface** *minutely punctated, and hexagonally tesselated.*

The **form** of this very abundant species exactly resembles, whether viewed from the back or side, that of a wicker hand-barrow familiar in some parts of the country. When the empty **lorica** is seen, it is a beautiful microscopic object. The rotating head, and whole internal organization agree with those common to the genus. It swims rather swiftly, in a peculiar style, continually revolving, both on the long and the transverse axis, throwing perpetual somersaults. Its irregular plunging and rolling strongly remind me of the motion of a ship in a heavy sea.

My *A. brevispina* (*loc. cit.*) (Pl. XXIX. fig. 5) is, I feel assured, only a *var.* of this species, with the spines degenerate, and the puncturing nearly evanescent. Ehrenberg's *A. testudo* and *A. valga* will, I think, fall into the same category.—P.H.G.]

Length (including spines), $\frac{1}{115}$ inch; width, $\frac{1}{280}$ inch. **Habitat.** Pools and lakes (P.H.G.): very common.

A. COCHLEARIS, *Gosse.*

(Pl. XXIX. fig. 7.)

Anuræa cochlearis . . . . Gosse, *Ann. Nat. Hist.* 2 Ser. vol. viii. 1851, p. 202.

[SP. CH. **Lorica** *spoon-shaped, ending behind in a straight slender spine; the back ridged and tesselate, as in* A. tecta.

This bears the same relation to *A. stipitata*, Ehr., as *A. tecta* bears to *A. curvicornis*; differing from *stipitata* by the roof-like back, and the mesial division of the facets, which latter (as shown in Ehrenberg's figures) are decidedly of the hexagon pattern. The outline, too, of *stipitata* is that of a broad, or even triangular shovel; whereas that of *cochlearis* is decidedly spoon-shaped, broadly ovate. It is delicately punctate or stippled. The protrusile **front** is very ample; a great chin of two fleshy lobes is seen sidewise, besides the lateral and frontal lobes. The **eye** is manifestly on a lens, which sparkles in focusing, like a gem, but pale in hue. An **egg** of enormous proportions is carried before the caudal spine, reaching nearly to the chin. The **spine** varies much in length, from a mere tubercle to equal length with the lorica-body.

The species is not uncommon in clear waters, often associated with *Asplanchna*, of which it forms a common article of food. I have taken an *Asp. priodonta* with an *An. cochlearis* in its stomach, which, *after an hour or two*, was ejected, and instantly swam about, *as lively*, and apparently *as uninjured* as ever!—P.H.G.]

Length (including spines), $\frac{1}{150}$ to $\frac{1}{130}$ inch. **Habitat.** Clear ponds and lakes (P.H.G.): common.

A. SERRULATA, *Ehrenberg.*

(Pl. XXIX. fig. 8.)

Anuræa serrulata . . . . Ehrenberg, *Die Infus.* 1838, p. 508, Taf. lxii. fig. 13.

[SP. CH. **Lorica** *oblong-square, much as the shorter-spined forms of* A. aculeata; *dorsally* **tesselate** *with hexagons, except that the hind row of facets are two great polygons mesially divided; ridges serrate; both surfaces punctate.*

The most prominent character of this species is its extreme roughness, the edges of all the facet-divisions, and the back of every spine being jagged with minute round excavations, which stud every part of the surface. I have counted about seventy punctures in one facet. This roughness varies in degree. The **antlers** are often greatly developed in stoutness, length, and curvature: the hind spines are sometimes nearly obliterate. The **pectoral edge** makes two arches (each with an intra-marginal line) with a notch between them. The **viscera** sometimes protrude in a globose form beyond the end of the lorica: I think this is when the **contractile vesicle** is filling. The **frontal lobes** take the form of three short cylinders, each with its fan, of vibratile setæ; each of

the lateral pair projects from the midst of a much thicker cylinder. There are two square **antennæ**. The **eye** is large, sparkling in sunlight, and refractile.—P.H.G.]

Length, $\frac{1}{112}$ inch. **Habitat.** Near London; Birmingham; Dundee (P.H.G.): common.

Genus NOTHOLCA, *Gosse*, gen. nov.

[GEN. CH. **Lorica** *ovate, truncate and* **six-spined** *in front, sometimes produced behind; of two spoon-like plates united laterally; no hind spines; dorsal surface marked longitudinally with* **alternate ridges** *and* **furrows**; *expelled egg not usually carried. Lacustrine and marine.*

The genus thus indicated may include the species *biremis, striata, inermis* (young ?), *acuminata*, and *foliacea* (?) of Ehrenberg, together with others, which appear to be hitherto undescribed.—P.H.G.]

N. ACUMINATA, *Ehrenberg.*

(Pl. XXIX. fig. 3.)

Anuræa acuminata . . . Ehrenberg, *Die Infus.* 1838, p. 506, Taf. lxii. fig. 9.

[SP. CH. **Lorica** *produced behind into a long truncate point, spoon-shaped;* **ventral** *plate concave, one-third shorter than the* **dorsal.**

The form is very elegant. Of the **frontal spines** the antlers are nearly straight, the laterals moderately long, the intermediaries very short. From their six points, and from their five interspaces, run strongly marked lines throughout the lorica, of which the former are elevated, the latter depressed angularly. The junction of the ventral plate is about one-third from the point where the cloaca opens. Here two muscle-threads are affixed, connected with the rectum, which they draw down. An ample **contractile vesicle** receives on each side a conspicuous branchial duct, which in some parts is slender, in others much expanded and corrugated, including many vacuoles, and carrying two vibratile tags each. A remarkable structure is seen in apparent connection with these organs, which recalls the pyriform sacs seen in *Pterodina*. The **œsophagus** is long, and attached to it on each side is a small vessel which seems the ordinary **gastric gland.** But somewhat behind these are seen a pair of sacs, connected with the stomach on each side, and each giving off two threads, by one of which it is fastened to the lining membrane of the lorica, while the other runs down for some distance parallel with, and close beside, the tortuous vessel (branchia ?), and is then attached to the interior, where two remarkable shelly bosses are seen. The stomach itself is tied to the lorica by threads, which are probably muscular.—P.H.G.].

Length, $\frac{1}{83}$ inch. **Habitat.** Ornamental waters near London (P.H.G.): very rare.

N. LONGISPINA, *Kellicott.*

(Pl. XXVIII. fig. 6.)

Anuræa longispina . . . . Kellicott, *Amer. J. Micr.* iv. 1879, p. 20, with fig.
„ „ . . . . (Abstracted) *J. Roy. Micr. Soc.* ii. 1879, p. 157, with fig.
„ „ . . . . Levick, *Midland Naturalist*, ii. 1879, p. 241, 1 pl.
„ *spinosa* . . . . Imhoff, *Zool. Anzeig.* Sept. 1883, No. 147, with fig.

SP. CH. **Lorica** *greatly produced behind so as to resemble a frontal spine;* **dorsal** *and* **ventral plates** *commensurate; of the six* **occipital spines** *the central pair consists of one very long curved spine, and of one aborted straight spine; the lateral pair, of two long, and curved; and the remaining pair, of two short, and straight; the* **ventral plate** *has a movable flap with a straight* **pectoral edge.**

Notholca longispina does not readily lend itself to any theory on the cause of an

animal's **form**; as it is hard to see how its extravagantly long spines can be of much service to it. They evidently forbid its approach to the confervæ and floating rubbish that are the favourite haunts of its class, under penalty of being probably anchored for life to the same spot; and they can scarcely serve as floats, for the animal is a heavy swimmer, as if overburdened with these great projections, and is usually found four or five feet below the surface. Neither can they be very serviceable as weapons of defence, for even the fry of a gudgeon would soon learn to snap it sidewise. At any rate it is a most interesting form, and though rare and impatient of captivity it is easily managed in the compressorium, as it can be firmly yet lightly held by its long curved spines without injury. The **lorica** is triangular in outline, the dorsal surface convex both lengthwise and across, the ventral slightly concave and rather more sharply curved as it approaches the hind end. Six **spines** spring from the anterior edge of the lorica. Two are lateral, and are continuations of thickened ridges running part way down the edges where the dorsal and ventral surfaces meet. They are equal in size, taper to a point, and curve first outward and then upwards and inwards. Then, on either side of the median dorsal line is a strikingly unmatched pair. One, the largest of all the six, is stout at the base, tapering to a point, and curved first downwards and then upwards, with a graceful sweep. The other is an abortive looking spine, of uniform thickness, about one-fifth of the length of its partner. In the gap between these two lies the **dorsal antenna**; and, as this antenna is exactly on the median line, it follows that the longest spine is not in the middle of the lorica (as it has been hitherto drawn [1]), but slightly on one side of it. There is yet another pair of spines, of equal length, considerably shorter than the lateral spines, and lying one on each side between the dorsal and lateral pairs. The hind end of the lorica flows off into yet another tapering spine curving downward and then upward, like the longest; and, with it and the body, presenting on a side view an elegant sigmoid curve. At the top of the ventral surface the lorica has a square flap, which can move, as on a hinge, to permit the head to come out, and which closes over it, when it is withdrawn. There is also a slit, like a trap-door at the hind end of the ventral surface, through which the cloaca is emptied. All the front spines are rough, but the hind spine is smooth. The **corona** has a thick dorsal wall crowned with ciliated eminences, and surrounding a deep cavity leading to the buccal orifice. This cavity is thrown open on the ventral surface by a scalloped V-shaped slit; and is guarded at each side on the top by two teat-shaped protuberances armed with stout vibrating styles. All the edge of the corona is **ciliated**, and so are the edges of the ventral slit, at the bottom of which lies the buccal orifice. The **mastax** with its sub-malleate trophi is close to the buccal orifice. There is a distinct **œsophagus** bearing two stalked **glands** below the mastax, and a cluster of rather larger glands just above the stomach. The **gastric glands**, **stomach** and **intestine** require no notice. A **contractile vesicle** lies just below the latter, close to the cloaca; the **lateral canals** and **vibratile tags** are conspicuous. The **muscular system** is like that of *B. rubens* (i. p. 8); and it is curious to see how, owing to the flexibility of the lorica, the longitudinal muscles can draw together all the frontal spines. As these are really continuations of stout chitinous ridges in the lorica itself, the approaching spines, with the flexible lorica folding up between them, look exactly like a closing umbrella. My specimens died before I had seen the **nervous ganglion**; but there is a dorsal antenna, protruding between the longest and the abortive spine when the head is expanded, and pulled in when the head is withdrawn. The adult had a single red **eye**, at the lowest part of the occiput, near the dorsal surface. Mr. Levick says that many of the first specimens that he found had two eyes; and that he thinks these animals were young ones. It would be very curious should it prove to be the case that two eyes in the young approach with age, and coalesce in the adult; especially as *Brachioni*

[1] Dr. Kellicott, Mr. Levick, and Dr. Imhoff, all place the largest frontal spine exactly on the median line of the lorica, and half-way between two small spines; I am satisfied that this is a mistake. Dr. Imhoff's figure shows *four* small frontal spines besides the three long ones: this also is wrong; there are only three, the abortive spine and a pair.

have an eye which has every appearance of being a coalesced pair. The extruded **egg** is carried on the ventral surface just above the hind spine.

Dr. Kellicott discovered this fine *Anuræa* in Niagara water at Buffalo, and soon after Mr. Levick found it in Olton reservoir. I am indebted both to Mr. Levick and Mr. Dunlop for many living specimens, and to Mr. Levick also for several mounted.

Length. Total, $\frac{1}{40}$ inch; of longest spine, $\frac{1}{100}$ inch. **Habitat.** Buffalo, U.S. (Dr. D. S. Kellicott); Birmingham (Mr. J. Levick); Greenock (Mr. M. F. Dunlop).

N. THALASSIA, *Gosse*, sp. nov.

(Pl. XXIX. fig. 2.)

[SP. CH. *The two* **lorica-plates** *commensurate;* **dorsal** *arched, long-ovate in outline;* **ventral,** *with* **pectoral edge** *straight. Marine.*

The **antlers** and lateral spines are moderate, nearly straight and sub-equal: the intermediate pair mere tubercles. The **pectoral edge** has no conspicuous unevenness. The **lorica** is scarcely changeable in outline, as if it were stiff and unyielding. Yet the shelly substance merges so insensibly into thin and evanescent membrane at the hind end (where a very delicate membrane, like a truncate tail [*rectum*?] is protruded), that we cannot determine the point of transition. The form and lobes of the **front,** and the array of fan-like setæ; the **brain** and great **eye**; the **mastax** and jaws; and the abdominal organization, do not notably vary from what we see in *Anuræa*. The broad protrusile and retractile membrane at the **cloaca** excretes mucus for temporary anchorage. One which I saw forcing its way through thick clusters of diatoms, emerged with several of them glued to its rear, which were then detached with some difficulty. In free swimming it is headlong and rapid, and very restless. In one example the intestinal canal was full of the frustules of diatoms. It is exclusively marine.—P.H.G.]

Length, $\frac{1}{118}$ inch. **Habitat.** Tide-pools in the Firth of Tay (P.H.G.): common.

N. SCAPHA, *Gosse*, sp. nov.

(Pl. XXIX. fig. 1.)

[SP. CH. **Lorica** *nearly as broad as long;* **dorsal plate** *greatly exceeding the* **ventral** *in width;* **pectoral edge** *sinuate. Marine.*

The transverse **outline** is highly rounded, resembling the half of an egg-shell, far within the margins of which a flat (ventral) plate is fixed across the cavity, leaving wide overhanging edges. The **lorica** is very flexible, so that, when the fore-parts are forcibly retracted, the dorsal outline suddenly appears perfectly circular, except at its spinous front edge, and then bears much resemblance to that of a *Brachionus*. The cloacal orifice is a very short and thin fissure at the extremity, and does not extend sensibly up each side.

In swiftly swimming, the wide but thin wing-like expansions of the **dorsal plate** are very conspicuous by their glassy clearness, and by their peculiar form, especially when seen end-wise; and this gives a very distinct aspect to the species, which is more than usually attractive. When alarmed it suddenly retracts with a snap; and if it happens to be presented sidewise at the moment, the frontal spines close with the sinuous pectoral edge, so as to cross and interlace. I saw one eagerly feasting on an *Actinophrys*, and watched it for half-an-hour. At first the frontal cilia worked energetically at it, gradually drawing it into the open front of the lorica, and holding it there. But the jaws were not applied to it; and it seemed as if the ciliary action alone were drawing off invisible gelatinous juices into the buccal funnel. Yet, when at length the *Notholca* relinquished its hold, the prey seemed uninjured. The species has been sent me by Mr. Hood, associated with the preceding, in sea-water from the estuary of the Tay. - P.H.G.]

Length, $\frac{1}{150}$ inch. **Habitat.** Firth of Tay (J.H.).

Genus ERETMIA, *Gosse*.

[GEN. CH. **Lorica** *neither tesselated nor ridged; destitute of spines proper, but furnished with long attenuate rigid bristles.*

This seems to be a natural group, containing numerous species. They appear to be destitute of the spines common to *Anuræa*, pointed extensions of the lorica itself; for the slender appendages are quite different in form, and probably in function.—P.H.G.]

E. PENTATHRIX, *Gosse*, sp. nov.

(Pl. XXIX. fig. 12.)

[SP. CH. *Five long* **bristles** *projected from the lorica; one dorsal and two from each side: no frontal or posterior spines.*

This species I know only from a single dead and empty lorica which I found in the sediment of water, dipped in June, from a pool at Sandhurst, Berks, by Dr. Collins. The **lorica** is ovate, truncate in front, with no spines of the ordinary pattern, but bearing attached to the medial line of the dorsum a long stiff seta, or attenuate spine, the base of which is deep but very thin, the depth gradually diminishing. From the sides, about two-thirds down, spring a pair of similar bristles of less basal depth; and, at a short distance from the round extremity of the lorica, another pair. All radiate from the surface of the lorica, and are consimilar in length and tenuity. No trace of the internal organs was left.

This has evident affinities with the *A. biremis* of Ehrenberg, which he describes from a single specimen obtained in the Baltic Sea. That species, however, has four frontal spines.—P.H.G.]

Length, unrecorded. **Habitat.** Pool near Sandhurst Mil. Coll. (P.H.G.): very rare.

E. CUBEUTES, *Gosse*, sp. nov.

(Pl. XXIX. fig. 11.)

[SP. CH. **Lorica** *bag-like, round behind, truncate before; with a diverging* **seta** *from the dorsum and one from the venter; four straight* **spinous processes** *from the rounded end; the whole surface cut into cubical tesseræ.*

This minute and very curious form I place in the genus *Eretmia*, though the body processes seem rather spines than setæ. I have found it, but only as a dead lorica, on two separate occasions, and in water from widely distant localities; but Mr. Hood has since found it living, and sent me a good drawing of it, which well agrees with my own. All were in autumn and winter of 1885–86.

The **lorica edge** is not spined, but notched. Yet the notches are but the intervals between the *tesseræ* of the front row, of which three are seen beside the lateral two. For the entire surface of the lorica is marked with two series of **depressions**, those of each series parallel to each other, but the two series crossing each other at right angles (or nearly); so as to leave a multitude of square tesseræ, or cubical knobs,—like dice set corner-wise:—a form of surface quite unique, so far as I know. I was, indeed, disposed to think it an *Arcelline* Infusory of the genus *Difflugium*, till I received Mr. Hood's report, which showed it a true *Anuræad*. He describes the **rotatory front** as bearing the normal three great ciliate lobes. The large red **eye** I had myself seen.—P.H.G.]

Length (including spines), $\frac{1}{346}$ inch (P.H.G.); $\frac{1}{200}$ inch (Hood). **Habitat.** Birmingham (P.H.G.); Black Loch, Dundee (Hood): rare.

CHAPTER XI.

SCIRTOPODA.

Cætera de genere hoc mirande multa videmus,
Quæ violare fidem quasi sensibus omnia quærunt:
Nequidquam; quoniam pars horum maxima fallit
Propter opinatus animi quos addimus ipsei
Pro visis ut sint, quæ non sunt sensibus visa.
Nam nihil ægrius est quam res secernere apertas
Ab dubiis, animus quas ab se protinus addit.

LUCRETIUS, *De Rerum Natura*, Lib. iv. l. 464.

The life of the brute has commonly one immense compensation in its favour; the perfection of the individual existence is so rarely sacrificed to the prosperity of the race. It is not necessary, in order that one hippopotamus should cut his food conveniently, that another hippopotamus should lead an unhealthy existence like a Sheffield grinder; nor does the comfort of any bird's nest require that another bird should slowly poison itself in preparing acetates of copper, sulphurets of mercury, or oxides of lead. The pride and beauty of a brute are never based upon the enduring misery of another brute. The wild drake's plumage, splendid as it is, suggests no painful thought of consumptive weavers, of ill-paid lace-makers, of harassed over-worked milliners: and the most sensitive of us may enjoy the sight of it without painful thoughts; for it is God's free gift, causing no heart-burning of envy, no care nor anxiety of any kind. —P. G. HAMERTON, *Chapters on Animals.*

We are then in a world of spirits, as well as in a world of sense; and we hold communion with it, and take part in it, though we are not conscious of doing so. If this seems strange to anyone, let him reflect that we are undeniably taking part in a third world, which we do indeed see, but about which we do not know more than about the Angelic hosts;—the world of brute animals. Can anything be more marvellous or startling, unless we were used to it, than that we should have a race of beings about us, whom we do but see, and as little know their state, or can describe their interests, or their destiny, as we can tell of the inhabitants of the sun and moon? It is indeed a very overpowering thought, when we get to fix our minds on it, that we familiarly use, I may say hold intercourse with, creatures who are as much strangers to us, as mysterious, as if they were the fabulous, unearthly beings, more powerful than man, yet his slaves, which Eastern superstitions have invented.—NEWMAN, *Parochial Sermons*, 'The Invisible World.'

CHAPTER XI.

Order IV. **SCIRTOPODA.**

Swimming with their ciliary wreath, and skipping with Arthropodous limbs; **foot** *absent.*

The fourth order, *Scirtopoda*, although it contains but two Rotifera, each in a genus by itself, is one of no little importance, as it is that in which the ROTIFERA and CRUSTACEA most nearly touch. The true position of the ROTIFERA in the animal kingdom has long been a matter of keen dispute, and the chief authorities have taken opposite sides: Professor Owen, Dr. Leydig, and others, rank them among CRUSTACEA [1]; while M. Milne-Edwards, Dr. Cohn, Professor Huxley, with the majority, would consider them as VERMES. Nor is this surprising; for the ROTIFERA possess many characters that are common, in various degrees, to ARTHROPODA and VERMES alike; and, so far as their nutritive, reproductive, or nervous systems are concerned, might with little difficulty be placed in either sub-kingdom. But there were three respects, before the discovery of *Pedalion* and *Hexarthra*, in which the ROTIFERA appeared to differ from ARTHROPODA, and to resemble VERMES. These are, first, that they do not possess pairs of jointed appendages, articulated to the body, with muscles prolonged into their interior; and on this point great stress was laid. Secondly, that they swim by means of ciliary wreaths; and thirdly, that they possess a vascular system, with ciliated tags, whose chief function is probably a respiratory one.

But the discoveries of *Pedalion* and *Hexarthra* have shewn that Rotifera exist whose internal structure is perfectly normal, and which yet possess three pairs of unquestionably Arthropodous limbs; and these discoveries have in consequence disposed of the chief objection to the ranking of the ROTIFERA among ARTHROPODA. It may, on the other hand, be fairly urged that the balance of argument even now inclines towards those who are in favour of the opinion that the ROTIFERA, as a class, are nearer to VERMES: yet no one, I think, who has studied both *Pedalion* and the Nauplius larva of one of our fresh-water ENTOMOSTRACA, would feel satisfied with their being placed in two distinct sub-kingdoms.

In conclusion, I see no reason why the ROTIFERA should be assigned solely to VERMES or ARTHROPODA; and I would propose to consider them as a class that links these two sub-kingdoms together.[2]

Family XX. PEDALIONIDÆ.

Arthropodous limbs *six;* **head** *truncate;* **corona** *of two concave lobes;* **ciliary wreath** *as in Philodinadæ;* **trophi** *malleo-ramate.*

The family contains two genera, *Pedalion* and *Hexarthra*, each containing only a single species. The two are much alike [3] in the possession of six Arthropodous limbs

[1] [I consider the ROTIFERA a class of the sub-kingdom ARTHROPODA, co-equal in rank with INSECTA and CRUSTACEA.—P.H.G.]

[2] Of course I am here treating the matter simply as one of formal classification; and from this point of view it is enough to say that if we knew none but the humbler forms of the ROTIFERA, we should call them VERMES; whereas if *Pedalion* and *Hexarthra* were our only examples, we should call them the lowest forms of ARTHROPODA.

[3] Mr. Julien Deby, in the *J. Roy. Micr. Soc.* 1879, p. 384, has suggested that the two Rotifera are

ending in fans of imbricated setæ, in the conical shape of the body, and in the broad truncate corona; but they differ strikingly in the way in which the limbs are set on the body: for in *Pedalion* they are arranged around it parallel to its longitudinal axis, while in *Hexarthra*, as in the Nauplius larva, they radiate from the centre of the ventral surface. Nor is this the only difference. *Hexarthra's* limbs are in three graduated pairs, while *Pedalion's* ventral limb is far longer than any of the others: moreover, *Hexarthra* lacks two long stylate appendages, ciliated at the ends, which are to be found on the posterior end of *Pedalion's* dorsal surface.

Genus PEDALION, *Hudson.*

GEN. CH. **Limbs** *arranged round the body in pairs, and parallel to its longitudinal axis; two stylate, ciliated* **appendages** *on the posterior dorsal surface.*

P. MIRUM, *Hudson.*

(Pl. XXX. fig. 1.)

Pedalion mirum . . .	Hudson, *Mon. Micr. J.* vol. vi. 1871, p. 121, pl. xciv.; and p. 215.
,, ,, . . .	,, *Quart. J. Micr. Sci.* vol. xii. 1872, p. 333, pl. xix.
,, ,, . . .	,, *Mon. Micr. J.* vol. viii. 1872, p. 209, pl. xxxiii.
,, ,, . . .	Lankester, *Quart. J. Micr. Sci.* vol. xii. 1872, p. 338.

SP. CH. **Ventral limb** *much the largest;* **dorsal limb** *on the median line;* **lateral limbs** *in two unequal dissimilar pairs; the* **bases** *of all the limbs, lying in a transverse section behind the dorsal antenna; their free ends terminating in fans of imbricated setæ.*

It was in July 1871 that I had the good fortune to discover this remarkable Rotiferon in a small road-side pond near the head of Nightingale Valley at Clifton. On placing a specimen of it under the microscope I for a moment fancied that I had brought home by mistake some Entomostracous larva, for its outline, its six limbs ending in fans of imbricated setæ, and its habit of jerking itself through the water, made it resemble the ordinary Nauplius of a *Cyclops*. However, a brief examination showed it to be a true Rotiferon, with a splendid corona and with internal organs much like those of *Triarthra longiseta*. The external **form** is extraordinary; not only has it six well-developed limbs, but all these limbs are hollow, communicating with the body cavity, and containing pairs of opposing muscles prolonged into their interior. The arrangement of the limbs too is more effective for locomotion than that in a Nauplius; for in *Pedalion* they are attached in pairs to its anterior end, and lie parallel to the longitudinal axis of the body, so that their united stroke acts at a great mechanical advantage; but in the Nauplius larva the limbs radiate from a spot on the ventral surface; and, in consequence of this inferior method of attachment, produce a very feeble skip compared with the furious rush of *Pedalion*. The **corona** is unusually large, and consists of two oval saucer-like lobes, so set as to give together a heart-shaped appearance to the head. The **ciliary wreath** is double, and precisely on the pattern of the *Philodinadæ* (Pl. C, fig. 3). Between the upper and lower wreath is the usual groove along which the food is conducted to the mouth. On either side the lower wreath dips down to the buccal orifice, which is prolonged ventrally into a great curved lip, fringed with very large cilia. The rather small **mastax** has two

identical, and that the differences between my description and Dr. Schmarda's "reside principally in the incompleteness of the details given by the latter, and are consequently differences of omission rather than anything else." It is difficult to understand how it can be an "omission" to describe and draw all the *six* legs as radiating from a spot on the ventral surface, while (on the supposition of the identity of the two creatures) there is only *one* on that surface, and all lie round the body and parallel to its length. Neither can it well be an "omission" or an "incomplete detail" to say that there are *two* legs of equal size longer than all the others, when there is only *one* such leg. Indeed, were Dr. Schmarda really capable of the gross blunders attributed to him by Mr. Deby, the whole of his observations would be worthless.

chitinous lips, which may be seen constantly advancing and receding in the buccal funnel, and apparently selecting the morsels which are allowed to reach the trophi. The **œsophagus** is short, and the nearly cylindrical **stomach** has very thick elastic walls; in a dying specimen I have seen the food expelled, and the walls close in quite upon themselves. The **gastric glands** are somewhat oval; and I think that I have seen two small stalked glandular-looking bodies attached to the œsophagus. The **intestine** is a broad short chamber with thicker walls and coarser cilia than those of the stomach. The two ciliated straight **processes**, on the hind end of the dorsal surface, have also a glandular structure and secrete a viscous fluid, by threads of which *Pedalion* may be found moored to algæ, or to the floating masses of floccose sediment.

These processes vary greatly in length in different individuals; they are always very short in the newly hatched female, and are wanting in the male. It is unusually difficult to demonstrate the **vascular system**, as its parts are so frequently obscured by the alimentary canal and the limbs. There are two lateral canals, each commencing in a plexus close to an eye and bearing a vibratile tag. Hence the canal runs down to a second plexus, halfway down the body, with two vibratile tags; and, skirting the side, finally unites with the cloaca. There is no contractile vesicle. The **ovary** requires no notice. *Pedalion* carries its extruded egg attached to its posterior extremity till it is hatched. Of the large oval female eggs only one at a time is so carried; the small, round male eggs are carried in clusters: the eggs of different sexes are never present together. The newly hatched female resembles its mother, and passes through no change but that of growth. The **muscular system** is very greatly developed. There are at least forty striated muscles arranged in pairs of elevators and depressors, not mere repetitions of each other like the muscles of a caterpillar, but very various in shape and arrangement, and obviously intended for different duties. Figs. 1*d*, 1*e*, 1*f* show these pairs very carefully drawn and, with the printed explanation facing Pl. XXX., render any detailed account superfluous. The **nervous ganglion** lies closely applied to the dorsal side of the buccal funnel, and has above it two **eyes**, widely apart and close to the surface of the corona; one in each of its lobes. They are clear refractive spheres set on plates of red pigment. Nerve-threads pass from the ganglion to lateral rocket-headed **antennæ**, one on each shoulder; and another nervous thread supplies a similar antenna which moves up and down in a protuberance on the dorsal median line (figs. 1*a*, 1*b*) just behind the dorsal gap in the ciliary wreath.

The **male** (figs. 1*h*, 1*k*) is the merest caricature of the adult female. The large, shapely **corona**, with its flowing curves has become a ciliated knob; the six **limbs**, with their fan-shaped plumes, have been altered into three little stumps, with a bristle or two at the end of each; even the huge ventral limb has vanished, and the whole creature has shrunk up to barely one-fifth of the length of the adult female. It swims very differently from its mother; for it spins constantly round its own length, like a joint on a spit, while at the same time moving forward. Now and then it jerks its side limbs, and it uses them to free itself from its shell. There are two longitudinal **muscles** for retracting the head and a pair of red **eyes**, but I could discover no other internal organs except the **testis** and **penis**. This latter I have seen protruded to a length quite equal to that of half the animal.

Length. Female, corona and body, $\frac{1}{120}$ inch; from corona to end of ventral limb, excluding setæ, $\frac{1}{85}$ inch: male, $\frac{1}{370}$ inch. **Habitat.** Clifton (C.T.H.); Birmingham (T.B.); warm water-lily tank in the Duke of Westminster's gardens at Eaton, and ponds in the neighbourhood of Chester (Mr. Thos. Shepheard): very rare.

The only other Rotiferon in this Order is *Hexarthra polyptera* (Pl. XXX. fig. 2),[1] which was discovered by Dr. Schmarda in some brackish water near El Kab in Egypt, in March 1853. He describes the **body** as a blunt cone with a right and left group of **cilia** on its broad end. The **trophi** resemble those of *Triarthra*. The **stomach** is short and broad; the

[1] Copied from Dr. Schmarda's fig. 1, *Zur Naturgesch. Ägyptens*, Taf. iii.

intestine is frequently constricted and narrow towards its end. The **gastric glands** are two lobed. He further notices the **lateral canals**, and a bladder-like organ which he conjectures to be the testicle, but which was probably the contractile vesicle. Two red globular **eyes** are seated in the corona, not far asunder. The mature **eggs**, which are green, are carried at the posterior end of the body. There are three pairs of **limbs** attached to *the ventral surface*. The foremost pair is the longest, the middle pair is less, and the lowest pair is the least. Two streaked **muscles** run down the first pair of limbs, and one muscle down each of the other four. All the limbs are terminated by fans of setæ. *H. polyptera* does not appear to have any ciliated **processes** on the dorsal hind surface.

ADDENDA.

[Asplanchna myrmeleo, *Ehrenberg* (vol. i. p. 123 : footnote). This interesting species is no longer an alien. Mr. Hood has lately sent me, from Dundee, living and healthy examples. They seemed to possess no contractile vesicle.—P.H.G.]

[Eretmia trithrix, *Gosse*, sp. nov. (Pl. XXVIII. fig. 2). **Lorica** a three-sided box, of which the posterior end is a triangle, and carries a long elastic **seta** at each angle: **egg**, when laid, carried between the alvine setæ. **Length**, $\frac{1}{162}$ inch. *Lacustrine.*—P.H.G.]

[Eretmia tetrathrix, *Hood*, sp. nov. (Pl. XXVIII. fig. 1). **Lorica** shaped like a deep obconic wine-glass, of which the foot is represented by a very long straight **seta**: three similar **setæ** stand up from the occipital margin. **Length**, of lorica, $\frac{1}{100}$ inch; total $\frac{1}{40\,0}$ inch. *Lacustrine.*—P.H.G.]

Notommata Werneckii, *Ehrenberg*. I am indebted to Mr. Fred. Bates for some threads of *Vaucheria sessilis* bearing many of the galls caused by this parasitical Rotiferon. Mr. Bates says that he has found the animal in abundance inhabiting these galls, which may occur anywhere along the thread of the *Vaucheria*: but that he has *not* found the parasites in the reproductive cells (see vol. i. p. 39).

Length (according to Balbiani), $\frac{1}{100}$ inch. **Habitat.** Neighbourhood of Leicester (Mr. F. Bates).

Œcistes ptygura, *Ehrenberg* (Pl. XXX. fig. 3). This is no doubt Ehrenberg's *Ptygura melicerta*. It has a two-lobed **corona**; a wide **dorsal gap**; no visible **ventral antennæ**; a pair of large dorsal **hooks**, adnate for half their length; a stout wrinkled **foot**; and an irregular floccose **tube**. It was found last May, at Twickenham, by Mr. G. Western, who kindly sent me the living specimen, from which fig. 3 has been drawn. Its position, in one of the axils of the plant to which it was attached, prevented me from measuring it; but it seemed to be about the size of an ordinary *Œcistes crystallinus*.

The following remarkable Rotifera are as yet unknown in Britain.

Balatro calvus (Pl. XXX. fig. 6), *Ed. Claparède* (15). This is an **il-loricated** Rotiferon, parasitic on different species of *Oligochæta*. Its peculiar hind extremity is shown in the figure. **Mastax** very small, containing two minute curved rami; **stomach**, simple and straight; **ovary** large; **ciliary wreath** and **antenna** wanting; **nervous**, and **vascular systems** apparently absent.

Drilophaga bucephalus (Pl. XXX. fig. 5), *F. Vejdovský* (150). An **il-loricated** *Proales*-like Rotiferon, parasitic on *Lumbriculus variegatus*; it adheres by its trophi to the worm's hinder segments, and sucks its juices; **nutritive, secreting,** and **vascular systems** normal.

Seison Grubei (Pl. XXX. fig. 4), *C. Claus* (17, 18). A doubtful Rotiferon; **il-loricated**, of extraordinary form, parasitic on *Nebalia*; **ciliary wreath** a few cilia at the mouth; **secreting system** highly developed; **nutritive system** present in the male as well as in the female; **vascular system** very rudimentary; **jaws** rotiferous.

APPENDIX.

THE VASCULAR SYSTEM.

*** *The numbers in brackets, as* (138), *refer to the memoirs in the Bibliography, pp.* 140–142.

1. This system of vessels, in its usual form, has already been described in vol. i. p. 8. There are three [1] principal varieties of it, including that already given above.

(i.) The lateral canals open into a contractile vesicle, which discharges itself into the cloaca. This is the ordinary plan.

(ii.) Each of the lateral canals ends in an expanded portion which dilates, and contracts, and discharges into the cloaca. This doubling of the contractile vessel is to be found, among others, in *Conchilus volvox* [2] and *Salpina macracantha*.[3]

(iii.) The lateral canals pass unexpanded directly into the cloaca, and the contractile vesicle is absent.[4]

2. It is probable that the contractile vesicle is filled by a fluid flowing into it through the lateral canals, and it is certain that it usually [5] empties itself outwards through the cloaca. This has been directly observed [6] in *Asplanchna priodonta* and in *Hydatina senta* by myself, and can be easily verified. It has been suggested that a return current of fresh water is drawn up by the expanding contractile vesicle through the cloaca; but no one has seen any appearance of this in the cloaca itself; and though Dr. Cohn [7] thinks that he saw a return current draw particles of carmine towards the opening of the cloaca of *Brachionus militaris*, after the outward current had driven them away from it, no one else seems to have succeeded in repeating the observation.[8] Occasionally the contents of the cloaca are driven into the intestine. Dr. Moxon has seen this in *Euchlanis dilatata*,[9] and Dr. Semper has seen it in *Trochosphæra æquatorealis*.[10] In each case it was effected by closing the aperture of the cloaca and opening that of the intestine simultaneously; but this is not the usual action, and (as Dr. Moxon suggests) seems only to be a method of obtaining a natural enema for a clogged intestine.

3. In all the three plans, given in § 1, the lateral canals sometimes appear surrounded by a filmy, floccose substance, through which they meander (generally two on each side)

[1] Dr. Semper (138) says that in *Trochosphæra æquatorealis* there is a contractile vesicle which has no connection with the lateral canals: if this is really the case, it would be unique. Mr. Gosse has described, p. 138, another variety of the vascular system in *Pterodina*, and in other Rotifera; but, as we differ widely here about the facts, as well as about the inferences drawn from them, I have (for the sake of brevity and clearness) omitted this variety from my account.

[2] Vol. i. p. 90. [3] Vol. ii. p. 85.

[4] Professor Huxley (91) states that this is the case in *Lacinularia socialis*; but Dr. Leydig (108) says he has seen a small contractile vesicle in this *Rotiferon*. Neither *Pedalion mirum*, *Pterodina patina*, nor *P. valvata* appears to have any contractile vesicle.

[5] See below; same paragraph. [6] Vol. i. p. 123. [7] (21).

[8] I have never seen *B. militaris*, which from the great size of its contractile vesicle is admirably adapted for such observations.

[9] (118). [10] Vol. i. p. 88.

in many loops and curves, and occasionally forming a plexus of complicated intertwinings. Attached to the canals by long stalks are the little flickering bodies called vibratile tags. The canals are generally visible just under the head, near a plexus, and run down each side of the body, from one plexus to another, till they reach the surface of the contractile vesicle. There are usually five vibratile tags on a side, and a plexus is a favourite point of attachment.

4. The tags are of various shapes. In some they seem to be simple cylinders, or cones with their bases at the free end. In others they are somewhat wedge-shaped; so that they have a broad triangular surface from one point of view, and a narrow spindle-shaped surface from another. If a tag happens to point straight up the microscope, a full view may be obtained of its free end; and the outlines, so obtained, of these free ends, vary considerably: in the case of *Euchlanis dilatata* it is a narrow oval with prolonged pointed ends;[1] and in that of *Brachionus pala*,[2] only a fine straight edge. Whenever I have obtained a distinct edgewise view of a tag, it has had the *appearance* of being closed at its free end with a knob. Down the length of the tag (when so seen) run an endless succession of swift undulations; which, on several occasions, in the dying animal, I have seen slowly slacken, till they have gradually resolved themselves into what *seemed* to be one stout, tapering, undulating cilium, of the length of the tag itself, attached by its broad base to the knob mentioned above, and pointing its taper extremity to the lateral canal.

But when the tag presents its broad triangular surface to the observer, there is a totally different appearance; and it seems to be crossed by quivering, parallel, straight lines that stretch from one side to the other (Pl. XIII. fig. 3*b*). It is obvious that no single cilium could present such an appearance. Possibly an undulating membrane might, the cross-lines being the summits of the waves which happened to be in focus; but the lines seem to be too sharp for this. Dr. Moxon suggests that the cross-lines are produced by rows of extremely minute cilia on each inner broad surface of the tag. It is not easy to imagine what such an apparatus might look like when seen in motion sidewise; but possibly the apparent waves produced by the cilia on either side might together cause the illusory appearance of an undulating cilium as long as the vibratile tag. That many of the inner surfaces of the Rotifera are lined with minute cilia has long been known. The whole alimentary tract is so; and, what is more to the point, this very appearance of a long undulating cilium is certainly produced in the tube of *Floscularia campanulata* by very minute cilia running in straight lines down its length.[3]

5. The next point is whether these tags are open or closed at their free ends. On this point it is enough to say that direct observation has entirely failed to decide the question. The chief authorities have come to opposite conclusions, and there seems to be no hope of settling the point by the microscope. The close analogy between the vibratile tags of the Rotifera and the appendages on the water-vessels of the Naids would, however, lead us to infer that in the former case, as well as in the latter, the tags in spite of appearances may be open funnels, furred inside with minute cilia. A similar difficulty awaits us when we inquire how the lateral canals originate in the head. In some cases the canals on either side are said to have their fore ends on the surface[4] in communication with the free water, in others to cross from side to side and anastomose[5]; so that the whole apparatus forms a loop with its two ends attached either to the cloaca or to the contractile vesicle; while in the great majority of cases it is impossible to say what is the real arrangement.

6. In attempting to determine the use of this apparatus we are met by this obvious difficulty; that we are not sure of the facts. Are the vibratile tags open at their free

[1] Dr. Plate (126) Taf. ii. fig. 19, c. [2] C.T.H. vol. ii. p. 117.

[3] Pl. D, fig. 1; also Dr. Moxon (118).

[4] As observed by Mr. Gosse in *Pterodina patina* and *P. valvata*, vol. ii. p. 138.

[5] As observed by Professor Huxley in *Lacinularia socialis* (91); by Dr. Leydig in the same (108); and by myself in *Stephanoceros Eichhornii*, Pl, iv. figs. 2, 4.

ends, or are they closed? Do they contain an undulating membrane, or are their inner surfaces furred with minute cilia? Does a current pass through them (supposing them to be open funnels) *towards* the lateral canals, as it seems to do, or in the opposite direction? Are the lateral canals open at their upper ends, or are they blind passages having no outlet save at the contractile vesicle? Is the substance surrounding the lateral canals a glandular secreting substance, or a mere mechanical support for the canals? Does the contractile vesicle fill itself by drawing up fresh water through the cloaca, or is it filled by fluid passing into it from the lateral canals?

I do not know how these questions are to be answered with any approach to certainty, and I have no expectation of their receiving any answers that will meet with general acceptance, for on all these points the best observers disagree: I shall, therefore, do no more than state, in the following paragraph, the view of those who consider the vascular system to be an excreting one; and leave to my colleague the advocacy of the opinion which he has long held, viz. that the system is mainly branchial, with, possibly, a subordinate excreting function.

7. The perivisceral fluid is in part[1] derived from the products of digestion which pass by endosmose through the cellular walls of the stomach; and it is out of this fluid that the various organs are repaired, and at its expense that the animal moves and grows. This growth, repair, and action change the constitution of parts of the perivisceral fluid, and render an excreting organ a necessity. The vascular system is this excreting organ; and, indeed, no other has ever been suggested as having an excreting function. The lateral canals with their floccose investments, or the vibratile tags,[2] or both, are the excreting vessels; while the part played by the contractile vesicle is one probably of storage and discharge: for the contractile vesicle varies extremely in size and frequency of action in different Rotifera, and in some is altogether absent.

The oxygenation of the perivisceral fluid, both in males and females, probably takes place at the fore part of the head, where the skin is never loricated, but appears to be thin; and, where, too, it is possible that there may be definite spots, covered with delicate membrane, so as to take advantage of the constant rush of water, drawn to the head by the ceaseless action of the cilia.

8. Now it is obvious (from § 6) that the above explanation (given in § 7) of the vascular system, rests on a number of assumptions which it is impossible to verify. But then as much, I think, may be said of the explanation that would make the function of this system a branchial one, or a combination in various degrees of both.

[1] Leydig is of opinion (110) that water passes by endosmosis into the body cavity. This, indeed, seems probable; for indigo-coloured water when swallowed (*e.g.* by *R. vulgaris*) almost instantly imparts a blue tint to the thick cellular walls of the stomach up to their outmost boundary. It can hardly be supposed that it goes no further, if the products of digestion do. It seems unlikely that the inner walls of these stomach-cells should be pervious to the products of digestion, and to water, alike; and that the outer walls should be pervious to the former, and impervious to the latter. It has, however, been objected, that we never *see* the indigo-coloured water in the perivisceral fluid. But it is hardly to be expected that we should. When we look at the blue stomach-walls, we are looking at a colour produced by a depth of solution equal to that of one or two thick cells; whereas the coloured fluid, oozing out through the stomach-walls, would be presented to our eyes in films of almost infinitesimal thinness; which would never be suffered to accumulate and so become visible, but would be at once broken up and lost, by the constant motion of the perivisceral fluid. Besides the blue tint after a time disappears from the cells. It seems more likely that this is due to the indigo-solution continuing its course through the cells into the body cavity along with the products of digestion, than to its parting company with these latter at the outer wall, and then alone reversing its course, and returning into the stomach.

[2] If the vibratile tags be supposed to be open ciliated funnels, through which the perivisceral fluid passes into the lateral canals, to be discharged through the cloaca, then we are met with the difficulty that this supposition would imply the frequent discharge of a fluid analogous to blood. But, on the other hand, if it were admitted that, in the perivisceral fluid, the products of digestion are largely diluted with water (see previous note), the force of this objection would be much weakened; for the supposed difficulty would be mainly due to our having applied, to so simple a fluid, the name of such a highly organised product as blood.

The conclusion seems a lame one, and yet I fear that it is hardly possible to hope for a better, when dealing with an apparatus of whose structure we know so little ; one which we are unable to examine except with our eyes, and yet one in which we have strong reasons for suspecting that, on crucial matters of detail, our sight deceives us.

P. H. G. *on the Vascular System.*

[My opinion is,—as it was in 1850 ("On the Anat. of *Not. aurita* ;" Tr. Micr. Soc. Lond., iii. 98),—that the vascular system is a proper respiratory system, and that the lateral canals are proper branchiæ. The water enters at the head, circulates, and is poured out at the cloaca. I believe these three facts may be predicated of the entire class. Accessories to the process are : (1) the afferent tubules ; (2) the "gastric glands ;" (3) the vibratile tags ; (4) the contractile vesicle.

1. In so many species that I consider the arrangement universal, I trace up the canals to the funnel through which the head-mass constantly moves up and down. The canals *never* partake of this motion, and it is evident that they are attached to the wall of the funnel, which I presume to be perforated with minute orifices through which the external water constantly percolates into the afferent tubules. In many species these appear to be numerous, and they are seen to branch and to anastomose very irregularly into each other, forming single, double, or multiple canals, which run, sometimes nearly straight, but more commonly bent sinuately in various degrees, throughout the length of the animal. In *Pterodina*, (especially in *patina* and *clypeata*) the tubules ramify and spread into broad fan-shaped plexuses of flat laminæ (which I consider tubular, and ciliate within), filling the wide triangular areas on each side of the mastax. Then they begin to unite again, and presently (in *P. valvata* especially), bending abruptly from the ventral to the dorsal side, form one broad and long pyriform sac which narrows to a long slender duct, and joins the œsophagus one on each side, pouring the effete water into the alimentary canal, and ultimately through the cloaca, without the intervention of a contractile vesicle.

2. The "gastric glands."—The organs thus named have usually been considered as ancillary to the digestive system. But their evident connection with the aquiferous system in *Pterodina* makes this doubtful ; and a number of other curious facts are observable, which confirm, more or less manifestly, this connection.

Sometimes these organs take the form of large reservoirs of delicate texture and wrinkled surface, joined to the œsophagus by long ducts, and affixed by threads (perhaps tubular) to the lateral canals, or to the lorica. In *Metopidia solidus*, each appears as an aggregation of saccules into a large three-sided and three-angled body, one angle passing up to the origin of the canal, and another by a long duct to the œsophagus, while the canal seems in some inexplicable way united with both. This, excessively slender at its origin, expands as it proceeds, becoming corrugate, till it attains a width almost rivalling the plexus of *Pterodina patina*, just before it enters the cloaca, without the intervention of a contractile vesicle. Yet, in some individuals, the contractile vesicle itself and its action are quite distinct.

In *Notholca acuminata* the "gastric gland" much resembles the *pyriform* of *Pter. valvata*, with a slender duct to the long œsophagus, and another duct from an outer angle leading down for some distance closely parallel with the lateral canal, and connected with it by a short transverse duct at each end.

Cathypna luna has a structure somewhat like this ; and, in a less degree, *Metopidia rhomboides*.

Several species of *Brachionus* display anomalies in these organs. Thus in *B. Bakeri* and *B. urceolaris* each is a great wrinkled sac of very delicate tissue, and of retort-shape, at the end of a long neck. In *B. rubens* there are *two* sacs on each side, united by a long sinuous duct. In *B. Mülleri* there is but one on each side, but it is cleft almost to the base into two varying portions. In all these the organs seem to have more or

less obvious connection with the expansions of the lateral canals. But, in one example, which I cannot distinguish from *urceolaris*, the sac is, at its outer extremity, indefinitely expanded, *fore and aft*, and seems to merge into the length of the canal itself, which yet begins clearly in the wall of the head-funnel, and terminates normally in a contractile vesicle.

On the other hand, in *Asplanchna*, the glands, which are small oval organs, are connate, on each side of the very long œsophagus, remote from, and apparently quite unconnected with, the canals.

3. Of the "vibratile tags" I have little to say of direct observation. In *Pterodina* they seem to me wholly wanting. I judge it nearly certain that they are tubular, and that *something* is driven through them, whose course is *from* the lateral canal to the body-cavity.[1] Assuming that the function of the system is the separation of oxygen from the water, may it not be that the tags are reservoirs in which pure oxygen collects, and from which it is pumped into the perivisceral blood, while the hydrogen left pursues its course, perhaps to fulfil some office still, mechanical or vital?

4. Of the contractile vesicle, the normal position, form, structure, and function are well known.[2] But in the two largest species of *Salpina*, *macracantha* and *eustala*, there are two of these organs, of ample dimensions, one on each side, into which the comparatively straight and thick lateral canals empty by trumpet-mouths. Strange to say, in the former species the "gastric glands" seem wholly wanting.

In the great *Asplanchnæ*, the organ, though manifest enough, is very small; in *Metopidia*, as already mentioned, it is only now and then present; while in *Pterodina*, it is (according to my experience) invariably wanting.

On the whole, then, I judge that Rotifera possess a well-marked branchial system, which has several striking parallels with that of the Annellida—the *Lumbricidæ* in particular.—P.H.G.]

THE SETIGEROUS SENSE-ORGANS.

The nervous system of the Rotifera is simple. It consists of one nervous ganglion situated on the dorsal side of the buccal funnel, usually near the mastax; and sending out nervous threads to the eyes,[3] and to certain organs of sense, which have been termed *antennæ* or *tentacles* as they are possibly tactile organs; but whose function is by no means certain. They consist of knobs or cylinders, which usually carry a bunch of fine setæ at their outer extremity. Sometimes they are enclosed in tubular sheaths rising from the surface of the body; and at others their extremities lie close to apertures in that surface, through which the setæ may be seen to protrude. The antennæ are in two pairs. Of these the upper pair is invariably dorsal; and its constituents, though sometimes widely separate,[4] are most frequently pressed close together,[5] or fused into one.[6] The lower pair is to be found sometimes on the dorsal surface,[7] sometimes on the ventral,[8] and sometimes on the line between the two.[9] In one case this lower pair is also fused together,[10] and the creature has but two antennæ; both dorsal, and both on the median line. It is only necessary to add that, in many species, one or other pair appears to be absent; notably the lower pair in all the *Philodinadæ*: but in some of these cases their absence may be only apparent; as the antennæ are often reduced to minute setigerous pimples, and so can be easily missed.

[1] The perivisceral fluid, or blood, is surely neither effused from the body, nor augmented in quantity, *sensibly*.

[2] Since a special reservoir would seem needless for the *mere* discharge of the effete water, an urinary office may belong to this bladder.

[3] When there is only one eye it is generally seated on the nervous ganglion itself.

[4] As in *Asplanchna priodonta*, Pl. xii. fig. 2*c*: *Copeus spicatus*, Pl. xxx. fig. 7: and *Brachionus plicatilis* (117).

[5] As in *Synchæta pectinata*; Pl. xiii. fig. 3*c*.

[6] The common case.

[7] As in *Notops Brachionus*; Pl. xv. fig. 1.

[8] As in *Melicerta ringens*; Pl. v. fig. 4.

[9] As in *Stephanoceros Eichhornii*; Pl. iv. fig. 2.

[10] As in *Copeus caudatus*; Pl. xvi. fig. 5*a*.

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3
3a
3b
3c
7a
7
11b
11c


13
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15
16
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PLATE XXVII.

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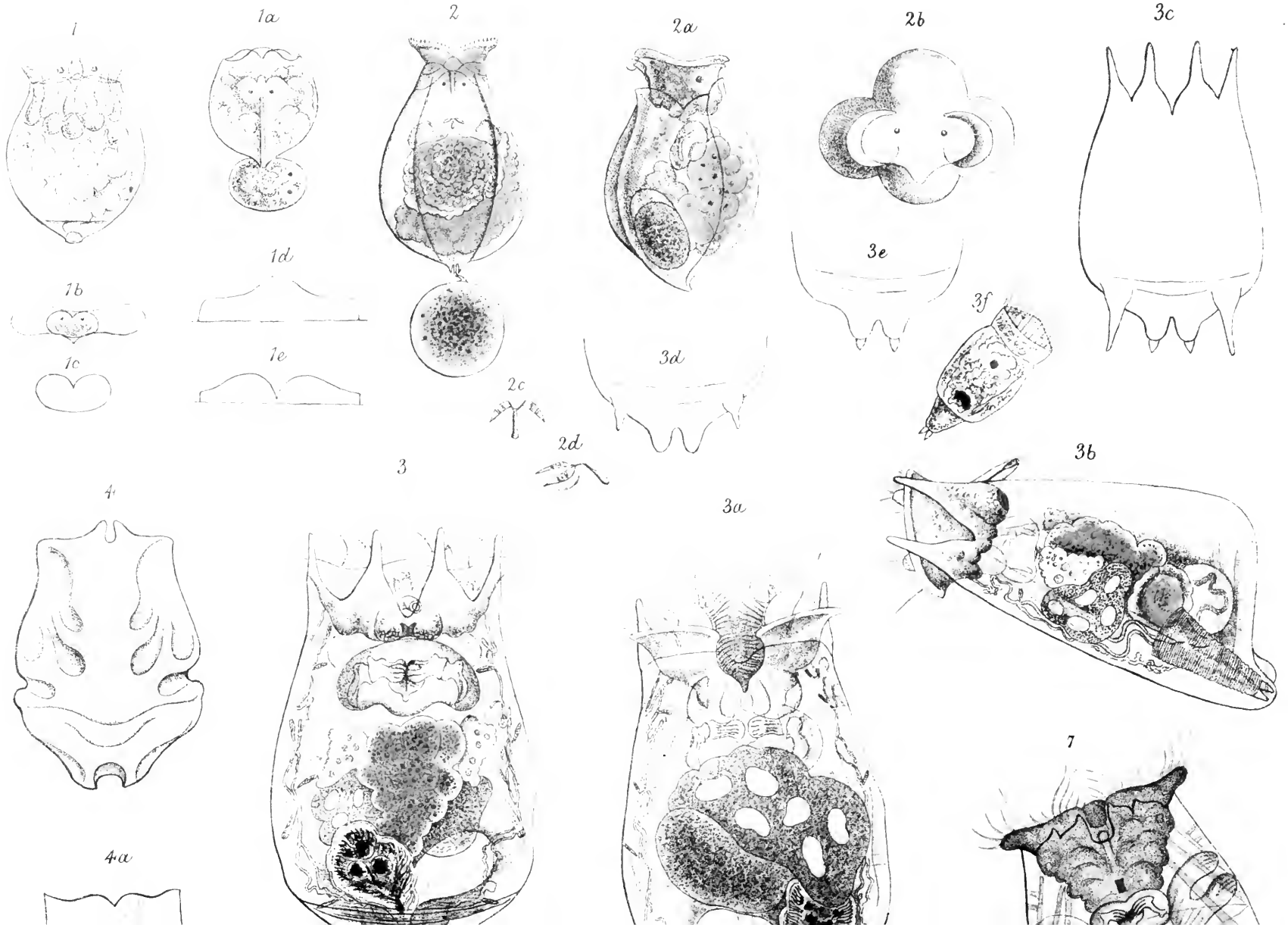
3*c*, 3*d*, 3*e*.	„	loricæ of three varieties	H
3*f*.	„ „	male	G
4.	Brachionus angularis	lorica, dorsal view	H
4*a*.	„ „	lorica, ventral view	H
5.	Brachionus rubens	dorsal view, extended	G
5*a*.	„ „	dorsal view, retracted	G
5*b*.	„ „	hind end of lorica	G
5*c*.	„ „	end of foot	G
5*d*.	„ „	brain and eye	H
6.	Brachionus urceolaris	dorsal view	G
6*a*.	„ „	male	G
7.	Brachionus Mülleri	dorsal view	G
7*a*.	„ „	extremities of lorica	G
7*b*.	„ „	male	G
7*c*.	„ „	penis and foot	G
7*d*.	„ „	spermatozoa	G
8.	Brachionus Bakeri	dorsal view	G
8*a*.	„ „	male	G


1
1a
2
2a
2b
3c
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3e
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2c
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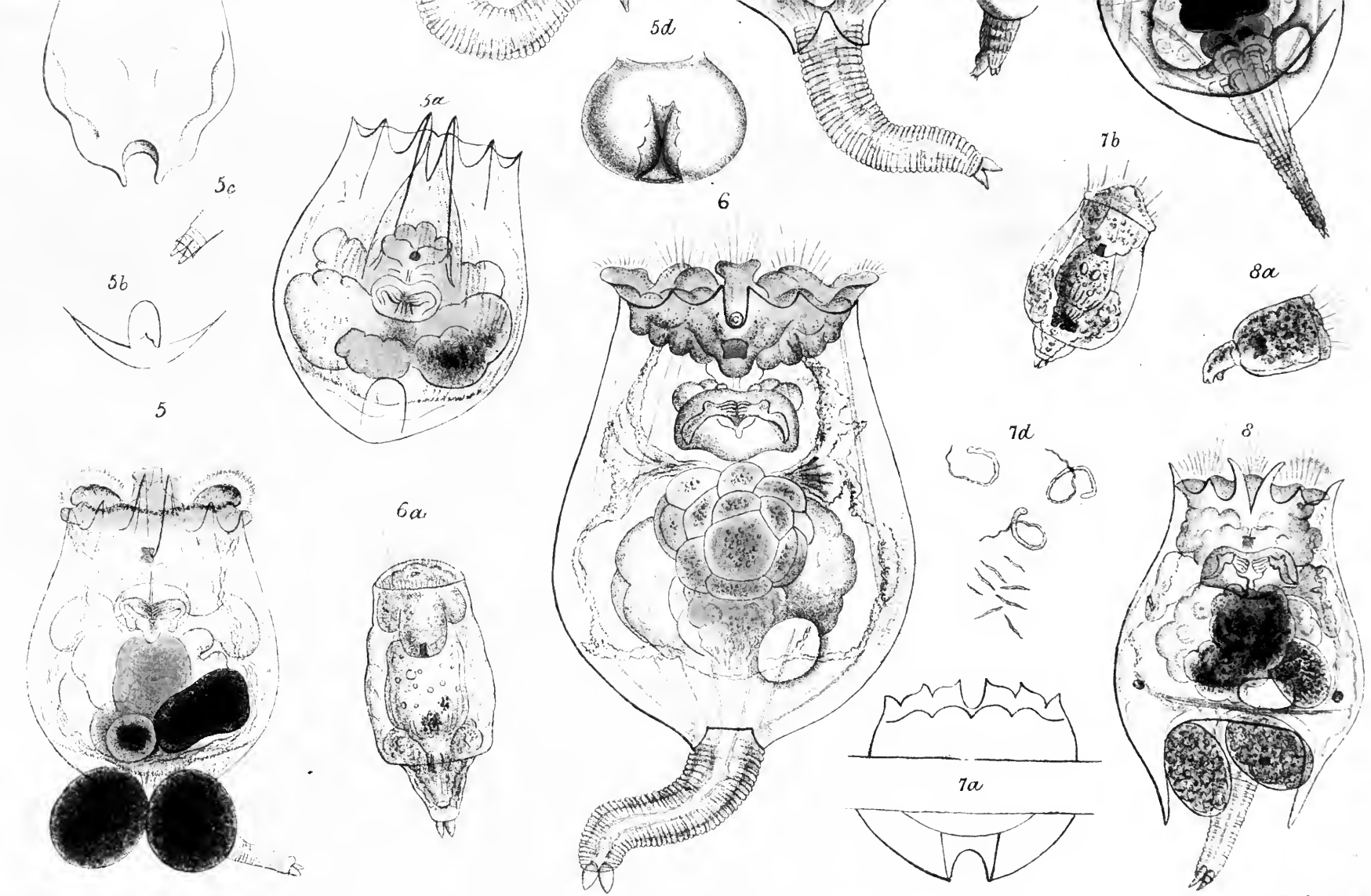
3b
4
3a
4a
7

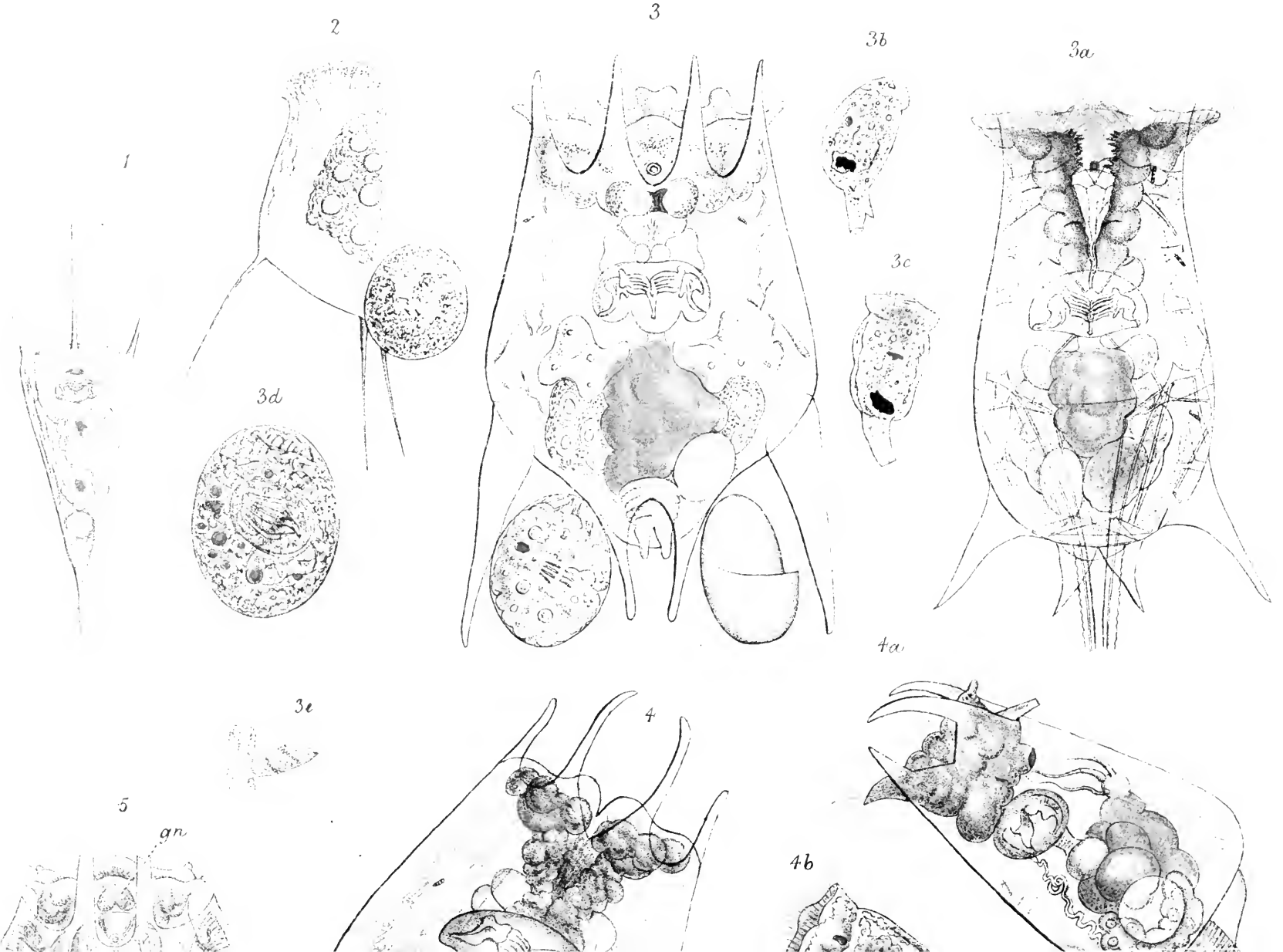


POMPHOLYX; BRACHIONUS.

1 P COMPLANATA 2 P SULCATA 3 B PALA. 4 B ANGULARIS. 5. B. RUBENS. 6 B. URCEOLARIS
7 B. MÜLLERI. 8. B. BAKERI.

PLATE XXVIII.

1.	Eretmia tetrathrix	dorsal view	G
2.	Eretmia trithrix	side view	G
3.	Brachionus pala	variety; dorsal view	H
3*a*.	„ „	variety; ventral view	G
3*b*.	„ „	male, side view	G
3*c*.	„ „	male, dorsal view	G
3*d*.	„ „	female egg	G
4.	Brachionus Dorcas	dorsal view	G
4*a*.	„ „	side view	G
4*b*.	„ „	male, dorsal view	G
4*c*.	„ „	male, side view	G
4*d*.	„ „	vibratile tag	G
5.	Noteus quadricornis	dorsal view; to show viscera	H
5*a*.	„ „	lorica, dorsal view	H
6.	Notholca longispina	lorica, obliquely dorsal view	H
6*a*.	„ „	lorica, side view	H
6*b*.	„ „	trunk, dorsal view	H
6*c*.	„ „	trunk, ventral view	H
6*d*.	„ „	top of lorica, ventral view; to show movable flap	H

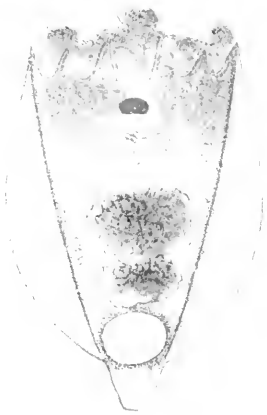

1
2
3
3a
3b
3c
3d
3e
4
4a
4b
5
gn

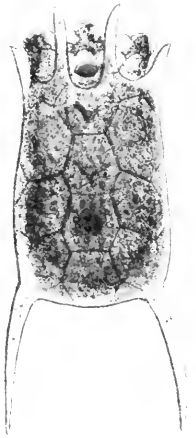
BRACHIONUS; NOTEUS; ERETMIA; NOTHOLCA.

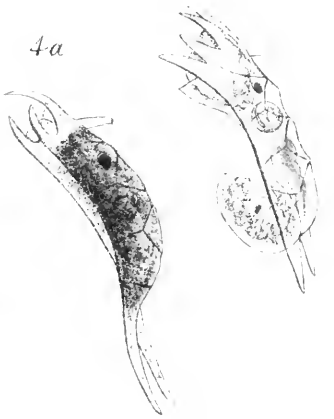
1 & 2 TETRATHRIX 2 E TRITHRIX 3 B PALA (?) 4 B DORCAS 5 NOT. QUADRICORNIS. 6 NOTH. LONGISPINANA

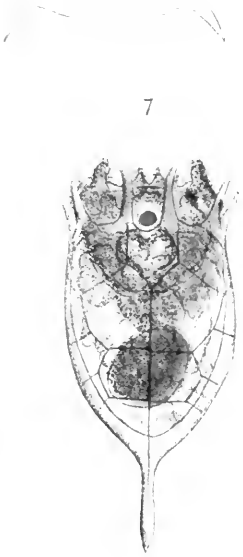
PLATE XXIX.

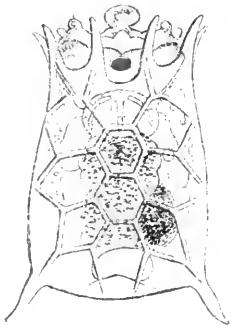
1. Notholca scapha	dorsal view, extended	G
1*a*. „ „	dorsal view, retracted	G
1*b*. „ „	transverse section	G
2. Notholca thalassia	dorsal view	G
2*a*. „ „	lorica, dorsal view	G
2*b*. „ „	lorica, side view	G
2*c*. „ „	lorica, pectoral edge	G
2*d*. „ „	trophi	G
3. Notholca acuminata	dorsal view	G
3*a*. „ „	side view	G
4. Anuræa aculeata	dorsal view	G
4*a*. „ „	side view	G
4*b*. „ „	mastax and trophi	G
5. Anuræa brevispina	dorsal view	G
5*a*. „ „	side view	G
6. Anuræa hypelasma	dorsal view	G
6*a*. „ „	ventral view, with eggs attached	G
6*b*. „ „	transverse section	G
7. Anuræa cochlearis	dorsal view	G
7*a*. „ „	side view	G
7*b*. „ „	rear view	G
8. Anuræa serrulata	dorsal view	G
8*a*. „ „	lorica, dorsal view	G
8*b*. „ „	lorica, side view	G
9. Anuræa curvicornis	lorica, dorsal view	G
9*a*. „ „	lorica, side view	G
10. Anuræa tecta	dorsal view	G
10*a*. „ „	lorica, side view	G
10*b*. „ „	rear view	G
11. Eretmia cubeutes	lorica, dorsal view	G
11*a*. „ „	lorica, side view	G
12. Eretmia pentathrix	lorica, dorsal view	G

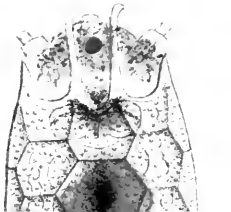


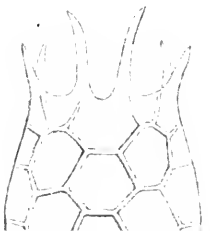


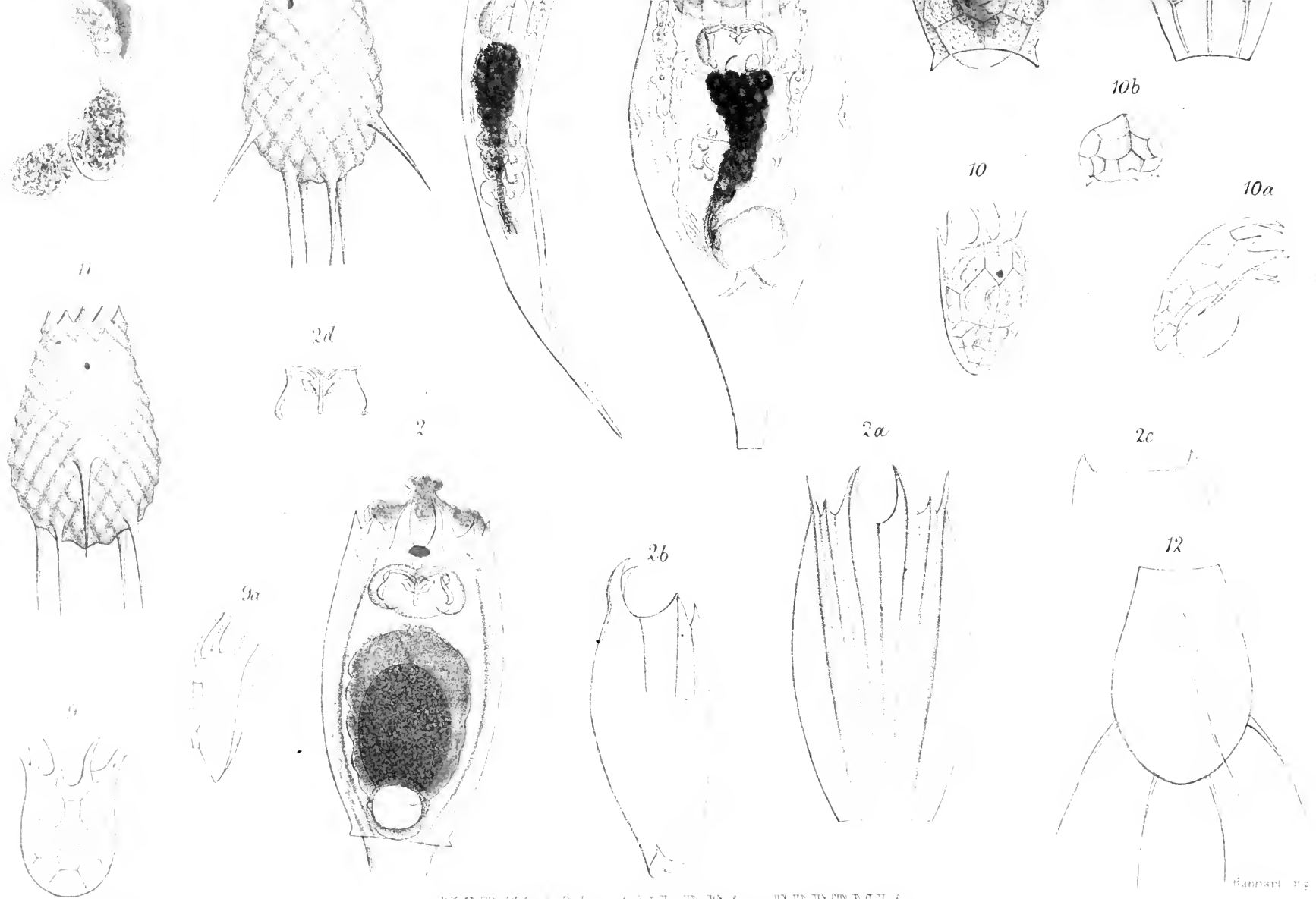












NOTIOLACA; ANUREA; ERETMIA.

1 N. BOLPHA. 2 N THALASSIA 3 N ACUMINATA 4 A ACULEATA 5 A BREVISPINA 6 A HYPELASMA
7 A COCHLEARIS. 8 A SERRULATA 9 A CURVICORNIS 10 A TECTA 11 E CUBFUTES 12 E PENTATHET

PLATE XXX.

1. Pedalion mirum . . side view . . . . . H
1*a*. ,, ,, . . dorsal view . . . . . H
1*b*. ,, ,, . . front view . . . . . H
1*c*. ,, ,, . . side view (side limbs removed) showing viscera H
1*d*. ,, ,, . . dorsal view, showing muscles . . . . H

a, dorsal limb { 1, depressors / 2, elevators
β, inner lateral limb { 3, depressors / 4, elevators
γ, outer lateral limb { 5, depressors / 6, elevators
δ, ventral limb { 7, depressors / 8, elevators

The ventral depressors (5, 5), of the outer lateral limbs, meet a similar dorsal pair on the mid-dorsal and mid-ventral surfaces; and the four together encircle the body. There is a similar encircling set of four (1, 1) belonging to the dorsal limb.

1*e*. ,, ,, . . ventral view, showing muscles . . . H
9, ventral longitudinal muscles for retracting head
1*f*. ,, ,, . . side view, showing muscles . . . . H
10, dorsal longitudinal muscles for retracting head
11, right depressor of dorsal antenna
12, circular muscles of the neck
13, right depressor of chin
1*g*. ,, ,, . . male, dorsal view . . . . . H
1*h*. ,, ,, . . male, side view . . . . . H
2. Hexarthra polyptera . dorsal view . . . (after Dr. Schmarda)
3. Œcistes ptygura . . head, dorsal view, showing hooks . . . H
4. Seison Grubei . . female, retracted; side view . } (after Dr. Claus)
4*a*. ,, ,, . . male, extended; side view . }
4*b*. ,, ,, . . trophi . . . . . }
5. Drilophaga bucephalus . side view; attached to *Lumbriculus* (after Prof. Vejdovský)
6. Balatro calvus . . ventral view . . (after M. Ed. Claparède)
7. Copeus spicatus . . side view . . . . . H
8. Brachionus Mülleri . . ventral view . . . . . H
9. Brachionus angularis . dorsal view . . . . . H
9*a*. ,, ,, . . aperture for lateral antenna . . . . H


1
1a
1b
1c
1d
1e
1f
1g
1h
3

PSEUDEUDION; HEXAPTERA, EUNOTES, SEISON; DRILOPHAGA, BALATRO; COPEUS, BRACHIONUS.

PMRM 2 H.PTERA 3 CYCLOPS 4.5 GRUBEI 5 P.BUCEPHALUS 6.BAL CALVUS
7 [illegible] 8 HIPPI 9 BR ANGULARIS

THE ROTIFERA.

SUPPLEMENT.

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THE ROTIFERA;

OR

WHEEL-ANIMALCULES,

BOTH BRITISH AND FOREIGN.

BY

C. T. HUDSON, LL.D. CANTAB., F.R.S.

ASSISTED BY

P. H. GOSSE, F.R.S.

SUPPLEMENT.

WITH ILLUSTRATIONS.

LONDON:
LONGMANS, GREEN, AND CO.
AND NEW YORK: 15 EAST 16TH STREET.
1889.

PREFACE.

It was originally intended that the two volumes of the 'Rotifera' should contain all the foreign, as well as all the British species; but, while the work was being written, so many new British forms were discovered, that want of space compelled the authors to omit all but a few of the more remarkable foreign Rotifera. The Supplement, however, now remedies this omission; and completes the work, by describing every known foreign species, as well as the British that have been discovered since its publication in 1886.

Upwards of one hundred and fifty species [1] have been added, in the Supplement, to the two hundred and fifty already described in vols. i. and ii.; and, in almost every case, the description is accompanied by a figure. Besides these, more than forty doubtful, or imperfectly described species, have been briefly discussed, and occasionally illustrated. Both the descriptions and drawings of the foreign species have been taken from the original memoirs in which they first appeared; the doubtful, or insufficiently described species, as well as the mere synonyms, being distinguished from the others by their position in each genus, and by the arrangement of the type.

The Bibliography has been considerably enlarged, and now exceeds two hundred memoirs, the greater part of which I have studied: all of them directly refer to the subject, and most of them are well worth the reading.

It is hardly necessary to add, that the labour of condensing such a mass of materials into a short Supplement has been great; especially when conflicting statements had to be weighed, and there was no opportunity of checking them by observations on the animals themselves; but I was anxious to complete the work, and

[1] Sixty of these are new British species discovered by Mr. Gosse.

specially anxious that my colleague's last discoveries should be placed where he himself wished to have them.

The natural pleasure, with which I see the observations and studies of thirty-five years thus brought to a successful conclusion, has been indeed marred by the sad loss of my deeply lamented friend. His great knowledge and experience, his keen powers of observation, his artistic skill, and his rare gift of description are known to all, and have made him *facile princeps* among the writers on the Rotifera; but it is only those who, like myself, were privileged to know him intimately, that are aware how much more he was than an enthusiastic naturalist. I shall never forget the hearty welcome (when I first met him) that the veteran gave to the comparatively unknown student, or the gracious kindness with which he subsequently placed at my disposal his beautiful unpublished drawings and his ample notes.

A happy chance had led our observations to differing parts of the same subject, and our united labours have produced, in consequence, the now completed work; but I shall ever count it a still happier chance, that gave me not only such a colleague, but also such a friend.

C. T. HUDSON.

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THE SUPPLEMENT.

SUPPLEMENT

TO

THE ROTIFERA:

OR

WHEEL-ANIMALCULES.

BY

C. T. HUDSON, LL.D. Cantab., F.R.S.

All these things, I say, declared by Jason of Cyrene in five books, we will assay to abridge in one volume. We have been careful, that they that will read may have delight, and that they that are desirous to commit to memory may have ease, and that all, into whose hands it comes, may have profit; leaving to the author the exact handling of every particular, and labouring to follow the rules of an abridgement. For to stand upon every point, and to go over things at large, and to be curious in particulars, belongeth to the first author of the story; but to use brevity, and to avoid much labouring of the work, is to be granted to him that will make an abridgement.—Book ii. of the Maccabees.

We continually forget, that brutes have not the advantage of obtaining accurate ideas, by spoken or written language. We do not realise the immensity of their ignorance. That ignorance, in combination with perfect cerebral clearness (ignorance and mental clearness are quite compatible), and with inconceivably strong instincts, produces a creature whose mental states we can never accurately understand. The impossibility of knowing the real sensations of animals—and the sensations are the life—stands, like an inaccessible and immovable rock, right in the pathway of our studies.—P. G. Hamerton, "Chapters on Animals."

The earth may smile,
And deck herself, each May, vain thing! with flowers,
And seem forgetful of the cruelties
Enacted on her ever-changing stage,
Till every spot, upon the storied surface,
Is rank with tragic memories.
The earth may smile, I say,
But, like a new-made widow's mirth, it shocks one.
Sir Arthur Helps, "Realmah."

There is much slaughter in the world of brutes, but there is little slavery; and the killing is done with merciful rapidity, ending life whilst its pulses still beat in their energy, and preventing infirmity and age. The brute creation has its diseases, but on the whole it is astonishingly healthy. It is full of an amazing vitality. The more we study animals, the more evident it is that they live, for the most part, in a heaven of exuberant health. That gladness which we seek, how often vainly, in artificial stimulants, the brute finds in the free coursing of his own uncontaminated blood. Which of us has not envied the glee of his own dog?—P. G. Hamerton, "Chapters on Animals."

'Tis a very excellent piece of work, madam lady: would 'twere done.—Shakespeare, "The Taming of the Shrew."

SUPPLEMENT.

FLOSCULARIADÆ.

Floscularia Millsii, *Kellicott* (180), (Pl. XXXII. fig. 1).

SP. CH. **Lobes** *five; of very great length; extremely slender, twig-like, without knobs; fringed with two opposite rows of cilia, not in whorls.*

This elegant and very curious creature was found, by Dr. Kellicott, in Black Creek, Ontario, U. S., on *Utricularia vulgaris*, in 1885. A description of a very similar Rotiferon was sent to me, in 1886, by Mr. Thomas Whitelegge of Sidney, N. S. W.

Dr. Kellicott says: "The delicate, sub-cylindrical, gelatinous sheaths, of *F. Millsii*, are frequently found occupying the fork made by branch or leaf; however, they are often found without this protection; the animal is usually solitary, but sometimes occurs in small groups of three or more. The peduncle is short, as in most Floscules; the posterior, attenuate, muscular part [foot] is relatively long, and terminates rather abruptly in the short, broadly ovate body. The capacious, hyaline mouth-funnel is but little broader at its free edge than below; the free border is set a very little obliquely. The rim of this bowl bears five extremely long, flexible, tentacle-like, trochal lobes, which are without the least knob-like enlargement at their extremities. These organs are very similar to those of *Stephanoceros Eichhornii*, except in the character and distribution of the cilia; in fact they are quite suggestive of the long, flexible tentacles of a polyzoon. The cilia on the lobes are distributed throughout the entire length, fine, longer towards the extremities, those at the ends nearly half as long as the lobes; they are arranged on the lateral borders of the tentacles, and stand straight out, almost reaching those of the adjacent lobes. When the long lobes are being pushed out of the sheath, they are held close together in a bundle; the very long cilia are then shaken out, as it appears, and a shimmer runs over them, very much like that seen on the long arms of *F. coronetta* and *F. cornuta*, when they are unfolded.

"It is not a sensitive species, and very readily displays its ciliary crown. The usual procession of Infusoria may be seen steadily moving down its throat, nor does it reject Algæ that may be drawn into the vortex. One, two, and sometimes three eggs may be seen in the tube at a time. I have not yet had an opportunity to observe them until they are hatched. This I very much regret, for it would undoubtedly shed light upon its generic affinities, and determine whether it is a *Floscularia* or a *Stephanoceros*."

The dimensions of a large individual are as follows: length from foot disc to body $\frac{1}{45}$ inch; of body $\frac{1}{110}$; of lobes $\frac{1}{45}$ inch; total length to top of extended lobes $\frac{1}{15}$ inch, but sometimes not exceeding $\frac{1}{30}$ inch.

Mr. Whitelegge describes his Rotiferon as so much resembling a *Stephanoceros*, that at first he thought that it was one. The differences between the two were, however, great. "The structure of the foot was new to me; it ended in a short immobile stalk, which is not affected when the animal retracts or extends; neither does it alter if the Rotiferon is detached. There are three ring-like protuberances at the end of the foot, just above the stalk, which generally remain unaltered when the animal extends itself.

The lobes are five in number, and the cilia are like those of *Floscularia*, while the lobes are like those of *Stephanoceros*, having the same incurved appearance towards the apex. Its size is about $\frac{1}{3}$ that of *Stephanoceros*." If Mr. Whitelegge's specimen was full grown, the Australian Rotiferon would be less than half the size of the largest American specimen; but of course it is not fair to judge from a solitary example—as this was.

FLOSCULARIA (?) CHIMÆRA, *Hudson*, sp. nov. (Pl. XXXII, fig. 2).

SP. CH. **Corona** *a two lobed cup; the dorsal* **lobe** *much the larger, like an overhanging hood; the ventral slightly notched; the edge of the cup fringed with setæ.* **Foot** *with two toes. One dorsal* **eye**. *No* **tube**. *Free swimming.*

This strange creature was discovered by Mr. V. Gunson Thorpe, in water round a fountain in the Botanical Gardens at Brisbane. It was a solitary specimen. While its general resemblance to a Floscule is obvious, yet it possesses characters unknown in the rest of the genus, or indeed in the family of the *Flosculariadæ*. For, first, the **body** forms, with the foot, one continuous slender cone, terminated by two small toes; instead of being a pear-shaped body, ending in a long, narrow, toe-less foot. Next, there is only one red **eye**, obviously situated on the dorsal surface of the hood; instead of there being two minute, deeply-sunk, cervical eyes. Again, no Floscule has either a mastax or gastric glands; but Mr. Thorpe's *chimæra* has two large gastric glands, and an obvious mastax. To all these points of difference must be added the habit of swimming freely; and the result is as exasperating to classify, as it is delightful to contemplate.

Length. About $\frac{1}{70}$ inch. **Habitat.** Botanical Gardens, Brisbane (Thorpe).

LIMNIAS CORNUELLA, *Rousselet* (196), (Pl. XXXII. fig. 4).

SP. CH. *Four horny* **processes** *on the dorsal surface below the corona; ventral* **antennæ** *very long, each equal in length to half the greatest width of the corona;* **tube** *slightly tapering, generally curved (and sometimes twisted), ringed, translucent at the extremities.*

This very well marked species was discovered by Mr. Charles Rousselet,[1] in November 1888, attached to the rootlets of a plant (*Tricena bogotensis*) growing on the surface of a hot-house tank in the gardens of the Royal Botanic Society, in Regent's Park; and I am indebted to Mr. Rousselet's courtesy for the living specimens from which my figures were drawn. The ventral **antennæ**, which are usually fully extended, would be long in any of the *Melicertadæ*, and therefore contrast strongly with the setigerous stumps and pimples of *annulatus*, and *ceratophylli*. The chin projects in an elegant trifid curve, and the **corona** has an unusually wide dorsal gap (fig. 4 *b*). The animal is fond of holding itself in its tube in an unusual position; so that the plane of its corona is at right angles to the longer axis of the tube. This latter is transparent and corrugated, like that of *annulatus*, only the corrugations are broader and shallower; and the tube itself is frequently obscured (especially in the middle) by fine granulations, and small brown, circular discs. Mr. Rousselet (*loc. cit.*) has given some excellent drawings of the tube (as well as of *cornuella* itself), showing its curved form, and the curious twist that it occasionally takes.

Length. From $\frac{1}{60}$ to $\frac{1}{50}$ inch. **Habitat.** See above.

LIMNIAS GRANULOSUS, *Weber* (199).

SP. CH. **Corona** *formed of two great lobes, dorsal*[2] *cleft deep; six* **processes** *on the dorsal surface, underneath the corona; three* **antennæ**. **Tube** *cylindrical, opaque,*

[1] Mr. Thomas Whitelegge of Sydney, N.S.W., in a list of Rotifera which he had found in his neighbourhood in 1883–4, describes a *Limnias* in some respects similar to *cornuella*. He says: "Its tube is fusiform, opaque brown and often curved. The most marked characteristic is the length of the two antennæ, which project beyond the disc, when the cilia are in full play; and also out of the tube, when the creature is retracted."

[2] There is some confusion here in the terms. If by the "dorsal cleft" above ("échancrure dorsale

yellow, strewed with round brown granules; transversely striated on the inside; **foot** *forked.*

M. Weber has drawn this *Limnias* with three **antennæ** all on the same surface[1]: one long, un-paired; and the paired two, short. As such an arrangement is unknown in the *Melicertadæ*, I have not reproduced his figure; especially as he himself states that all three are on the dorsal side. The **foot**, too, is described as "forked," and the **foot-glands** as discharging their secretion through an aperture in the angle of the fork. This structure and arrangement are unlike those in the foot of any other Floscule. The whole account requires confirmation.

Length. Not recorded. **Habitat.** Neighbourhood of Geneva (Weber).

Limnias shiawasseënsis, *Kellicott* (181).

SP. CH. *Seven horny* **processes** *on the dorsal surface below the corona;* **ventral antennæ** *long, nearly equal to the diameter of the tube;* **tube** *slightly increasing in breadth from below upwards, clear below, covered above by dark floccose, not smooth or annulate, but beset with transverse parallel rows of minute raised points.*

Dr. Kellicott found this apparently rare Rotiferon, in July 1888, on *Myriophyllum* in the Shiawassee river at Corunna, Michigan, U.S. It resembles *cornuella* in the length of its antennæ, but there are several points of difference in structure and habit between the two. "The coronal discs, when acting, are not pushed so far above the tube as in the other species—the lower edges just clearing the margin of the tube; the discs are held nearly vertical, and the long ventral antennæ stand out considerably higher than the discs and at a sharp angle with the tube. The antennæ are slender, nearly straight, and terminated by a slender cone which bears a brush of setæ; when the lobes are withdrawn, and the corona is just concealed, the antennæ stand up above the tube, and the extremity and brush of setæ are then seen to be invaginated. The corneous denticles [horny **processes**] are seven in number. In the middle line, just below the dorsal gap, there are two arising from a common base, their apices are obtuse. On each side of these, a little lower, is another with obtuse apex; this pair points obliquely upward towards the uppermost pair. Below these, wider apart, are two more, broad and set obliquely; and below this pair, near the middle line, is another pair, broad and set obliquely. The cloaca may be seen thrust up to the rim of the tube, between these processes, to discharge the fæces. The chin is obscurely lobed at its apex." (Kellicott, *loc. cit.*)

Length. Not recorded. **Habitat.** Shiawassee river, U. S. (Kellicott).

Œcistes socialis, *Weber* (199).

SP. CH. **Body** *elongated;* **corona** *small, circular;* **foot,** *twice as long as the body;* **teeth,** *three; one ventral* **antenna**; *two* **eyes** *in the young.*

This *Œcistes* was discovered by M. Weber, in 1886, inhabiting a parasitic growth of

profonde") is meant the deep V-shaped cleft on the *oral* surface, at the bottom of which the lobes meet, and the whole of whose edge is fringed with cilia, then the term "dorsal" is a mistake for "ventral"; but if "échancrure" means the wide, non-ciliated, gap in the corona, between the lower portions of the two coronal lobes, then, though the term "dorsal" is correct, yet the attribute "profonde" is singularly inappropriate. Most probably the term "échancrure" stands for the V-shaped cleft on the oral surface, and for "dorsal cleft" we should read "ventral cleft."

[1] The text says that there are "two lateral tentacles," one on each side of the dorsal cleft ("échancrure dorsale"), and, "lower down dorsally, in the median line of the body is one long dorsal tentacle." An inspection of M. Weber's figure (Pl. xxvii. fig. 4), however, shows at a glance that the long, unpaired antenna is really meant to be on the same surface as the two, short, paired antennæ; for it intercepts the view of the ventral (*i.e.* oral) surface on which the shortest pair are placed. Moreover, in the same figure, the lower portion of the coronal lobe, on the spectator's right hand, is curved backward *away* from him; clearly proving that the surface he is looking at, and on which *all three* antennæ are placed, is the oral, or ventral one.

greenish-yellow, slightly gelatinous balls, on the stems of water plants. The ten or twenty individuals, of each group of this social Rotiferon, are all fixed towards the point which attaches the parasite to the plant. No distinct tubes are visible; but the *Œcistes* are immersed in a continuous mass similar to the tubes of other species of the genus.

The animal expands and contracts continually, and with great vivacity. Its great length, and its corona, place it close to Gosse's *serpentinus*, but it has not the dorsal hooks of this latter. M. Weber describes the **corona** as a circular single curve of cilia, notched slightly on the dorsal side, and fringing the edge of a deep funnel with a central buccal opening at the bottom of it. If this description be correct, then of course the animal is no *Œcistes*: nor can it belong to the *Melicertadæ* at all; for these have all laterally placed mouths, lying behind, and *outside of*, an imperforate disc, and on this disc are *two* parallel rows of cilia, the lower of which is continued round the buccal aperture. M. Weber adds that there are two obvious **salivary glands** above the mastax; **gastric glands**; **contractile vesicle** and **lateral canals**; and *one* short, setigerous, ventral **antenna.** He could not detect the **nervous ganglion**; but he says that, though he was prevented by the dark-coloured intestine and by the habitat of *socialis* from studying its internal structure thoroughly, yet he was satisfied that it had a strong similarity to other species of the same genus.

The unpaired **antenna**, which M. Weber describes as being on the ventral surface, is unlike anything in the *Melicertadæ*. But so short and wide apart are the paired ventral antennæ in *Œ. crystallinus*, that it is most difficult to get a view of both together; and it has been frequently asserted in consequence that it has but one. It is probable, therefore, that there are really *two* antennæ on the ventral surface of *socialis*.[1]

Length. Not recorded. **Habitat.** Near Geneva (Weber).

Œcistes mucicola, *Kellicott* (181).

SP. CH. **Corona** *small, only slightly wider than the body, nearly circular;* **foot** *narrow, smooth, and, when fully extended, twice to thrice the length of the body; one minute horny* **process** *on the dorsal surface, just below the corona;* **ventral antennæ** *and* **tube** *apparently absent.*

"This interesting Rotiferon was found in abundance in a quiet pool, exposed to the sun, and in which great quantities of the gelatinous thalli of *Nostochaceæ* and *Rivulariaceæ* abounded. Little globules of the alga *Gloiotricha pisum* were attached to the dissected leaves of *Myriophyllum*, and in nearly all, one or more of the parasites were lodged, and in some, several found shelter. There is no apparent tube; the foot is usually attached near the centre of the small masses, and the disc pushed out beyond the surface. It is an exceedingly sensitive species, retiring to shelter at the least noise or shock. The body of the animal resembles somewhat that of *serpentinus*, but instead of two dorsal hooks below the corona there is one corneous tooth [**process**] not at all hooked; the foot is not thick when extended, nor wrinkled, but attenuate and smooth; its manners are not similar to those of *serpentinus*, as described by Mr. Gosse, and the eggs are of decidedly different shape and colour," being long-ovate and colourless. (Kellicott, *loc. cit.*)[2]

[1] I have not copied either of M. Weber's figures, as I think that there must be grave mistakes both in the description and in the drawings. It is most unlikely that the corona should have only one wreath of cilia, and that the usual imperforate disc should be converted into a deep funnel, with the mouth at the bottom of it.

[2] This may possibly be M. Weber's *Œ. socialis*, as they are alike in **corona, foot,** absence of **tube,** and in their parasitic habit. But M. Weber says that *socialis* has no dorsal hooks, and one ventral antenna; whereas Professor Kellicott could find no ventral antennæ, but saw one dorsal horny process.

Lacinularia pedunculata, *Hudson*, sp. nov.

The following account of this Australian species was sent to me by Mr. Thomas Whitelegge, who found it at Sydney, N. S. W, in 1886.

"This is a very remarkable form, and a cluster might easily be mistaken for a fallen flower of an acacia. The clusters are yellowish orange, a quarter of an inch in diameter, having a peduncle or stalk half an inch long, formed by the united feet of the animals. The union is so complete, that it was only after a great amount of patient investigation, that I became certain of the peduncle's consisting of many intertwined feet. The trochal disc seems to me to be intermediate in shape between that of *L. socialis*, and that of *Megalotrocha alboflavicans*. The gelatinous material, in which the animals are immersed, is well developed. This species I have found in abundance, after heavy rains, in shallow pools. Its period of activity is very brief, and the winter ova, as well as the ordinary ones, are soon formed in great numbers."[1]

Megalotrocha semi-bullata, *Hudson*, sp. nov. (Pl. XXXII. fig. 3).

SP. CH. **Corona** *four-sided; opaque* **warts** *two;* **ventral antennæ** *two small setigerous tubercules;* **dorsal antennæ** *apparently absent.*

Mr. Gunson Thorpe, who found this new *Megalotrocha* near Brisbane, describes it as forming free-swimming clusters of several Rotifera, adhering to one another by the tips of their feet, but without any tubes. The **corona** is not round, but four-sided; and the lower portion of the **foot** is distinctly marked out from the rest by three confluent swellings, where the upper portion joins it, one on each side, and one on the dorsal surface. Mr. Thorpe says that the animal contracts no further than the top of this trifid knob. The two opaque **warts** are on the ventral surface, one on each shoulder, and stand out prominently, above the surface of the body, when the ciliary wreath is withdrawn (fig. 3 *b*): the two ventral antennæ lie just below the opaque warts, and the eyes are on the upper edge of the ciliary wreath, between the two rows of cilia (fig. 3 *a*), a most unusual position. The rest of the structure is normal. Mr. Thorpe has seen the **male**, which has a squarish corona like that of the female.[2]

Length, of an individual, $\frac{1}{36}$ inch. **Habitat.** Acclimatisation Gardens, Brisbane.

Philodina macrostyla, *Ehrenberg* (42), (Pl. XXXII. fig. 6).

SP. CH. **Body** *much fluted longitudinally; frontal* **column** *long, tapering;* **antenna** *with a small, three-lobed, club-shaped, terminal joint;* **eyes** *narrow, obliquely set;* **teeth** *three, thick;* **spurs** *long, slender, slightly sigmoid, acute.*

Ehrenberg's specific characters are "**Body** white, smooth; **eyes** oblong; **spurs** very long." But I have no doubt that this Rotifer is Mr. Gosse's *P. tuberculata*, the specific characters of which I now give to it. Each has a long, tapering, frontal **column**; very long, narrow, sharp **spurs**; a stout **antenna**, with hairs set on a trifid knob at the free end; obliquely set, narrow **eyes**; and three **teeth** in each ramus. Each, too, has a smooth white **skin**; for, when *tuberculata* is put into clean water, it drops its floccose covering, and appears free from spine or tubercle.[3] The last joint of the foot divides

[1] I am indebted to Mr. Whitelegge for some specimens preserved in spirit. The long stalk is formed of intertwined mucous threads which issue from the extremity of the *Lacinulariæ*; one pair of threads from each. This is obvious in the portion of the stalk which forms the diameter of the cluster; but the ribbed appearance gradually fades away towards the lower end, where the mucous threads seem to have been fused together.

[2] In consequence of this discovery of Mr. Thorpe's, the characteristics of the Genus *Megalotrocha* (vol. i. p. 86) will require some alteration. Instead of "**trunk** with four opaque warts" read "**trunk** with opaque warts," and for "**antennæ** absent" read "**antennæ** absent or inconspicuous." The SP. CH. of *Megalotrocha alboflavicans* may now be given as follows: "Opaque **warts** four; **antennæ** apparently absent."

[3] Mr. Gosse, in one of his last notes, says "*P. tuberculata* has no tubercles." Mr. G. Western, who

into two equal branches, each carrying a pair of unequal **toes** (fig. 6 *b*); the outer of which is the larger of the two. It is a fine handsome Rotifer, and not restless; so that its structure can be easily observed.

Length, $\frac{1}{60}$ inch. **Habitat.** Neighbourhood of London (G. Western).

Philodina microps, *Gosse* (171), (Pl. XXXI. fig. 1).

[SP. CH. **Body** *very slender, closely resembling* Rotifer vulgaris, *both in form and manners, but with eyes distinctly pectoral, small, round, of very pale red hue.* **Column** *thick, rounded, with minute hooked proboscis at front;* **spurs** *rather small, separated by a horizontal edge;* **corona** *in action not wider than head.*

This can scarcely be confounded with any recorded *Philodina*. For some time I felt sure it was *Rotifer vulgaris*, and marvelled that I could not see the eyes in the column. But when I looked to the *pectus*, they were plain enough, though very pale. I know no other species, whether of *Rotifer* or *Philodina*, with so very small a corona in rotation. The whole trunk is fluted. The viscera are tinged with pale smoke-brown, deepest in the abdominal canal. In some examples the hue is rather of a chestnut-brown.

I have examined perhaps half-a-dozen specimens, inhabiting the conferva of marine rock-pools in the Firth of Tay. The species is very shy of rotating, thus differing from other *Philodinæ*, which are characteristically free. At the moment of extruding the column, its broad extremity opens a central orifice which is strongly ciliated around its margin, while a row of cilia, apparently *few* and *distant*, is seen fringing the outer edge. The antenna consists of (two ?) telescopic joints, its dilated extremity carrying four divergent setæ.

Length, $\frac{1}{80}$ inch. **Habitat.** Firth of Tay. P. H. G.]

P. collaris, *Ehrenberg* (42)=*P. erythrophthalma* (vol. i. p. 99).

P. setifera, *Schmarda* (135), (Pl. XXXII. fig. 7), is said to have a row of setæ running down the foot, of which I give Schmarda's figure.

P. gracilis, P. calcarata, P. macrosipho, *Schmarda* (134). See note below.[1]

Rotifer trisecatus, *Weber* (199), (Pl. XXXII. fig. 9).

SP. CH. **Body** *a dull grey;* **skin** *rough, with longitudinal and transverse folds, so as to form twelve apparent segments; a coarse fold near the neck.* **Body** *elongated, cylindrical, diminishing suddenly; truncated, at the level of the anus, to form a* **foot** *narrower than the rest of the body;* **proboscis** *long;* **eyes** *two; coronal* **lobes** *short;* **teeth** *two;* **pharynx** *stout;* **intestine** *generally coloured brown;* **spurs** *movable at their extremity, long and slender; three long, slender* **toes,** *divided into three segments.*

This Rotifer is rendered distinct from others, by the exaggerated length of its spurs and toes, and by the division of the latter into three joints, of which the last is capable of a feeble motion. The **corona** when expanded is scarcely wider than the neck; the **proboscis** is stout, cylindrical, long, stretching much beyond the expanded corona, and seldom retracted even when the corona is in action. It bears two ovoid **eyes.** Unlike that of other species, the end of the **foot** is usually extended, showing the three toes.[2]

Length. About double that of *R. vulgaris*. **Habitat.** Near Geneva (Weber).

kindly sent me many living specimens, had noticed the same thing. Mr. D. Bryce, also, some time ago, forwarded to me a sketch of *tuberculata*'s four toes.

[1] Both of Schmarda's pamphlets (134) and (135) contain species said to be new, but so drawn and described that it is not possible to do anything else than omit them.

[2] There is, in the description of the figures, a confusion of terms similar to that in *Limnias granulosus*. Fig. 2, Pl. xxx., in M. Weber's pamphlet, is said to represent the dorsal surface; and the bent foot in it is said to be showing its ventral surface; and yet that surface is the one that bears the spurs, and consequently is really the dorsal or anti-oral surface. To make it more perplexing, the proboscis seems, in the figure, to be on the opposite surface to the spurs.

ROTIFER ELONGATUS, *Weber* (199), (Pl. XXXII. fig. 8).

SP. CH. **Body** *greyish;* **cuticle** *crossed by transverse folds forming thirteen or fourteen segments; lobes of the* **corona** *small.* **Proboscis** *short*; **eyes** *two, round, red;* **teeth** *two;* **toes** *three, long, cylindrical, slightly apart, retractile.* **Spurs** *thick at the base, short, with mobile free extremities.*

The **corona** of *elongatus* is scarcely wider than the greatest breadth of the body, and the whole animal when extended forms a long, gently tapering, cone. The length of the fully extended **foot** is about $\frac{1}{3}$ of the whole Rotifer. The **corona** is feeble, and the animal rarely swims, but creeps swiftly. The **proboscis** is short and thick, bearing an aureola of cilia. The **foot** has six segments, gradually diminishing in size from the cloaca to the toes. The **spurs** are widely divergent, slightly curved, and pointing somewhat to the toes: their tips are faintly articulated, and mobile. The three **toes** are long, round, and cylindrical, like little worms; and, once displayed, they separate slightly, in order to fix themselves on an object: they are usually retracted. M. Weber says that this species is distinguished from others of the genus by the form and length of the toes, which resemble the toes of *Actinurus*, with this difference, "that the toes [of *Actinurus*] are very long and *non-retractile*, remaining always extended, and acting somewhat as points of support (*un balancier*)." Here, however, M. Weber is in error. Both Mr. Gosse [1] and myself have often seen the toes of *Actinurus* drawn in, just like those of any other *Rotifer*.

Length. Almost that of *Actinurus neptunius*. **Habitat.** Near Geneva (Weber).

R. ERYTHRÆUS, *Ehrenberg* (42), is an imperfectly observed, and very doubtful species.
R. MAXIMUS, *Bartsch* (7),=*R. tardus* (vol. i. p. 105).
R. INFLATUS, *Dujardin* (40), is a species formed by confounding together several *Philodinæ*; and by refusing to distinguish between the genera *Philodina* and *Rotifer*.
R. MEGACEROS, *Schmarda* (134), (Pl. XXXII. fig. 10.) is said to have a pair of spurs on each of the last two joints of the foot; those on the penultimate joint being very long and curved: I have given Schmarda's figure of the spurs.

CALLIDINA PIGRA, *Gosse* (169), (Pl. XXXI. fig. 2).

[SP. CH. **Body** *fusiform, fluted, not collared;* **column** *having a decurved acute hook;* **spurs** *minute;* **viscera** *rufous.*

I have seen two examples, both of which had the extremities colourless, but the middle tinged of a delicate sherry-brown, the viscera somewhat deeper in hue; while in one was an immense egg, of a coffee-brown, almost opaque, whose appearance suggested the probability that the species is strictly oviparous. The acute hooked proboscis is very conspicuous. The **corona**, scarcely divided, is not wider than the neck at the antenna, and this neck is not swollen into a collar. The penultimate **spurs** are very minute cones, whose bases are not separated by an interspace. The whole central body is indented with longitudinal furrows. The **mallei** are destitute of visible teeth.

The animal is remarkably sluggish, rarely swimming, but turning its head slowly and aimlessly from side to side.

Length. When extended, $\frac{1}{90}$ inch. **Habitat.** Woolston Pond. P. H. G.]

CALLIDINA SYMBIOTICA, *Zelinka* (205), (Pl. XXXII. fig. 12).

SP. CH. **Body** *of sixteen segments, longitudinally furrowed, colour reddish, intestine a deeper yellowish-red;* **teeth** *two in one ramus and three in the other;* **œsophagus** *without a loop;* **corona** *large, with a short peduncle;* **upper lip** *notched, so as to have two little flaps;* **spurs** *short; two* **toes**, *each ending in five minute hollow prominences.*

[1] Mr. Gosse says: "These [the toes] are often retracted in various degrees, even when the foot is otherwise extended."—*Evenings at the Microscope*, p. 300.

This *Callidina* was discovered by Dr. Carl Zelinka, inhabiting the *Jungermanniæ Frullania dilatata, F. tamarisci,* and *Radula complanata.* Dr. Zelinka has published an elaborate treatise on this form, explaining its structure most minutely, and accompanied by many large drawings and diagrams. The main differences, between it and the other species of the genus, are in the **mastax** and the **foot.** The first has rami with unequal numbers of teeth; and the second has toes, each of which ends in five small tubes, leading up to the foot-glands. Dr. Zelinka kindly sent me his treatise, and I at once went to some elms, on Clifton Down, on whose trunks I knew that the above-named plants were to be found. There was a bitter frost, and the snow lay deep; and though I procured plenty of the brown withered-looking *Frullania,* I had little hope of finding any Rotifera in its cups. However, on tearing out the brown mass with needles, I saw some green stems under the brown ones; and on moistening these under the microscope, I soon had the pleasure of seeing first one *Callidina,* and then another, come to life, stretch its head out of the cup in which it had been curled up, and unfurl its wheels (fig. 12 *a*). Dr. Zelinka describes the foot-glands (fig. 12 *b*) as consisting of four rows of cells, and their long excretory ducts as discharging through ten little tubes, five of which project from each toe. A somewhat similar arrangement has been discovered by Dr. Zelinka in *Discopus Synaptæ,* and I know of no other example among the *Philodinadæ*; but a mastax in which the rami have an unequal number of teeth is occasionally met with; individuals, of the same species, differing from each other in this respect. It is obvious how the *Callidina* contrives to exist in its strange home. Rain usually takes a definite course down the furrows in the bark of a tree, just as it does down the valleys of a river-basin; and the *Jungermanniæ* follow its track. The green cups are filled by the rain, and protected from rapid evaporation of their contents by the minuteness of their apertures, and their position on the under side of the frond. They thus form suitable homes for the *Callidina*; which, when at last the water begins to dry up, draws in its head and foot, shapes itself into a ball, exudes a gelatinous covering around itself, and waits for happier times.

Length, (fully extended) *cir.* $\frac{1}{75}$ inch. **Habitat.** Cups and leaves of *Jungermanniæ.*

Callidina Leitgebii, *Zelinka* (205).

SP. CH. **Body** *of sixteen segments, longitudinally furrowed, colourless, alimentary canal generally full of green algæ;* **teeth** *in one ramus five, in the other six;* **œsophagus** *with a loop;* **corona** *large, with a short peduncle;* **upper lip** *not notched, but with a median projection;* **spurs** *short; two toes, each ending in five minute hollow prominences.*

A very similar animal to the last; and also found by Dr. Zelinka in *Jungermanniæ.* It is said to have the same peculiar toes.

Length, *cir.* $\frac{1}{130}$ inch. **Habitat.** Cups and leaves of *Jungermanniæ* (Zelinka).

Callidina quadricornifera, *Milne.*

Macrotrachela quadricornifera . . . . . Milne (186).

SP. CH. **Body** *stout, and Philodine-like;* **corona** *large, not constricted;* **proboscis** *very thick and square;* **foot** *about* $\frac{1}{8}$ *of total length, and with three short thick toes;* **spurs** *four, there being an extra pair on the top joint of the foot.*

This species of Mr. Milne's is remarkable for the extra pair of spurs on the foot. The general shape is not unlike that of *P. citrina,* and the wheels are very similar; but the **foot** is much shorter in proportion. The **mastax** is large, and so is the **contractile vesicle.** There is a short, broad, perforate **antenna,** armed with fine setæ; and the transverse **muscular system** is well developed.

Length, $\frac{1}{70}$ inch. **Habitat.** Neighbourhood of Glasgow (Milne).

Callidina aculeata, *Milne* (Pl. XXXII. fig. 11).

Macrotrachela aculeata . . . . . Milne (186).

SP. CH. **Body** *somewhat fish-shaped, with three or four posterior rows of spines, and one anterior row near the mastax;* **foot** *about* $\frac{1}{7}$ *of total length, with three short toes;* **spurs** $\frac{3}{4}$ *width of penultimate joint.*

Mr. Milne met with but few specimens of this remarkable *Callidina*. Its body has many longitudinal furrows; and Mr. Milne draws the four rows of **spines** with as many as five or six spines in each row.

Length, $\frac{1}{100}$ inch. **Habitat.** Near Glasgow (Milne).

Callidina socialis, *Kellicott* (181).

SP. CH. **Corona** *relatively wide;* **column** *thick and ciliated;* **dorsal antenna** *short, terminated by many minute, setiferous pointed elevations;* **spurs** *long and stout;* **teeth** *two.* **Parasitic** *on the limbs and dorsal folds of the larva of the beetle* Psephenus Lecontei.

It is a slender elongate form; when the body is fully extended the width of the **corona** considerably exceeds that of the body. The **body** is transparent, without colour, except the light brown of the stomach, apparently imparted by contents of that hue. The longitudinal flutings of the trunk, and the transverse folds above and below these are conspicuous. The **contractile vesicle** was not observed. Many examples of the larva were examined, every one of which was infested by the Rotiferon; often scores were witnessed, clinging in groups.

Length, (when fully extended) $\frac{1}{65}$ inch. **Habitat,** Corunna, Michigan (Kellicott).

Callidina constricta, *Dujardin* (40).—Dujardin merely states that this *Callidina* has a very small corona, and rami crossed by fine parallel teeth. There is neither description nor figure of the proboscis, dorsal antenna, or foot; it is impossible to say whether it is distinct from those species already described.

Callidina cornuta, *Perty* (124).—This also is an imperfectly described animal. Perty only says that it is neither *constricta* nor *elegans*, that it has a *Notommata*-like projection on each side of the head, and that its jaws are like those of *constricta*. He gives no figure.

Callidina rediviva, *Ehrenberg*, is described as being "fusiform, diffusely granular, or else fleshy; with red distinct ova, and strong rotatory organs. In the sediments of water-spouts of houses, Berlin. Length, $\frac{1}{60}$ to $\frac{1}{48}$ inch." [1]

C. alpina and C. scarlatina, *Ehrenberg*, are Alpine species, of which I can find no details; except that *scarlatina* was found dried up, like pink dust, near the tops of the Alps.

Genus Discopus, *Zelinka* (206).

GEN. CH. *One of the* Philodinadæ; **eyeless,** *the last two joints of the* **foot** *converted into a great sucker; the* **foot glands** *arranged in two transverse rows, and fastened laterally and ventrally to the inner surface of the body-wall;* **ducts** *of the foot glands running down to the last joint of the foot, and insulated in a capsule.*

Discopus synaptæ, *Zelinka* (206), (Pl. XXXII. fig. 5).

This parasitical Rotiferon was discovered by Professor E. Ray Lankester, in 1868, in the body-cavity of the *Synaptæ* of the Channel Islands. Dr. Lankester had neither the

[1] Pritchard's *Infusoria*, 4th ed. p. 702.

time, nor the opportunity, to investigate its structure thoroughly; but he gave two characteristic sketches of the ventral and lateral surfaces, showing the remarkable sucking disc in the foot. According to Dr. Carl Zelinka, who has since found it on the surface of the Channel *Synaptæ*, the **corona** is short, but slightly expanded; there are ciliated cushions on each side of the buccal aperture, and this latter widens at the top into a projecting beak. The internal structure resembles that of *Callidina*, except that there is no **contractile vesicle.** The **lateral canals** and vibratile tags, though present, are hard to find. The penultimate joint of the **foot** (figs. 5 *a*, 5 *b*) has been altered into a circular sucking disc placed ventrally, and bearing in its centre a circular raised collar or cup, into which the ducts of the foot-glands open. This cup may be considered to be the altered last joint of the foot. There are twelve completely separated **gastric glands,** arranged in two rows, one above another, round the lower ventral portion of the trunk.[1]

Length, $\frac{1}{110}$ to about $\frac{1}{170}$ inch (Zelinka); $\frac{1}{500}$ inch (Lankester). **Habitat.** Parasitical on the skin, and in the body-cavity, of *Synaptæ*.

Adineta oculata, *Milne.*

Callidina oculata . . . . . Milne (186).

SP. CH. **Body** *spindle-shaped;* **head** *small;* **mastax** *and rami very small, the latter with two transverse teeth each;* **spurs** *the width of the penultimate joint;* **toes** *three, half the length of the spurs;* **eyes** *two, large, brilliant red.*

Mr. Milne's species is a stouter animal than *vaga*, and can at once be distinguished from it by its pair of brilliant red **eyes.** It has also a pair of obvious **gastric glands;** whereas in *vaga* they are either inconspicuous, or absent.

Length, $\frac{1}{50}$ inch. **Habitat.** Near Glasgow (Milne).

Asplanchna Sieboldii, *Leydig* (110), (Pl. XXXII. fig. 14).

Dr. Leydig, who discovered this *Asplanchna* in 1853, says (*loc. cit.*) that the female so closely resembles *A. Brightwellii*, that he should have considered them identical, had it not been for the difference in shape between the males. As Dr. Leydig has observed the male in the ovi-sac, there is no room for suggesting that the male of one species might have been accidentally captured among the females of another.

The male (fig. 14), like that of *A. Ebbesbornii*, has two cervical **humps** and two lateral; but is sharply conical, the corona being the base of the cone, and the extremity of the penis-sheath the apex. Its internal structure is well shown in Dr. Leydig's figure; and follows so exactly the plan of the male of *Ebbesbornii*, that further description is unnecessary. Oddly enough, too, the markings on the ephippial egg of *Sieboldii* resemble those on the ephippial egg of *Ebbesbornii*, and not of *Brightwellii*.

Length. Not recorded. **Habitat.** Dirty roadside ditch at Zell (Leydig).

Asplanchna intermedia, *Hudson* (Pl. XXXII. fig. 15).

SP. CH. *The* **female** *indistinguishable from* A. Brightwellii: *the* **male** *with two side* **humps,** *but none on the neck; in other respects closely resembling the male of* A. Brightwellii.

I found this *Asplanchna* in 1875, and described it, and its male, in the *Mon. Mic. J.* of that year, p. 52, giving a sketch of the male. Of the female it is not necessary to say more than that Mr. Gosse, who has studied it, agrees with me in saying that he could not distinguish it from *Brightwellii*. The **contractile vesicle** and **sperm-sac** of

[1] Dr. Carl Zelinka's memoir on this parasitic Rotiferon gives the most minute description of its whole structure, and is accompanied by a profusion of highly interesting figures. The whole memoir deserves attentive study, containing, as it does, not only an exhaustive account of *Discopus synaptæ*, but also full discussions of many topics concerning the Rotifera.

the male are very small; and the **lateral canals** have the vibratile tags arranged in a straight line on either side. The creature is so wonderfully transparent and empty, that it is difficult to see it even with a hand-lens, although $\frac{1}{60}$ inch in length. The hind dorsal corner of the body is somewhat prolonged into a sort of third hump, and darts out stiff and obvious (as do the lateral arms) when the head is retracted. The opposite ventral corner is prolonged, to a blunt point, and is the sheath of a long protusile penis. In one specimen I saw tags in which no ciliary motion was visible. What appears to be an atrophied œsophagus and stomach hangs freely in the body-cavity, between the head and the above-named dorsal hump. Mr. Gosse has seen the male *in utero*.

Length (male), $\frac{1}{60}$ inch. **Habitat.** Birmingham (P.H.G., and T.B.): Clifton (C.T.H.).

Asplanchna amphora, *Hudson*, sp. nov.

SP. CH. **Body**, *of female, conical, with one dorsal, and two lateral* **humps**; **eye** *single;* **rami** *with long curved simply pointed ends, and a stout hook at the middle of the inner edge of each, not serrated;* **contractile vesicle** *not large, expanding to very much less than half the body-cavity;* **vibratile tags** *above forty on each side, and arranged in straight lines;* **ovary** *a narrow ribbon;* **male** *with two lateral humps.*

Professor Leidy kindly sent me this *Asplanchna*, in 1887, preserved in spirit; and I am indebted to Mr. G. Western for many living specimens. The female closely resembles *Ebbesbornii*; but the posterior extremity is almost conical, whereas in *Ebbesbornii* it is ventrally prolonged into a blunt curved hump. The two lateral **humps**, also, are nearer the middle of the body, and the ephippial **egg** is covered with dotted scales. Mr. Rousselet lately called my attention to the fact that the vibratile tags are crowned with a row of fine hairs, with a long one at each corner. Mr. G. Western has seen the male *in utero*.

Length, $\frac{1}{20}$ inch. **Habitat.** Philadelphia (Leidy); near London (Western).

Asplanchna triophthalma, *Daday* (207).

SP. CH. **Female** *humpless;* **head** *truncate;* **eyes** *three—two smaller a little below the dorsal margin, one greater cervical;* **vascular system**, *as in* priodonta; **ovary**, *a transverse ribbon.* **Male** *humpless.*

Dr. Daday courteously sent me his memoir on this *Asplanchna*, which he found "in the great pool near Mezö-Záh." It distinctly differs from *priodonta* in the position of the two smaller eyes, and in the truncate head. Dr. Daday has given a drawing of the vibratile tags showing each crowned with a row of fine hairs.

Length. About $\frac{1}{22}$ inch. **Habitat.** See above (Daday).

A. helvetica, *Imhof* (179). I can see no difference between *helvetica* and *priodonta*; but M. de Guerne (173) separates them, because *helvetica* has only six "denticulations" on the inner margin of each ramus, and its supplementary tooth, or uncus, is "strongly arcuate"; while "the figures and descriptions" of *priodonta* give it more than six denticulations, and a "scarcely arcuate" uncus. I have examined many specimens of *priodonta*, since my attention has been called to these points, and I have always found six denticulations in each ramus (Pl. XXXIII. fig. 2); and that the apparent curvature of the uncus varies much with pressure, with the point of view, and with the individual. The wide dispersion of *helvetica* throughout Switzerland, Northern Italy, Austria, North and South Germany, Auvergne, Russian Lapland &c. &c., makes it highly probable that the two species are identical.

A. Herricki, *de Guerne* (173, 175), (Pl. XXXIII. fig. 5). SP. CH. "**Body** *amphora-shaped:* **trophi** *stout, consisting only of two rami, with an almost straight internal margin, terminated by a strong hook, with an apex not internally denticulated.*" Mr. Herrick, who discovered this *Asplanchna* in Minnesota, U. S., says it resembles *Brightwellii* and is hermaphrodite. M. de Guerne (*loc. cit.*), while very properly discrediting the latter statement, forms a new species of it solely on account of the shape of the rami. As these, however, are of extraordinary shape and proportions, and have no fulcrum or unci, I think it better to wait till there is some further account of the creature published.

A. Girodi, *de Guerne* (173), (Pl. XXXIII. fig. 6). SP. CH. "**Body** *globose;* **trophi** *elongated, stout, consisting only of two rami, each with a bidentate apex, having one tooth curved and sub-obtuse, the other compressed and lamellar.*" M. de Guerne says these trophi are distinguished from all others by the lamellar teeth just below the apex. But this is an error, for *Brightwellii, priodonta,* and *Ebbesbornii* have all these apparent lamellar teeth. In fact their rami, seen side-wise (Pl. XXXIII. fig. 2 *b*), are evidently deep plates bounded at the top by a thick broad ridge; which, at the apex, is prolonged, beyond the plate, into a curved hook. When the ramus is subjected to pressure from above, the deep plate is bent by the glass (to which it stands at right angles), and its free lower corner is twisted, so as to look sometimes like a second tooth, just below the extreme apex, sometimes like a small plate: and often it is hidden altogether, under the thick curved pincer-like ridge, which alone is usually drawn as the ramus. I was unaware of this construction, till my attention was drawn to it by exactly reproducing M. de Guerne's figure of the trophi of *Girodi*, on crushing the trophi of *Brightwellii*. These latter are correctly drawn in fig. 4, Pl. XXXIII. Nor is this all. The unci disappeared entirely, as they have in the figure of *Girodi*, fig. 6, and the lines *a, a*, seen in that figure were shown to be the crushed remains of fibres (*b, b*, fig. 4), of the true nature of which I am in doubt.

There may be other characters which entitle *Girodi* to specific rank; but the above are evidently insufficient.

A. Imhofi, *de Guerne* (173), (Pl. XXXIII. fig. 7). SP. CH. "**Body** *ovately globose;* **trophi** *elongated, strong, composed only of two rami; apex slightly incurved, bifid;* **ramus** *armed, in the middle, with a stout internal tooth;* **base** *of the ramus triangular, solid, with an external hook above.*" Here again the characters are taken almost solely from the trophi; which are said, like those of *Girodi, Herricki*, and *Krameri*, to have no unci: no other part of the structure is described, and neither the male, nor the ephippial egg has been observed. Moreover there is an ambiguity in M. de Guerne's description and drawing. What is meant by the "solid, triangular bases of the rami"? They seem, according to fig. 7, to be bounded by the lines *c, c*; which are of the same depth of tint as the outer edges of the rami, and are continuous with them. But these lines are really the boundaries of a soft muscular mass which embraces the narrow fulcrum, *f*. The true bases of the rami are the curved lines, *d, d*. The same ambiguity exists in the drawing of *Girodi*, fig. 6. That these sloping lines, *c, c*, are the edges of muscle, and not of the hard parts of the jaws, is certain: for I have seen the fulcrum, *f*, moved slowly to and fro, like a pendulum, by the alternate contraction and expansion of the muscle on either side.

A. Imhofi may very possibly be a new species; but the rami, as drawn in M. de Guerne's figure, are hardly enough to make it certain.

A. Krameri, *de Guerne* (173), (Pl. XXXIII. fig. 3). SP. CH. "**Body** *globose:* **trophi** *consisting only of two rami, which are curved, slender at the base, stout at the extremity, sickle-shaped, and with the interior margin denticulated.*" It will be seen that here the trophi, on which alone the creature's distinct specific rank is made to depend, have two fulcra; one to each ramus. If the drawing be correct, then, the thin deep plate, of which

the fulcrum consists, must have been split by violence evenly down its whole length—a rather unlikely thing. The unci, too, have been destroyed. Dr. Kramer's figure of *Krameri* shows an *Asplanchna* whose ovary, contractile vesicle, and lateral canals are those of *priodonta*. The drawing of the head teaches us nothing; for it is represented merely as a puckered bag. Neither does the text help us much: for Dr. Kramer describes the oviduct as two fine threads, and the nerve-threads and rocket heads, of the ventral antennæ, as fine canals ending in oval bladders &c. &c.; and he then unites the ventral antennæ, their nerve threads, the contractile vesicle, and the oviduct into one "Organ-komplex," which he says he cannot undertake to explain. It is impossible to say whether *A. Krameri* is a new species, or not.

For the reasons detailed above, I do not consider these four species as established; but I ought to add that M. de Guerne's memoir on the *Asplanchnadæ*, in which they are found, is most interesting and suggestive, and contains very instructive details of the distribution of these charming Rotifera.

A. MAGNIFICA, *Herrick* (175); probably = *A. myrmeleo*.

Genus, ASPLANCHNOPUS, *de Guerne* (173).

GEN. CH. *An* Asplancha *with a ventral retractile* **foot**, *ending in two* **toes**.

This new genus we owe to M. de Guerne (*loc. cit.*), who has very properly separated the Rotifera it contains from the genus *Asplanchna*, on account of their possessing a foot.

ASPLANCHNOPUS MYRMELEO, *Ehrenberg* (Pl. XXXII. fig. 13).

Notommata myrmeleo . . . . . Ehrenberg (42).

SP. CH. **Female** *with short, wholly retractile* **foot**, *but without* **humps**; **eye** *single;* **rami** *greatly curved, with simple pointed ends, not serrated;* **contractile vesicle** *expanding to about half the body-cavity;* **vibratile tags** *about fifty on each side, set on a separate, and very narrow, lateral canal;* **ovary** *horse-shoe shaped, with broad and double, rounded ends.*

This handsome Rotiferon has only lately been found in Great Britain. Mr. Hood found it near Dundee in 1886, and sent it to Mr. Gosse, too late, unfortunately, for its insertion in the "Rotifera." It the summer of 1888, however, Mr. C. Rousselet kindly forwarded several specimens to me from Staines, all of which were female. It is an *Asplanchna* with a forked foot; and the only points of its structure, that require notice, are the foot, the trophi, the gastric glands and the ovary. The **foot** is very short, ending in two minute toes, and springs from the ventral surface, into which it can be withdrawn by four muscles. The **trophi** are bent almost into a circle; they are very massive at the base, but taper to fine points without any hooks, or serrations, to break their circular outline: neither did I notice any unci, such as are to be seen in *priodonta* and *Brightwellii*. The **gastric glands** are so deeply bilobed, that the animal seems to possess four gastric glands, just like *Copeus spicatus*. The **ovary** is most remarkable, not only for its great size and peculiar shape (which will be best understood from the figure) but also from its being constantly thrown into ever varying curves; now stretching the whole length of the body, and now drawn down into wavy folds towards the hinder end.

Mr. Geo. Western has described and figured[1] a male Rotiferon (Pl. XXXII. fig. 13 *b*) born in a trough filled with water obtained at Staines, where the female *A. myrmeleo* was then abundant. It is very probably the male of *myrmeleo* whose general appearance it much resembles; especially in the characteristic **foot**. It has a large tripartite **brain**, and **eye spot**; two dorsal **antennæ**; a very large **contractile vesicle**, and numerous

[1] Mr. C. Rousselet described and drew the female, in the August number of *Science Gossip*, 1888. This led Mr. G. Western to hunt for the male, which he described and drew in the November number of the same year.

vibratile tags. There are the usual **sperm-sac** and protusile penis, the latter lying "behind the foot under a valve-like flap."

Length, of female, cir. $\frac{1}{25}$ in.; of male, cir. $\frac{1}{50}$ in. **Habitat.** Dundee (J. H.); Staines (Rousselet and Western).

Asplanchnopus syrinx, *Ehrenberg* (Pl. XXXIV. fig. 37).

Notommata syrinx . . . . . Ehrenberg (42); Schmarda (134 and 135).

SP. CH. **Body** *bell-shaped;* **foot** *very small, scarcely visible;* **jaws** (*rami*) *curved, bifid at the point.*

This Rotiferon, according to Ehrenberg, is very similar to *A. myrmeleo*, but differs from it in the following points. The surface of the **head** is convex; the **foot** is hardly visible, and has two minute toes; the points of the **rami** are bifid; and the **vibratile tags** are not more than from eight to thirteen on each side.

Schmarda found this Rotiferon in Egypt, and in a well on Adam's Peak in Ceylon. He noticed in one fœtus a secondary tooth to each ramus. No other observer appears to have met with this animal, except Weisse.

Length. About $\frac{1}{40}$ inch. **Habitat.** Berlin (Ehr.); Egypt and Ceylon (Schmarda); St. Petersburg (Weisse).

Asplanchnopus eupoda, *Gosse* (Pl. XXXI. fig. 3).

Asplanchna eupoda . . . . . Gosse (169).

[SP. CH. **Body** *globose, with a stout foot, retractile at will;* **rami** *of incus long, each armed on its inner edge with four widely-severed teeth.*

The most remarkable feature is the foot, which is, proportionally, much larger than in *A. myrmeleo*. The pincer-like rami are those of a normal *Asplanchna*, having a close resemblance to those of *A. priodonta*, save that their inner edges are not cut into saw-teeth, but beset with three distant spinous teeth, while each curved point is double. I have examined eight or ten examples, all from the canal, Smallheath, Birmingham.

Length, $\frac{1}{52}$ inch. **Habitat.** See above; lacustrine. P.H.G.]

Sacculus saltans, *Bartsch* (Pl. XXXII. fig. 24).

Ascomorpha saltans . . . . . Bartsch (7, 8).

SP. CH. **Body** *with two dorsal longitudinal ridges, and two lateral;* **lateral view** *sac-like, nearly symmetrical;* **head** *truncate, with a lip-shaped projecting* **process** *on the mid-dorsal edge of its base;* **corona** *a simple marginal circle.*

The **body** of *saltans* is bounded (says Dr. Bartsch) by four surfaces which meet in four longitudinal ridges, two dorsal and two lateral. Unlike *viridis*, its lateral view shows a dorsal outline very similar to the ventral; and its flat head, with the thumb-like dorsal process, is very different from the low cone which rises from the neck of Mr. Gosse's Rotiferon. Its manners, too, are striking. Dr. Bartsch describes it as now hovering over the same spot, now suddenly darting forward, now turning on its longer axis, and now spinning round its transverse horizontal or vertical one; and, when these antics are over, again returning to hover over the old spot as before.

Length, $\frac{1}{170}$ inch. **Habitat.** Near Tübingen (Bartsch).

Sacculus hyalinus, *Kellicott* (181), (Pl. XXXII. fig. 23).

SP. CH. **Body** *hyaline, with two lateral, sub-dorsal grooves;* **lateral view** *oval, almost symmetrical, the dorsal outline a little more curved than the ventral;* **dorsal view**

sac-like; **head** *depressed with a thin, downwards pointing, projecting process on its mid-dorsal edge;* **corona** *a simple, marginal circle.*

"This 'bonnie gem' was discovered among *Utricularia* and *Lemna* in a small pond shaded by alders and swamp-maples. The animal is an ovoid, hyaline sac, constricted anteriorly to a short cylindrical neck, which, when the corona is retracted, is fluted, and the free edge is crenate. There is on each side a sub-dorsal **groove.** The **corona** has a circlet of ample cilia, and at the dorsal border there is a conspicuous spatula-shaped **apex,** which, seen laterally, is thin and turned downwards; on each side of this is what appears to be a stout incurved seta. The **stomach** is large and lobed, of a rich yellowish brown. The **mastax** is an oblong clear globule, the apex of which is pushed to the front; the trophi appear to be virgate. There is a large nearly globular **contractile vesicle,** which is situated near the posterior wall; as it collapses, the extremity of the sac caves in, and occupies in part the space it filled. The large red **eye** is circular (fig. 23 *b*) seen dorsally, and concavo-convex seen obliquely from below. Dorsally viewed there is a brilliant circular centre, particularly when illuminated from the mirror below; seen laterally there is disclosed a clear sphere (fig. 23 *c*) in the centre of the concave lower face: this seems to act like a lens."

Length, $\frac{1}{236}$ inch; width, $\frac{1}{370}$ inch. **Habitat.** Corunna, Michigan (Kellicott).

Sacculus germanicus, *Leydig* (Pl. XXXII. fig. 25).

Ascomorpha germanica . . . Leydig (110).

SP. CH. **Dorsal view** *sac-like;* **head** *conical, with a triangular projecting process on the mid-dorsal edge of its base;* **corona** *a simple marginal wreath, with several long styles set at intervals.*

It is with some hesitation that I give these specific characters taken from Leydig's description and figures. He himself notices three points of difference between *germanicus* and *Ascomorpha helvetica* (*S. viridis*), viz. that its coronal head is orange yellow, that its size is half that of *viridis*, and that its motions are peculiar—very similar, indeed, to those of *saltans*. His figure shows another peculiarity, namely the projecting of the back in a sort of triangular beak. He adds that he had seen as many as six round eggs (evidently male eggs) attached to one individual; but that those, which carried the rough ephippial eggs, never had more than one at a time.

Length, $\frac{1}{300}$ inch.

The SP. CH. for Sacculus viridis have not yet been given (vol. i. p. 124), as it was described as the solitary species of the genus. They are as follows:—

Dorsal view *sac-like;* **ventral view** *unsymmetrical with a gibbous dorsal outline;* **head** *conical, without a mid-dorsal process on the edge of its base;* **corona** *a simple marginal circle, with several long styles set at intervals.*

Synchæta longipes, *Gosse* (169), (Pl. XXXI. fig. 4 [1]).

[SP. CH. *In front much like* S. pectinata, *but with the* **foot** *distinct, separated, long, furnished with two small toes.*

The well-marked **foot,** having a rhomboid outline, common to all the eight or ten specimens that I examined, appeared to me sufficient, when combined with its small dimensions, to distinguish this species from *S. pectinata*, with which else it has much in common. The broad head bears four frontal warts and two setæ. It has occurred in some profusion in fresh water near Dundee. A great, occipital **brain** carries a well-defined eye, which appears black. The **foot** is capable of retraction as far as its angle, and is occasionally twitched up and vibrated.

Length, $\frac{1}{173}$ inch. **Habitat.** Fresh-water, Dundee. P.H.G.]

[1] Mr. Hood (177) says that Mr. Gosse's figure has been taken from a young animal.

S. GYRINA, *Hood* (176). This marine Rotiferon was found in spring time by Mr. Hood in a tide-pool in the estuary of the Tay along with *Mytilia tavina*, *Notholca spinifera*, and *Distemma raptor*. It disappeared throughout the summer and winter months, but reappeared in abundance in the following spring. It is so like *Synchæta baltica* that I hesitate to give it specific rank. The following are the points of difference which appear to separate the two in some degree. The **body** in Mr. Hood's drawing is narrower, just below the auricles, than it is further down; and from there it swells out till the middle of the animal is reached, from which point it again diminishes, and then suddenly lessens to form a base to the true foot. Both Ehrenberg and Mr. Gosse draw *S. baltica* as much more conical, and as gradually tapering to the foot. Mr. Hood says that it does not carry its eggs, as *baltica* does, but lays them at the bottom of the pool, on confervæ &c. Its mode of swimming is peculiar; for it swims always in circles: sometimes in wide ones, sometimes in circles not much exceeding its own length in their diameter, and it never swims head over heels, as *baltica*, or *pectinata*, does.

The **male** is very slender, not over $\frac{1}{300}$ inch in length; with a broad corona and a pair of conspicuous red eyes. Mr. Hood observed the connection of the sexes, which took place while the female was in rapid motion, and lasted more than one minute; he also observed that the males had connection with young females only, never with the full grown.

Length, (of female) $\frac{1}{90}$ inch. **Habitat.** Tide pools, estuary of the Tay (J.H.).

POLYARTHRA HEXAPTERA, *Schmarda* (135). Schmarda found this Rotiferon in the great clay vessels of drinking water at Paita and Guyaquil. He says that on each side of the body three bristle-shaped spines spring from a common base; and that there are three teeth in each "maxilla." His figure (in other respects worthless) shows spines very similar to those in Ehrenberg's figure of *trigla* (see vol. ii. p. 3, note); so possibly there may be a *Polyarthra* with spines like those of a *Triarthra*: but his statement that there are three teeth in each "maxilla" is incomprehensible; unless (which is highly improbable) the trophi of his *Polyarthra* are on a different plan from those of *platyptera*.

Length. About $\frac{1}{250}$ inch.

TRIARTHRA TERMINALIS, *Plate* (126).

SP. CH. *Base of the unpaired* **spine,** *at the posterior extremity of the body; the spine itself almost immovable, and lying in a line with the ventral surface.*

Dr. Plate (*loc. cit.*) says that *terminalis* resembles *longiseta* in many respects, but differs from it in having the lowest of its three **spines** seated at the hinder end of the body, so that its base projects even beyond the orifice of the cloaca. Moreover, this spine does not move with the front pair, but generally remains extended in a line with the ventral surface. The length of the spines is variable, but Dr. Plate found that in many examples the length of the front pair was thrice that of the body; of the unpaired spine, twice: all three were usually free from imbrications, whereas those of *longiseta* are imbricated.

Length, $\frac{1}{120}$ inch. **Habitat.** Bonn (Plate).

T. CORNUTA, *Weisse* (126) = *T. breviseta*.

HYDATINA BRACHYDACTYLA, *Ehrenberg* (42). SP. CH. "**Body** *suddenly diminished at the base of the foot;* **toes** *minute.*" A very doubtful species. It was only $\frac{1}{144}$ inch in length, and was probably not adult. Ehrenberg's drawing adds nothing to his description.

H. CHILENSIS, *Schmarda* (135). The points of difference said to exist between this and *H. senta*, are that there are five teeth in each uncus, that the toes are longer, and that

the gastric glands are pear-shaped. But gastric glands often differ in shape, and so occasionally does the number of teeth in an uncus. At the most, *chilensis* may be a variety; it is $\frac{1}{60}$ inch long, and was found in St. Jago, Chili.

H. TETRAODON, and H. MACROGNATHA, *Schmarda* (135). See note 1, Supᵗ, p. 8.

Genus TRIPHYLUS, *Hudson.*

GEN. CH. *A genus of the* NOTOMMATADÆ; **body** *sub-cylindrical, somewhat compressed, gibbous dorsally;* **foot** *short, retractile, on the ventral surface;* **eyes** *two, frontal.*

TRIPHYLUS LACUSTRIS, *Ehrenberg* (Pl. XXXII. fig. 16).

Diglena lacustris . . . . . Ehrenberg (42).

SP. CH. **Corona** *without setigerous prominences;* **ciliary wreath** *single;* **foot** *about one-fifth of the total length;* **trophi** *forcipate;* **skin** *slightly thickened into two ridges on the dorsal surface.*

No one appears to have studied this Rotiferon since Ehrenberg described it; so it was with great pleasure that I examined some living specimens, kindly sent to me by Mr. George Western, who had found them in a pond at Littleton.

The animal closely resembles *Notops clavulatus* in the greater part of its internal structure, and *Notops hyptopus* in its general shape; while it differs from both in having two frontal eyes, and no solitary cervical one. It is quite unlike the *Diglenæ*; among which it was placed solely on account of its two frontal eyes. The **body** is sac-like; not nearly so compressed as that of *hyptopus*; the head, transversely truncate and slightly convex; the corona, a simple marginal wreath, notched ventrally; the foot small, ventrally placed, retractile, and with two small toes. The **mastax** (fig. 16 *b*) is globular, with a backward projecting part, like a stalk, containing the fulcrum. The trophi are of a forcipate pattern, and can be best understood from the above figure. The **œsophagus** is very long, thin, and expansible, exactly like that of *hyptopus* or *clavulatus*: the stomach is long, conical, sacculated, studded with globules, and with three ribbon-like cœcal projections on each side. The **gastric** glands are long cylindrical organs, bifurcate at their free ends. There is a good-sized **contractile vesicle**; and the lateral canals and vibratile tags are obvious. The **nervous ganglion** is small, lying between the eyes and the dorsal antenna; which latter is a mere setigerous pimple on the neck, with two threads passing to it from the nervous ganglion. Very powerful muscles pass from the head down the whole length of the body-cavity and are fastened at its base; thus completing a picture which might almost stand for that of *Notops clavulatus* itself.

Of course *lacustris* is not technically a *Notops*; its two frontal eyes appear to forbid its entrance into that genus, just as they seem to invite it into the genus *Diglena*. For all that, its true affinities are with *hyptopus* and *clavulatus*, for it is internally like the one, and externally like the other.

Length, $\frac{1}{70}$ inch. **Habitat.** Littleton, near London (Western).

COPEUS EHRENBERGII, *Ehrenberg* (Pl. XXXII. fig. 17).

Notommata copeus . . . . . Ehrenberg (42).

SP. CH. *Front furnished with a pair of long thick cylindrical* **auricles,** *ciliated at the tips, projectile and retractile; lumbar regions with a stout* **seta** *on each side, projecting at right angles to the lateral surface;* **tail** *pointed, stiff;* **chin** *projecting moderately, ciliated;* **brain** *threefold.*

This fine Rotiferon is so like *C. labiatus*, when its auricles are withdrawn, that it might easily be mistaken for that animal. It differs from *labiatus* in the shape of the front; in the possession of large telegraph-like auricles; in the much smaller size of its ciliated lip; and in its foot having three joints instead of two. Moreover, Mr. Gosse, although he met with several specimens of *labiatus*, never found one with the gelatinous

covering which is generally present on *Ehrenbergii*. *C. pachyurus*, when its auricles are extended, has also a great resemblance to this *Copeus*; but the transparent bag-like membrane which hangs behind in folds, and seems to do duty for a tail, is very unlike the stiff tail of *Ehrenbergii*: the lumbar processes, too, of the former are mere stumps;[1] and its size only half that of the latter.

Length, $\frac{1}{36}$ inch. **Habitat.** Berlin (Ehr.).

ALBERTIA VERMICULUS, *Dujardin* (40), (Pl. XXXII. fig. 21).

SP. CH. **Body** *uniformly cylindrical, slightly tapering to a large, conical, undivided* **foot.**

The genus *Albertia* is due to Dujardin, who formed it to contain *A. vermiculus*, which he had found in the intestines of garden slugs and earthworms. The **corona** is reduced to a few cilia on a sort of hood, which is protruded from the front of the body. The **mastax** is forcipate. Four pedunculated bodies are attached to the alimentary canal: the two anterior, sac-like; the two posterior, kidney-shaped. Dujardin says that "they empty their contents into the intestine, and are refilled by it." The **ovary** is a long straight sac, with seldom more than four eggs at once. Fœtuses, more or less developed, are seen in the largest individuals. **Contractile vesicle** and four pairs of vibratile tags are plainly visible.

Length. From $\frac{1}{77}$ to $\frac{1}{50}$ inch. **Habitat.** In the intestines of slugs and earthworms.

TAPHROCAMPA SELENURA, *Gosse* (169), (Pl. XXXI. fig. 5).

[SP. CH. **Body** *thick towards the head, tapering towards the foot; marked with strong articulations like* T. annulosa; **brain** *opaque, with a distinct red eye on its inner side;* **caudal fork** *a wide crescent;* **trophi** *as in* Notommata aurita.

Since the note in vol. i., p. 17, I have made repeated examinations of this form, which, I am now convinced, has specific value. The crescent behind is glassy clear throughout, continuous with the body, not articulated; its form is that of the new moon when first visible. Cf. *Balatro calvus*, Claparède (15).

Length, $\frac{1}{100}$ inch. **Habitat.** Lacustrine. P.H.G.]

NOTOMMATA LIMAX, *Gosse* (171), (Pl. XXXI. fig. 6).

[SP. CH. **Body** *vermiform, integument soft;* **alimentary canal** *ample, thrown into apparent annulation by alternate constrictions and swellings;* **brain** *having a globose terminal bulb partly filled with opaque chalk masses, and partly with a large eye;* **foot-bulb** *contained within the body;* **toes** *long, slender, acute, decurved.*

The slug-like softness of the skin gives this species some resemblance to *Diglena permollis*; but it is less versatile in outline. The **brain** recalls *N. aurita*, the ample sac having a slender tube running through it occupied with opaque specks, and terminating in an ovate expansion. This is, in part, opaque with chalk deposits, and its rounded extremity is filled with a large crimson eye (fig. 6 *c*). There is a likeness to *N. cyrtopus* in the **toes**; but the general facies is very diverse. Swimming, it will suddenly augment its speed, by pushing out for an instant a pair of auricles. There is a distinct tuberculous **tail.** The whole animal is tinged with pale yellow.

Length, $\frac{1}{173}$ inch. **Habitat.** In *Utricularia*, from a lough near Carrick-on-Shannon, P.H.G.]

NOTAMMATA OVULUM, *Gosse* (169), (Pl. XXXI. fig. 7).

[SP. CH. *Very small;* **body** *globose, plump;* **dorsum** *gibbous;* **venter** *flat;* **brain** *clear;* **eye** *wanting;* **foot** *short;* **toes** *rather long, acute, decurved.*

[1] Mr. W. Chapman and Mr. G. Western have called my attention to the presence of a bunch of setæ on the lumbar processes of *pachyurus*.

This attractive little form has so much resemblance to *N. lacinulata*, that I have doubted whether it is not a variety of that species. There are, however, divergencies, important, if minute. It is very much rounder in all aspects; the **toes** are longer, uniformly diminishing to acute points, and decidedly decurved; no trace of **eye** could be discerned. It swims rapidly, but evenly; does not *spring*, and does not *twitch*; both which actions are so characteristic of *lacinulata*. **Auricles** (?) are occasionally pushed out. The front projects in a tubercle, halfway between which and the auricle on each side is a stiff seta. I have examined three specimens, two from Woolston, and one from Dundee.

Length, $\frac{1}{370}$ inch. **Habitat.** Lacustrine. P.H.G.]

NOTOMMATA THEODORA, *Gosse* (171), (Pl. XXXI. fig. 8).

[SP. CH. **Eye** *small, quite frontal;* **foot** *slender, straight, protrusile to an immense length, or wholly retractile.*

A noble form, of great elegance, and of glassy clearness; colourless, save for a tinge of pale-orange in the tissues of the head (frequent in the kindred species), and the occasional hue of the contents of the stomach. The **body** has the massive aspect of the species named, but the position of the eye is notable, close to the frontal edge of an ample brain. The form and extreme versatility of the **foot**, too, are quite peculiar. Sometimes the body is truncate behind, and only the tips of the tiny toes are seen protruding from the hyaline cavity; when, with lightning suddenness, the foot, like a slender rod of glass, is shot out to a length equalling the whole trunk; and so carried, while the animal darts along with headlong swiftness. The only parallel to this that occurs to me, is the case of *Rotifer macrurus*. The toes are often turned suddenly, to the right or left, at a joint just above them, the long foot else preserving its perfect straightness. When smoothly swimming the front often appears as if **auricles** were on the point of developing; but I have not seen them extruded. In retraction the front often becomes pursed-in in the middle.

Length. When fully extended, about $\frac{1}{60}$ inch. **Habitat.** Lacustrine. P.H.G.]

NOTOMMATA POTAMIS, *Gosse* (170), (Pl. XXXI. fig. 9).

[SP. CH. **Body** *sub-cylindric, gradually tapering to the foot;* **brain** *clear, obscurely three-lobed;* **head** *broad, with conspicuous oblique* **auricles**; **trunk** *strongly fluted;* **foot** *long;* **toes** *short, pointed.*

Having much in common with *N. Naias*, both in general form and in details, this presents characters which appear to mark it as specifically distinct. In more than a dozen examples which I have examined, alive and dead, from Woolston Pond and other waters, these distinctive features were seen. The **auricles** are large and strongly marked, extruded freely, and so remaining even in death, having the form, not of *hemispheres*, but of short truncated *columns*, thrust out *obliquely*, so as to make the whole head obconic. A great clear **brain** shows a tendency to triplicity; the middle sac bears a conspicuous red **eye** on its inner surface, above its swelling. The whole body is fluted strongly, about twelve deep incisions running longitudinally throughout, so that a transverse section would show so many rounded elevations. The **stomach** has a pair of minute ovate **glands**, is very large and saccate, with a distinct intestine. The last joint of the trunk forms a globose saccate sort of **tail**, over and behind the first joint of the foot, not unlike that of *Copeus pachyurus*. The **branchial system** displays thick convolute vessels, and a small contractile bladder. The whole animal, in life, is often tinged with delicate yellow, of deeper hue in the stomach. Several specimens, which seem to belong to this species, recently obtained (April 1887) from a pond near my residence, have the head of an orange hue, the front half of the mastax of a transparent

crimson, and the eye of a rich ruby-red; the whole giving a most attractive appearance to the animal, which is, moreover, very vivacious in manner.

Length, $\frac{1}{96}$ inch. **Habitat.** Lacustrine. P.H.G.]

NOTOMMATA TORULOSA, *Dujardin* (40), (Pl. XXXII. fig. 20).

Lindia torulosa	Dujardin (40); Cohn (20).
Notommata roscola (?)	Perty (124).
Notommata tardigrada (?) . . .	Leydig (110).

SP. CH. **Body** *cylindrical, with several transverse constrictions, slightly tapering at both ends, rounded in front;* **auricles** *evertile and pedunculated;* **toes** *very short;* **brain** *long, cylindrical, and ending in a rounded dark mass which is white by reflected light.*

It is, I think, highly probable that a Rotiferon with these specific characters has been described as a new species by three separate observers in succession, and has been named differently by each of them. I shall follow Leydig's and Cohn's descriptions, which agree in almost every particular; only Leydig never saw the creature protrude its auricles. The Rotiferon has a worm-like **body**; a long, spheroidal **mastax** with forcipate trophi; a rather long **œsophagus**; a long, straight stomach, ending in a short, clear, intestine; and a conspicuous, small **contractile vesicle.** Neither Leydig nor Cohn could see the vibratile tags. The **nervous ganglion** is of the generic pattern, a long cylinder with a rounded end stretching from the fore part of the head, over the mastax, to the top of the stomach. This rounded end is, says Cohn, full of strongly refractive particles, which are greyish-white by reflected light, and dark by transmitted light. In front of them lies, in adults, a black **eye-spot**; which in young individuals is red. Each **auricle**, according to Cohn, is a roundish ciliated knob on a thin peduncle. The main differences between Cohn and Leydig are due to the latter having had no opportunity of seeing the auricles, and the former having overlooked some very fine short cilia which fringe the mouth, a slit on the ventral surface of the head. A minor difference is that Leydig's animal was $\frac{1}{48}$ inch, while Cohn's was $\frac{1}{96}$ inch, and Dujardin's $\frac{1}{75}$ inch.

Cohn is of opinion that Perty's *N. roseola* is most probably the same animal; and in this I agree with him. It is true that his figure shows a stouter animal, with cylindrical auricles; but his description agrees closely with those of Cohn and Leydig, while all his figures of Rotifera are rough and unsatisfactory. Both Cohn and Perty noticed that the body had a faint pink tinge. This Rotiferon belongs evidently to the genus *Notommata*, as defined by Mr. Gosse (*not* Ehrenberg), and I have of course added the specific name *torulosa* devised by its discoverer Dujardin.

Length. Maximum observed, $\frac{1}{48}$ inch; minimum, $\frac{1}{96}$ inch. **Habitat.** Among the slime of the Maine (Leydig); pools and watercourses of the Aar towards Belp (Perty).

NOTOMMATA ONISCIFORMIS, *Perty* (124), (Pl. XXXII. fig. 19).

SP. CH. **Body** *very flatly arched, so as to resemble an* Oniscus; **trophi** *stout;* **uncus** *with many teeth;* **auricles** *round and small;* **toes** *rather long.*

Perty says that the **cilia** lie between the auricles; that the **eye** is red; that the **uncus** has many teeth; and that he could see no organs, through the thick, striped, though hyaline coat, but the eye, mastax, and alimentary canal. Mr. Gosse (vol. ii. p. 23) has noticed the similarity of its cross-section to that of his *N. pilarius*.

Length, $\frac{1}{144}$ inch. **Habitat.** Pools and watercourses of the Aar, towards Belp; among confervæ and charæ (Perty).

N. REINHARDTI = *F. Reinhardti*, Ehrenberg (42). SP. CH. **Body** *fusiform, truncated in front; a long cylindrical retractile* **foot**, *with short toes.* This is very closely allied

to Mr. Gosse's *Notommata Theodora*, if not identical with it. Each is of great translucency; with a long, retractile, slender **foot** (equal in length to the trunk), minute **toes**, and a red frontal **eye** on an ample **brain**. They differ, however, in their habitats and habits. *Theodora* is a fresh-water species found among confervæ in a mill-stream, and "it darts along with headlong swiftness." *Reinhardti*, on the contrary, is only half the size of *Theodora*, is marine, parasitic on *Sertularia* and *Coryne*, and "its motion is not very lively." **Length**, $\frac{1}{120}$ inch.

N. CENTRURA, *Ehrenberg* (42). If Mr. Gosse's *Copeus labiatus* (vol. ii. p. 28) be deprived of its lumbar spines, and of its extraordinary lip, we should have precisely Ehrenberg's *N. centrura*; as, indeed, Leydig pointed out (110). Mr. Gosse thought it impossible that so good an observer as Ehrenberg could have overlooked the lip; and it is very difficult to suppose that he could have done so. But his figure has evidently been taken from an animal under pressure; and shows what look very much like two lumbar spines bent back, by the cover-glass, on to the body; and so pressed as to divide into the separate hairs of which they are composed. Under such circumstances the great lip might have been hidden by the head; and it is just possible that Ehrenberg did overlook it.

N. MELANOGLENA, N. MEGALADENA, N. SULCATA, *Schmarda* (135). See note 1, Supᵗ, p. 8.

PROALES WERNECKII, *Ehrenberg* (Pl. XXXII. fig. 18).

Notommata Werneckii. . . . Ehrenberg (42); Balbiani (4, 5).

SP. CH. **Body** *fusiform, segmented by transverse folds, tapering continuously to front and rear; ventral ciliated* **face** *distinctly oblique; a slightly decurved* **proboscis**; **toes** *small, straight, pointed: parasitic in galls of* Vaucheria.

Although Ehrenberg established the fact that a Rotiferon lives in excrescences on the filaments of *Vaucheria*, he had no opportunity of studying the creature, as all his specimens died before they were hatched. Professor Balbiani, however, was more fortunate; and he has given (*loc. cit.*) an admirable account of the animal, and its habits, accompanied by equally good drawings. It is from this account that the following remarks are taken.

The tubes of *Vaucheria* often bear two kinds of excrescences: the one, the organs of reproduction; the other, which are much larger, are generally club-shaped capsules, nearly at right-angles to the stem, and of the same green colour. These are the habitations of *N. Werneckii*, and Professor Balbiani is of opinion that they are the reproductive organs of the plant, stimulated into excessive growth by the action on them of the saliva of the Rotiferon. (See Vol. ii., p. 134.)

The young animal is at first a free swimmer, and then, while still young, enters the plant by some opening in the reproductive capsule; either by the ordinary one in the male capsule, or by one at the summit of the altered cell. It remains in the cell for the rest of its life, feeding on the colourless plasma of the cell, and laying eggs.

The **body** is soft and fusiform, and divided by folds of the cuticle into segments capable of being retracted, one within the other. The head, on its dorsal surface, is prolonged into a projecting **proboscis**; and, on the ventral surface, is cut away obliquely, so that the profile tapers to the proboscis. The last segment of the body bears two small pointed **toes**. At the base of the proboscis a flap descends on either side, whose edge is ciliated; and these ciliated flaps surround the entrance to the buccal funnel, at the bottom of which lie the true mouth, and a ciliated organ, capable of protrusion, representing the **corona**. This organ is excessively mobile, as is also the proboscis, but is made use of only in a very early stage of the animal's existence. The buccal funnel is long, the **trophi** virgate; and the salivary and gastric **glands** are unusually large. The communication, between these latter and the stomach, is gradually enlarged; and the gastric glands are ultimately drawn into it. The **contractile vesicle** is small, and the

lateral canals are obvious; but no vibratile tags have, as yet, been seen. The **nervous ganglion** is a pale, rounded, finely granulated mass, above the mastax; and seated above its posterior border, in the neck, is the **eye**: a small crystalline, refractive lens, on a small mass of red pigment. Above the anterior border of the brain, is a small spherical pit in the dorsal surface, covered with fine vibratile cilia. The use of this organ is unknown. There is a simple **ovary**, which becomes much distended with eggs flattened by pressure against one another; and after a time the ovisac appears to be ruptured, and the eggs fall into the general cavity of the body, which becomes much distorted. Professor Balbiani satisfied himself that the *same* female, while occupying, alone, the same capsule, laid first ordinary "summer" **eggs**, and then ephippial ones. Professor Balbiani has not seen the **male**, which at present is unknown.

Length. About $\frac{1}{100}$ inch. **Habitat.** Galls of *Vaucheria*.

PROALES CORYNEGER, *Gosse* (171), (Pl. XXXI. fig. 10).

[SP. CH. **Body** *nearly cylindrical, rounded in front and rear;* **foot** *stout, apparently one-jointed;* **toes** *two, furcate, rod-shaped, thick at base, tapering to an obtuse point, very slightly recurved, half as long as body-and-head.*

This obscure form I cannot, on the evidence of a single specimen, identify with any species known to me; though I own it presents little distinctive character. Its long, thick, club-shaped **toes** form its most obvious distinction; these are usually carried *wide apart*. The figure suggests *Diaschiza*; but I could not detect any dorsal fissure, and the soft skin seems destitute of a lorica. There is a minute red **eye** in the occiput. In swimming it is rapid, smoothly gliding; darting to and fro, without any appreciable aim.

Length, $\frac{1}{130}$ inch. **Habitat.** Kingskerswell, lacustrine. P.H.G.]

PROALES OTHODON, *Gosse* (170), (Pl. XXXI. fig. 11).

[SP. CH. **Body** *nearly cylindrical, but arched in the line of the back, straight in that of the belly; very plump throughout;* **mastax** *forcibly protusile;* **foot** *and* **toes** *minute.*

This occurred in water from Woolston—a single example only. It is of plump hog-like form, without wrinkles, and almost without folds. It has no very marked characteristics, yet it does not seem referrible to any recognised species. There is a slight projection from the front in a lateral view, which, however, in a dorsal view appears to be a wide ridge seen endwise. The face is obliquely prone, from the midst of which the **jaws** are occasionally protruded, with force, in the manner of a fierce *Diglena*: the details of these jaws I was not able to trace. A sac-like **brain** is conspicuous, but I could discern no **eye**. The **stomach** and distinct intestine are ample; the former carries a pair of gastric **glands**, which are large, high, and pointed.

Length, $\frac{1}{144}$ inch. **Habitat.** Woolston, lacustrine. P.H.G.]

PROALES PREHENSOR, *Gosse* (170), (Pl. XXXI. fig. 12).

[SP. CH. **Body** *bottle- or oil-flask-shaped, but with the belly nearly flat; fore parts long, very protusile;* **eye** *small;* **face** *prone; a short tuberculous tail;* **foot** *short;* **toes** *blade-shaped, straight, acute, usually appressed.*

I have doubts where I should place this species. Technically, it seems a *Notommata* or *Proales*, with the form of a *Distyla*, yet having much in common with *Distemma*. The **toes**, in particular—blades, widest in the middle, with slender produced tips, and generally carried close together as one (though sometimes widely spread)—remind us forcibly of *Distyla* or *Cathypna*. The **trophi**, too, suggest the same alliance: viewed ventrally, the length and form of the mallei, and the triradiate incus, for instance:—yet I believe I have seen a great blade-like prolongation of the incus arching far into the occiput; and, at times, what seemed a short forcipate form of the ami, as in *Diglena*

and *Distemma*. There appears a sort of **proboscis**, but close appressed, not at all movable. I have never seen the **jaws** protruded, though they are every moment brought to the bottom of the ciliate face, snapping up atoms of food.

It is not much given to locomotion, but can swim, rather slowly: usually, it rolls hither and thither, or adheres by the toes. It picks industriously among the vegetable floccose for morsels of food: it is vivacious and energetic, and altogether attractive; constantly reminding me of the marine *Distemma raptor*. I have observed, in all, about a score of examples, all isolated.

Length, $\frac{1}{173}$ inch. **Habitat.** Woolston, lacustrine. P.H.G.]

Furcularia lactistes, *Gosse* (171), (Pl. XXXI. fig. 13).

[SP. CH. **Back** *much arched, soft and plump, smooth, round;* **foot** *stout;* **toes** *long, slender, acute, decurved; foot and toes together equal in length to the trunk; a short pointed* **tail.**

It possesses much elegance of form, and a most restless activity, every instant retro-jecting the long foot and toes, with the action of a kicking horse, very forcibly and pertinaciously. It has one very curious habit: it constantly insinuates itself between two stalks of conferva, where it immediately begins to make itself a cell (only just large enough to hold it) by incessantly turning head over heels. As soon as it has got its place, it bends the front down to the belly, and begins to roll round and round, without a moment's cessation for hours. If forced out, it at once begins the same process somewhere else. The habit, which is not that of an individual, but is characteristic of the species, may be compared with the tube-making propensity of *F. forficula* (vol. ii. p. 41). In other respects it has the manners of its genus; as in its sudden and rapid motions, its volutions, and its swift shooting way of swimming. The **incus-fulcrum** appeared to be a massive pillar, with long, slender, divergent, arching rami: the mallei, evanescent.

I met with several examples of this interesting species, inhabiting floating tufts of a floccose conferva, that waved in a rapid rivulet in the village of Kingskerswell. And, a few weeks later, two more occurred in water from Carrick-on-Shannon. These had the same form, and identically the same habits, as the Devonshire specimens. More recently, I have detected the same species in other waters.

Length, $\frac{1}{175}$ inch. **Habitat.** Lacustrine. P.H.G.]

Furcularia molaris, *Gosse* (171), (Pl. XXXI. fig. 14).

[SP. CH. **Body** *ovate, with a thick truncate head, and suddenly diminishing to a long foot, terminated by two blade-shaped, straight, acute,* **toes**; *back elevated; belly straight.*

A single round **eye**, well-defined, of ruby brilliance, near the frontal part of a clear saccate **brain**, marks this rather insignificant species. The **trophi** are nearly as in *F. lactistes* just described; but the mallei are more developed. An ample **alimentary canal**, undivided, nearly fills the trunk; and a clear **ovary** crosses it obliquely, having in general embryonic vesicles more or less conspicuous. The long **foot** and toes are carried straight behind, and both extended are about as long as the trunk. It is, as usual, restless, moderately swift, with a smooth gliding course. It is an elegant and attractive little species, which, for lack of any marked characteristics, I name from the locality in which I found it—the Kingskerswell mill-stream. Here, on different occasions, I have met with several examples.

Length, $\frac{1}{175}$ inch. **Habitat.** Lacustrine. P.H.G.]

Furcularia sterea, *Gosse* (171), (Pl. XXXI. fig. 15).

[SP. CH. **Body** *ovato-cylindric, with a thick truncate head, and sub-prone face; behind ending in a short, decurved, acute* **tail**; **foot** *short and thick, apparently one-jointed;* **toes** *moderate, acute, scarcely decurved.*

Having much in common with *F. molaris*, this is quite diverse in facies and habit. The head is of nearly the same thickness as the trunk; the little overarching tail (seemingly a stiff point), and the short but massive foot, are differences that strike one at first sight. The **eye** is distinct, quite prominently frontal; immediately beneath it the **face** recedes, and becomes a sub-prone ciliate surface, applied to the feeding-ground. It it much larger than *F. molaris*. The single specimen seen had a great **contractile vesicle**, and a small undeveloped **ovary**. The **stomach** seemed undivided. The fore-parts were tinged of a delicate yellow hue. It was not much addicted to swimming, but crept vivaciously about the vegetation, grubbing and browsing.

Length, $\frac{1}{173}$ inch. **Habitat.** A pond in Watcombe Park, Torquay. P.H.G.]

Furcularia sphærica, *Gosse* (171), (Pl. XXXI. fig. 16).

[SP. CH. **Body** *globose dorsally, nearly flat ventrally;* **foot** *short, thick;* **toes** *small, straight, acute; the dorsum projecting over them with a slight rim or margin, which, laterally seen, looks like a* **tail.**

In lateral aspect this pleasing little form may easily be mistaken for a deep *Colurus*, till the **trophi** reveal its true Furcularian character, confirmed by a minute ruby **eye** at the extreme front; as also by its motions. The **head** seems not retractile. I first formed acquaintance with it, in half-a-dozen examples on different occasions, from tide-pools in the Firth of Tay. Then a specimen, recently dead, occurred in fresh-water among *Myriophyllum*, thickly studded with *Melicerta ringens* and *Floscularia cornuta*. And presently, to confirm the amphibious habitat, I found one alive in *Utricularia* from a lough in the centre of Ireland. These fresh-water specimens I could in nowise distinguish from the marine.

Length, $\frac{1}{210}$ inch. **Habitat.** Marine and lacustrine. P.H.G.]

Furcularia eva, *Gosse* (171), (Pl. XXXI. fig. 17).

[SP. CH. **Body** *stout, fusiform, strongly elevated on the shoulder;* **foot** *short, indistinct;* **toes** *more than half as long as body-and-head, thick for half this length, then abruptly attenuated for the remainder.*

The great length and peculiar form of the toes, which are often thrown back, and carried over the back, give a facies to this rather fine species, which at once strikes an observer. Sometimes these organs are extended in opposite directions in a horizontal line, imparting to the animal the figure of the letter ⊤ reversed. The **mastax** is ample; the incus a thick rod, bent in the middle backwards, and ending occipitally in a pair of long and broad scythe-shaped processes; the mallei indistinct. A slender **brain** descends behind; but no **eye** is visible, unless two very pale globules, close side by side, in the very front, are such.

A single specimen only has occurred, whose activity mainly consisted in the vigorous throwing into different positions of the characteristic toes.

Length, $\frac{1}{144}$ inch. **Habitat.** Mill stream, Kingskerswell. P.H.G.]

Furcularia lophyra, *Gosse* (169), (Pl. XXXI. fig. 19).

[SP. CH. **Body** *fusiform;* **head** *separated by a constriction; back sharply ridged;* **toes** *broad at base, tapering at mid-length to long-drawn fine points.*

Somewhat near to *F. gracilis*, but the above characters, which are constant in a great number of examples, sufficiently distinguish it. The **body**, sub-cylindric at first, swells more or less behind the middle, where the dorsum rises to a sharp edge, *not a carina*. The **head** is large, always distinct, with a brilliant **eye** at the very front, and a prone ciliate face. The **trophi** are those of *gracilis*, very large, often extruded. A thick short **foot** bears two great toes (often widely expanded) one-fourth of the whole length;

each is a glassy rod, of thick base, which tapers somewhat abruptly near the middle to a long point of great tenuity.

Length, $\frac{1}{200}$ to $\frac{1}{100}$ inch. **Habitat.** Lacustrine. P.H.G.]

FURCULARIA MELANDOCUS, *Gosse* (169), (Pl. XXXI. fig. 18).

[SP. CH. **Body** *swollen, obtusely narrowed in front, tapering behind;* **brain** *saccate, opaque at the extremity;* **foot** *large;* **toes** *conical, each terminating in a soft, slender point, much produced.*

Of excessively versatile outline, rapidly lengthening and shortening every instant. The **front** is apparently hard, with a sharp edge, below which is a broad, sub-prone, ciliate face. An ample **brain-sac**—its terminal portion filled with chalky deposit, usually intensely black by transmitted light, but in some examples much diluted—looks like a bottle of ink swaying to and fro in the animal's contortions.

The prolonged finger-like tips of the **toes** have a strong adhesive power, dependent on a pair of great mucus-glands. A minute frontal **eye** is not *quite* certain.

Length, $\frac{1}{130}$ inch. **Habitat.** Woolston pond; several examples. P.H.G.]

EOSPHORA NAIAS, *Ehrenberg* (42), (Pl. XXXIII. fig. 9).

SP. CH. **Body** *hyaline, conical, not auricled;* **toes** *much shorter than the foot.*

Ehrenberg says that the internal structure resembles that of *Hydatina*, except that the **mallei** are one-toothed, and that he failed to find either an **antenna** or **vibratile tags.** The **brain** is large, lies higher up than the mastax, and carries a transversely-oval red **eye.** There are also two paler red spots on prominences on the frontal edge of the head: these Ehrenberg considers to be eyes, but Leydig (110) maintains that they are nothing but spots of a deeper orange hue than the rest of the edge of the corona; and that *naias* is a true *Notommata*, with only one eye, in the neck. Herr Eckstein (41), however, agrees with Ehrenberg as to the nature of the spots. I have given Leydig's figure, which is much more characteristic than Ehrenberg's, and shows the forcipate trophi, and the frontal prominences, on the inner side of which the red spots are situated.

Length, $\frac{1}{144}$ to $\frac{1}{96}$ inch. **Habitat.** Berlin (Ehr.).

EOSPHORA DIGITATA, *Ehrenberg* (42), (Pl. XXXIII. fig. 10).

SP. CH. **Body** *hyaline, conical, not auricled;* **toes** *one-third of length of foot.*

Very similar to *naias*, but with longer toes.

Length, $\frac{1}{96}$ inch. **Habitat.** Berlin; among confervæ (Ehr.).

EOSPHORA ELONGATA, *Ehrenberg* (42), (Pl. XXXIII. fig. 8).

SP. CH. **Body** *elongated, almost fusiform, slender, truncate in front;* **toes** *short.*

Ehrenberg gives no more information about this animal than what may be derived from his SP. CH., and his drawings. He had found it in 1831, and had drawn it; but had not met with it again. Herr Eckstein, however, (41) has carefully described and figured this Rotiferon; and from his description the following account is derived. The **trunk** is of an ovoid shape, with a distinctly separate head. The **corona** consists of two wreaths of rather long cilia, among which are two spots with still larger setæ. The three-lobed **mastax** lies behind and below the brain, the trophi are stout, and the œsophagus is long and curved. The spherical **stomach** bears not only the usual gastric **glands** but also a third very large gland, which crosses its middle as a transverse, broad ring, divided by deep incisions into anastomosing parts.[1] The two **foot-glands** have each a long tube leading to the end of the toes. The **nervous ganglion**, or brain, is three-

[1] This is, I think, an error. See the explanation of a similar mistake in the description of *Triophthalmus dorsualis*, Sup', p. 32.

lobed and bears a great red **eye**; two smaller red spots are borne on prominences in the front of the head; and on each side of the body, about the middle, is a rocket-shaped **antenna**, like those in *Hydatina senta*. A **contractile vesicle**, lateral canals, vibratile tags, and **ovary** are also present.

Herr Eckstein says that this creature preys on other Rotifera; and he vividly describes how he has seen a *Monostyla* drawn by the vortex of *elongata*'s cilia into its buccal funnel, and there slit up by the teeth and devoured.

Length, $\frac{1}{72}$ inch. **Habitat.** Berlin (Ehr.).

E. CARIBÆA, *Schmarda* (135). See note **1**, Supᵗ, p. 8.

DIGLENA CONURA, *Ehrenberg* (42), (Pl. XXXIII. fig. 11).

SP. CH. **Body** *ovately oblong, front transversely truncate, the hinder part of the body gradually diminishing to a conical foot.*

This *Diglena* somewhat resembles *catellina*, but lacks its plump, dorsal rotundity. The **foot**, too, is differently placed; being in a line with the long axis of the body, instead of being placed ventrally beneath it. The only difference (according to Ehrenberg) in the internal structure is that the **gastric glands** are almost hemispherical, while those of *catellina* are spherical.

Length, $\frac{1}{144}$ inch. **Habitat.** Berlin (Ehr.).

DIGLENA CAPITATA, *Ehrenberg* (42), (Pl. XXXIII. fig. 12).

SP. CH. **Body** *oblong, conical, with an obliquely truncate and dilated front, gradually diminishing behind to two long, and apparently baseless,* **toes.**

Ehrenberg says but little of this species, which is mainly distinguished by its broad head, conical body, and long **toes.** These latter seem to spring at once, without the interposition of a single joint, from the base of the body itself. The **mastax** is long; the **mallei** one-toothed; the **gastric glands** spherical.

Length, $\frac{1}{216}$ inch. **Habitat.** Near Berlin (Ehr.).

DIGLENA AQUILA, *Gosse* (171), (Pl. XXXI. fig. 20).

[SP. CH. **Body** *fusiform;* **head** *furnished with a beak;* **foot** *short, thick;* **toes** *nearly as long as trunk, thick to half-length, then diminished to stiff, straight rods with obtuse points.*

The long, straight, blunt **toes** are very characteristic. The **proboscis** is a broad shield, somewhat as in *Stephanops*, permanent, surrounded by a ring of very long vibratile cilia. It forms, indeed, a hooked beak, shaped like that of an eagle, the edges of which converging to a point (fig. 20 *c*) are distinctly visible from above, through its hyaline substance.

In manners it is headstrong, abrupt, vigorous; most restless, never pursuing one course more than an instant, but suddenly stopping, and turning round on itself, augmenting its speed greatly for a moment, rushing, or rather *shooting*, forward for three or four times its length, then again and again, but never springing sidewise. I first received it from the middle of Ireland, by the kindness of Mr. Hood junr.; then in a pond near my own residence; and on several occasions since. It bears a very close resemblance to a species discovered by Mr. E. C. Bousfield, of which he courteously sent me a drawing, under the name of *Notommata rapax*. This has two conspicuous styles (antennæ?) projecting straight from the head, which I do not see in *D. aquila*. If, however, the two are identical, his specific name has the priority. None of my earlier examples showed any trace of an **eye-spot**; but I have met with a specimen, in another missive from Mr. Hood junr., in which was conspicuous a very large black occipital eye, if, indeed, it was not an opaque chalk-mass of the brain.

Length, $\frac{1}{65}$ inch. **Habitat.** Babbacombe; Ireland. P.H.G.]

Diglena rosa, *Gosse* (171), (Pl. XXXI. fig. 21).

[SP. CH. **Body** *lengthened, fusiform, annulose, larva-like;* **proboscis** *frontal, beak-shaped, within which are two colourless* **eyes**; **foot** *minute;* **toes** *small, straight, acute.*

The strong division of the body into annular false joints recalls *Taphrocampa*. The head, too, resembles that of an insect-larva. The frontal **beak** is broadly triangular, like that of *D. aquila* just described, and its sharp point, hooked downward, can be seen from above, through its transparent substance. Two well-defined, perfectly colourless bodies, side by side, are also seen through the base of the beak, apparently **eyes** without pigment. A ring of close-set cilia surrounds the front, behind the base of the beak. The **face** is truncate, studded with warty eminences. The body terminates in a distinct, bulbous tail.

Several examples occurred in conferva-tufts waving in the swift mill-stream in Kingskerswell. All were of a clear horn-yellow hue, with the long alimentary canal full of opaque food-matter. They were restless and swift; the jaws often protruded from the face, *more generis*. The beak was much more acute and better shaped in some, than in others.

Length, $\frac{1}{150}$ to $\frac{1}{115}$ inch. **Habitat.** Lacustrine. P.H.G.]

Diglena suilla, *Gosse* (170), (Pl. XXXI. fig. 24).

[SP. CH. **Body** *cylindric, or fusiform, massive, often gibbous in the middle;* **face** *broad, sub-prone, with small, tubercular frontal* **proboscis**; **eye** *large, cervical;* **foot** *thick, short;* **toes** *minute, decurved.*

This thick-bodied, plump, snouted, swine-like creature occurred in a number of examples, among conferva much crowded with groups of diatoms, in sea-water from Invergowrie. The **body** rises into successive swellings, divided by sharp constrictions like that of a full-fed caterpillar, diminishing abruptly to an oblique thick head, with a distinct round pimple in front, in which is a very minute refractive corpuscle, like a glass bead. This, however, is probably not an eye, the true **eye** being large and conspicuous, near the tip of an ample brain. The **front** is truncate, but appears semi-prone, from the inclination of the head; it is ciliated on its whole surface, the cilia *surrounding* the globose proboscis, not *covering* it.

The **jaws** are of the same form as in other *Diglenæ*, as *permollis*; viewed laterally, they are produced into a long point, which is often deliberately projected and retracted. Young specimens lack the plumpness of adults, especially in the hinder parts. The **stomach** is of great size, usually gorged with green granular food. The animal, in habit, is very sluggish.

Length, $\frac{1}{200}$ inch. **Habitat.** Invergowrie; marine. P.H.G.]

Diglena (?) pachida, *Gosse* (170), (Pl. XXXI. fig. 23).

[SP. CH. **Body** *thick, sub-cylindric, very variable in outline;* **skin** *leathery, thrown into strong folds;* **eye** *wanting;* **toes** *two, furcate, long, slender, acute, decurved.*

Several examples of this curious thickset form, more remarkable than attractive, occurred to me last summer, in sea-water from various rock-pools in Torbay. It is uncouth, heavy, and sluggish, apparently illoricate, but inclosed in an integument which seems of leathery stiffness, making stout, transverse folds, whence the fore and hind parts project at intervals. The **head**, at extreme protrusion, shows a thread-like frontal proboscis, an ample **brain**, but no eye, and **trophi** which appear slight and very simple, but need further examination. The **toes**, long and slender, have that backward direction which is seen in many *Diglenæ*, yet have a forward curve. The internal organs are nearly lost in an indistinguishable granulation.

Its generic affinities are very doubtful. It is not improbable that a more matured acquaintance may elevate this strange form to the rank of a genus. In any case it is a notable addition to our marine Rotifera.

Length, $\frac{1}{87}$ inch. **Habitat.** Rock-pools, Torbay; marine. P.H.G.]

Diglena (?) silpha, *Gosse* (169), (Pl. XXXI. fig. 22).

[SP. CH. **Body** *sub-cylindric, stouter at the head, abruptly lessened behind;* **brain** *saccate, long, opaque at the end;* **toes** *minute, conical.*

The whole animal is very soft and plump, not wrinkled, even in retraction. A well-marked, soft, decurved **proboscis** is on the front: no **eye** is visible. The sudden attenuation of the body to a slender cylinder, one-fourth of the whole length, is remarkable: this terminates in two or three soft lobes, below which are two very minute **toes**, with no appreciable foot intervening; for the rectum can be traced to a cloaca just above the toes. Fuller examination is needed: I have seen but a single example, and the **trophi** were not satisfactorily defined. Cf. *Notommata forcipata*, lateral aspect.

Length, $\frac{1}{100}$ inch. **Habitat.** Ireland; lacustrine. P.H.G.]

Diglena (?) uncinata, *Milne* (186), (Pl. XXXIII. fig. 13).

SP. CH. **Body** *sub-cylindric, gibbous dorsally behind; ciliated* **face** *oblique, and overhung by a hood;* **foot** *very short, with two very long, decurved and divergent, blade-like* **toes**; **eyes** *absent.*

The truncated **face** is covered with strong cilia; two, or two pencils, of which are more than double the length of the rest, which are themselves longer than usual. The **nervous ganglion** is large, and below it lies an ovoid **mastax**, with a very formidable pair of protrusile three-toothed jaws. There is a very distensible "clear-walled" **œsophagus**, often wrinkled up, but sometimes so distended with food as to occupy half the body below the mastax, and so push down the true **stomach**.[1] This latter has two large, flat, wedge-shaped **glands**, each containing a peculiar vesicular hollow surrounded by two or three dozen granules. The **ovary** is large, extending up to the **mastax**, and developing eggs of a great size. The **vascular system** is normal; at least two vibratile tags are readily seen behind the mastax. Two **foot-glands** lie just at the insertion of the toes; and a short, fine seta springs from the "posterodorsal" surface of the foot, but is exceedingly difficult to detect. "This little creature has a curious way, when moving along, of suddenly, and with exceeding quickness, switching itself back on its toe-points, head over and back again, the motion being somewhat comparable, in its quickness and unexpectedness, to the springing of the Infusorian *Halteria grandinella*."

The above characteristics and description have been taken from Mr. Milne's memoir (*loc. cit.*). The author shows clearly the close relation between this species and the next, which was described by him under the title of *Pleurotrocha mustela*. Like Mr. Milne, I hesitate where to place these two eyeless Diglenoid Rotifera; but on the whole I agree with Mr. Gosse, that their trophi and their energetic habits ought to weigh more than the presence or absence of eye specks; and that they should be placed in the genus *Diglena*.

Length, $\frac{1}{100}$ inch.

Diglena mustela, *Milne* (Pl. XXXIII. fig. 14).

Pleurotrocha mustela . . . . . Milne (188).

SP. CH. *Like the preceding, but with very short* **toes.**

There are one or two other points in which the two species differ. The **gastric glands**, in *mustela*, are pyriform, and attached to the (true) stomach by long stalks.

[1] See *Triopthalmus dorsualis*, p. 32.

There are no ciliated tufts, in the **corona**, longer than the rest; there is a blunt dorsal **antenna** protected by the hood; and the **vibratile tags** are sufficiently inconspicuous to have escaped observation. The creature is fierce and active: if it strikes an object with its jaws, it hangs on and sucks like a weasel, even when whirled round by its prey. Infusoria are often attacked by it, and will tear themselves out of its grasp, leaving pieces of their bodies in its jaws. Once Mr. Milne saw it make so desperate a snatch at its prey, that it locked its rami together into a straight line; and, unable to unlock them, died of its fatal greediness. It often swallowed a *Glaucoma*; and on one occasion devoured no fewer than six (or half its own bulk) in less than an hour. All of these were digested in the large œsophagus (see *D. uncinata*), and in an hour and a half there was nothing left but a pulpy mass, which had not yet reached the true stomach.

Mr. Milne has also seen and described the **male**. It is a much smaller animal than the female, more elongated, and with a more developed hood. Its structure is normal.[1]

Length, (of female) $\frac{1}{100}$ to $\frac{1}{140}$ inch; (of male) $\frac{1}{180}$ inch.

D. ANDESINA, D. DIADEMA, D. LONGIPES, D. MACRODONTA, *Schmarda* (135); see note 1, Supᵗ, p. 8.

D. GRANULARIS, *Weisse* (41)=*D. catellina*.

DISTEMMA FORFICULA, *Ehrenberg* (42), (Pl. XXXIII. fig. 19).

SP. CH. **Body** *cylindrically conical;* **toes** *stout, re-curved, toothed at the base;* **eyes** *red.*

Ehrenberg says but little of this Rotiferon. He thinks it closely related to *Furcularia forficula*; and notices that the two red **eyes** are situated at the end of a long cylindrical **brain**.

Length, $\frac{1}{120}$ inch. **Habitat.** Near Berlin (Ehr.).

DISTEMMA PLATYCEPS, *Gosse* (171), (Pl. XXXI. fig. 25).

[SP. CH. **Body** *subfusiform;* **belly** *flat;* **head** *broadly truncate;* **eyes** *two colourless globules, remote, occipital;* **foot** *rounded;* **toes** *taper, acute, slightly decurved.*

Though not unlike certain conditions of *Diglena suilla* and *permollis*, this is distinguished by its two large colourless **eyes**; and by the fact that while the **trophi** are of the usual calliper form, the mallei are (or *seem*) attached to the bases rather than to the ends of the circular rami; while the fulcrum is nearly as long as the mallei. An inconspicuous hooked **proboscis** is present, which appears retractile. The broad **face** is of hyaline delicacy, free from corrugations and marks, as if clear gelatinous flesh, and this well defined from surrounding tissues, in all aspects.

Young specimens are very restless and mobile, but an adult was of slow movement. Five or six examples occurred to me in water from a tide-pool near Carnoustie, in Forfarshire. In the one the jaws were about half extruded from the face, and (as if by paralysis) could not be retracted, or even moved: an accident, the occurrence of which I have observed on repeated occasions, in predatory Rotifera. The species was numerous also in a ditch near Goodrington, South Devon.

Length, $\frac{1}{144}$ inch. **Habitat.** Marine and lacustrine. P.H.G.]

D. SETIGERUM, *Ehrenberg* (42), (Pl. XXXIII. fig. 18). SP. CH. "**Body** *ovato-oblong;* **toes** *decurved, seta-like;* **eyes** *red.*" Mr. Gosse points out (vol. ii. p. 54) that this Rotiferon belongs to the *Rattulidæ*; and possibly (vol. ii. p. 70), in spite of the two cervical eyes assigned to it by Ehrenberg, to his new genus *Cœlopus*. Ehrenberg gives no account of its internal structure, and says hardly anything about it, except that one

[1] The whole of the above account of these two species is derived from Mr. Milne's able and exhaustive paper (*loc. cit.*).

toe lay inside the other, so that the two appeared to be one. Further investigation will be necessary to determine this Rotiferon's true position.

Length, $\frac{1}{216}$ inch. **Habitat.** Near Berlin (Ehr.).

D. (?) MARINUM, *Ehrenberg* (42), (Pl. XXXIII. fig. 16). SP. CH. "**Body** *ovato-conic;* **foot** *long;* **toes** *stout, equal in length to the foot;* **eyes** *close together, red.*" Ehrenberg marks this as a doubtful species; and indeed it resembles the rest of the genus in only one point, viz. in having two cervical **eyes.** These are closely pressed together, so as to look somewhat like those of a *Brachionus.* The **trophi**, too, have five teeth in each malleus, and are very unlike those of *D. raptor* (Pl. XIX. fig. 1 *b*). Ehrenberg's drawing seems also to show the presence of a transparent **lorica**, with a round opening for the foot. It is obvious that this Rotiferon must be more carefully observed, in order that its proper position may be assigned to it.

Length, $\frac{1}{144}$ inch. **Habitat.** Baltic Sea (Ehrenberg and Eichwald[1]).

D. (?) FORCIPATUM, *Ehrenberg* (42), (Pl. XXXIII. fig. 17). SP. CH. "**Body** *ovato-oblong;* **foot** *short;* **toes** *thick;* **eyes** *colourless.*" A doubtful species, scarcely described at all, and feebly drawn. Ehrenberg merely says of it that it is vehement in its motions, and predaceous.

Length, about $\frac{1}{250}$ inch. **Habitat.** Near Berlin (Ehr.).

Genus TRIOPHTHALMUS, *Ehrenberg.*

GEN. CH. "*One of the* NOTOMMATADÆ, *with the three cervical* **eyes** *in a transverse row, and a forked* **foot.**"

TRIOPHTHALMUS DORSUALIS, *Ehrenberg* (42), (Pl. XXXIII. fig. 20).

Ehrenberg merely says of this fine Rotiferon (which is the only species of the genus) that its **body** is hyaline, swollen, and with a suddenly diminished foot, half as long as the body: that it resembles *Notommata ansata* in form, and *Asplanchna myrmeleo* in size; and that he regrets his having observed and drawn it under too low a power.

Mr. Gosse met with it once, and says, in a manuscript note, that "the **front** is pale orange, the **brain** saccate, and the **eyes** in a row near (not *at*) the end of the brain. Over the foot hangs a bulbous joint, which looks, laterally, like a **tail.** The creature resembles a stout-built *Notommata aurita* or *naias.*"

M. Eckstein (41) gives a large figure of *dorsualis*, in which the internal structure is distinctly displayed; and describes an additional **gastric gland** lying in a cluster of folds, close round the stomach, and containing many large clear vesicles. I think that M. Eckstein has, here, mistaken the thick-celled walls of the true stomach for a gastric gland; and has considered a distended portion of the œsophagus to be part of the true stomach. I have often seen *Synchæta tremula, Notops hyptopus*, and *Notops clavulatus* with a portion (and even the whole) of the long œsophagus, so fully distended with food, that it was continuous with the stomach; and so had the precise appearance of M. Eckstein's drawing. For, owing to the delicate thinness of the œsophageal walls, and the thickness of those of the stomach, when both become stuffed with a continuous mass of food, the stomach cells seem to be in a thick belt round that mass, and show off their oil globules to advantage on the dark ground.

M. Eckstein adds, that of the three cervical **pigment spots**, the centre one only is completely rounded, and that those on either side of it seem incomplete towards the inner edge. Mr. Gosse's drawing, too, confirms this observation. But M. Eckstein has also seen two red spots on the top of two low frontal prominences. These Mr. Gosse failed

[1] Unfortunately Eichwald's account of this creature (43) adds nothing whatever to that of Ehrenberg.

to find, as both he and I have failed to find many similar spots, seen by Mr. Eckstein, on the heads of various Rotifera.

Length, $\frac{1}{350}$ to $\frac{1}{488}$ inch (Ehrenberg); $\frac{1}{714}$ inch (P.H.G.); $\frac{1}{1000}$ inch (Eckstein). **Habitat.** Watcombe (P.H.G.).

Family SEISONIDÆ, *Plate* (192).

Elongate vermiform animals, $\frac{1}{50}$ to $\frac{1}{9}$ inch in length, of similar form in both sexes; the males somewhat smaller, and less abundant, than the females. The **body** is divided into four apparent segments, viz. the head, neck, middle body (trunk), and foot; these, with the exception of the last two, are sharply separated from each other. The neck can be retracted in its whole length into the trunk, along its ventral surface. The corona is rudimentary or wanting. The buccal funnel and œsophagus meet at the anterior end of the mastax, which is thus a sacciform ventral appendage of the œsophagus. In the head, two dorsal and two ventral, long-stalked, pyriform **glands** empty their secretion before, or into, the mastax. Similar cells exist in the hind head and neck. **Stomach** elongated, formed of non-ciliated polygonal cells, and with two **gastric glands** in front. **Sexual organs** paired, with a common dorsal evacuator; that of the male opening at the junction of neck and trunk; that of the female, at the posterior extremity of the trunk. **Ovaries** consisting of numerous distinctly separated ova. The **male sexual** apparatus complicated; having various parts, which may be regarded as seminal vesicle, *vas deferens*, and *ductus ejaculatorius*. Two **lateral canals**, furnished with vibratile tags, traverse head, neck, and trunk; and discharge themselves externally, with the sexual organs. There is a dorsal **nervous ganglion** in the head, bearing a dorsal antenna: there are no lateral antennæ. The longitudinal **muscles** are strong, the transverse feeble; none are striated. The **tail** has a number of long-stalked, pyriform, viscous glands, opening at the hind extremity of the foot. At the same point, towards the ventral surface, there is a vesicle opening by a short, projecting canal, the signification of which is doubtful.

The animals are ectoparasites on *Nebaliæ* of the Mediterranean and North Sea; especially on their branchial laminæ. Ephippial eggs do not occur.

Genus SEISON, *Grube* (172).

With an **intestine** discharging itself with the excretory organ; so that the anal aperture is situated differently in the two sexes. **Corona** two tufts of cilia placed on the anterior extremity. In the posterior half of the head 5–6 flask-shaped cells; the efferent duct of which passes into the fore part of the neck. **Sexual organs** of the female placed ventrally to the stomach. The **lateral canals** do not fork in the trunk. The *ductus ejaculatorius* of the male possesses well-developed muscles in its walls, and performs undulatory movements. On the right side it forms a lobiform diverticulum; and opposite to this, on the left side, a multipartite glandular body. No spermatophores. The foot terminates posteriorly in an adhesive disc. The whole ventral surface of the trunk is covered with a great number of transverse muscular fibres, and thereby acquires a striated appearance. In the Adriatic near Trieste.

SEISON GRUBEI, *Claus* (17), (Pl. XXX. fig. 4).

SP. CH. **Trunk** *not annulated;* **neck** *formed of three segments.* See vol. ii. p. 134.

SEISON ANNULATUS, *Claus* (18).

SP. CH. **Trunk** *divided into a large portion, and, following this, four short joints;* **the neck** *shows more than three rings.*

Genus PARASEISON, *Plate* (192).

Both sexes without **intestine.** **Corona** as in *Seison*, or reduced to a few tactile setæ, or entirely wanting. In the hind head only two flask-shaped **glands**, which open into the œsophagus, in the commencement of the neck. **Sexual organs** in male and female placed laterally or dorsally to the stomach; only exceptionally displaced below it. **Each lateral canal** with five vibratile tags, and giving off a thin-walled, cœcally terminating, lateral branch, in the anterior part of the trunk. The *ductus ejaculatorius* of the **male** with smooth walls, with no movements or lateral organs, with numerous flask-shaped spermatophores. The **foot** does not terminate with an adhesive disc, but the hind extremity of the foot has the form of a hemisphere beset with a row of small denticles, between which the viscous glands discharge themselves. In the Bay of Naples.

PARASEISON ASPLANCHNUS, *Plate* (192), (Pl. XXXIII. fig. 22).

SP. CH. *Average size of the adult* **female** $\frac{1}{25}$ *inch. Without true* **corona**, *but with four tufts of tactile setæ, standing round the buccal aperture.*

PARASEISON NUDUS, *Plate* (192).

SP. CH. *Size* $\frac{1}{40}$ *inch.* **Head** *without any trace whatever of a* **corona**; *and also without buccal tactile setæ. It also becomes attenuated in front; so that the buccal aperture comes to be situated at the apex of a small cone.*

PARASEISON PROBOSCIDEUS, *Plate* (192).

SP. CH. *Head without any trace of* **corona**, *without tactile setæ at the mouth, but with a small proboscidiform eversion of the skin, situated above the buccal aperture, which serves as a tactile organ. Rare.*

Length, $\frac{1}{34}$ inch.

PARASEISON CILIATUS, *Plate* (192).

SP. CH. *Assists in the transition to the genus* SEISON, *inasmuch as the* **corona** *is developed as in that genus; and further there are, on the ventral surface, two longitudinal streaks composed of numerous parallel muscular fibres. Not uncommon.*

Length. About $\frac{1}{25}$ inch.

Genus SACCOBDELLA, *Van Beneden and Hesse* (162).

SACCOBDELLA NEBALIÆ, *Van Beneden and Hesse* (162),

The abdomen terminates in two pedunculate sucking discs. Neck composed of five segments of about equal length. **Foot** of four rings. Buccal aperture on the lower surface of the head, not far from the anterior margin. The intestine is said to traverse the whole body in the median line. Colour of the body a very light blue. The ova possess a small stalk, and several of them may be united to form a bush-like group. In the North Sea.

Length. From $\frac{1}{12}$ to $\frac{1}{9}$ inch.

M. A. F. Marion (114) says that *Nebalia Straussii* lives shut up, in July and August, in the voluminous mass of the rudimentary capsules of *Murex brandaris*; and that *Saccobdella* adheres to the foliated branchial feet of the young *Nebaliæ*, when they are in the "poche incubatrice" under their mother's carapace.

Paraseison, according to Dr. L. Plate, attaches itself, by preference, to the branchial laminæ of *Nebalia*, but also creeps about on all other regions of the body. It attaches itself by the adhesive secretion of its foot-glands; and, as there are not unfrequently several ova lying together (in one case there were eleven) in different stages of develop-

ment, it is probable that the adult animal remains for a long time in one place. Sometimes it seeks its nourishment—vegetable detritus and decomposed particles of *Nebalia*'s eggs—by bending its body nearly at a right-angle and feeling about with its head, stretching its swan-like neck in all directions, and every moment retracting it completely into the trunk.[1]

MASTIGOCERCA CORNUTA, *Eyferth* (Pl. XXXIII. fig. 21).

Monocerca cornuta . . . . . Eyferth (46).

SP. CH. **Body** *a long cone, with a long very low dorsal ridge, continuous with the frontal spine; front beset with five projecting* **spines**; **toe** *nearly as long as the lorica; no* **sub-styles.**

There is one **spine** continuing the dorsal ridge or groin beyond the edge of the lorica; this is the longest of the five. Opposite to it, from the ventral edge, project a pair of about half the size; and there is also on each side another short spine, dividing the space between the dorsal and ventral spines. Herr Eyferth adds that the long **toe** is slightly bent downwards, so that the dorsal spine, dorsal ridge, and toe together form a curve: a curve, however, which his figure hardly shows.

Length. Including the toe, $\frac{1}{50}$ inch.

MASTIGOCERCA IERNIS, *Gosse* (171), (Pl. XXXI. fig. 26).

[SP. CH. **Body** *long-oval; a long dorsal* **ridge** *throughout, rising abruptly with an oblique edge in front;* **toe** *not so long as lorica;* **sub-styles** *two, unequal, the chief one about one-third as long as the toe, remote from it at the base.*

This species has much resemblance to *M. scipio*; but the regular form of the lorica and that of its ridge, and the origination of the toe and of the main sub-style, on *opposite* sides of the foot-bulb, so as to be remote from each other, seem sufficient peculiarities to warrant its distinctness.

Several examples have occurred in *Utricularia vulgaris*, sent me by Mr. W. R. Hood from a lough in the heart of Ireland. Most of these were dead, mere empty loricæ, affording excellent opportunities for precise observation and delineation; others were alive and active. I subsequently found it in water from Cannock Chase, sent by Mr. Bolton. The distinctive characters noted above were conspicuous in all: as also in some vigorous examples from Perthshire. In these the extremities of the jaws were occasionally protruded. I detected, moreover, on the front, three tubercles (one central and two lateral), which seemed fleshy, extensile, and retractile.

Length (entire), $\frac{1}{80}$ inch. **Habitat.** Lacustrine. P.H.G.]

MASTIGOCERCA BICRISTATA, *Gosse* (169), (Pl. XXXI. fig. 27).

[SP. CH. *Two equal sub-parallel* **carinæ**, *running nearly the whole length of the dorsum.*

Discovered near Dundee by Mr. Hood, who sent me from time to time many examples. It has a general likeness to *M. carinata*, but is much larger. The double carina confirms the conjecture that the asymmetry of that and other species is due to unequal development.

The **carinæ** are thick at their base, and sharp at their edge, so that the furrow is sharp at the bottom, and has sloping sides.

Length, $\frac{1}{50}$ inch, of which the toe is nearly half. **Habitat.** Dundee (J.H.). P.H.G.]

MONOCERCA VALGA, *Ehrenberg* (42), is probably a male Rotiferon.

[1] The whole of the above account of the *Scisonidæ* has been taken from a translation of the *Mittheilungen aus der Zoologischen Station zu Neapel*, Bd. vii. pp. 234–263, published in the *Annals and Magazine of Natural History*, No. yii. July 1888.

STEPHANOPS CIRRATUS, *Ehrenberg* (42), (Pl. XXXIII. fig. 25).

SP. CH. **Lorica** *armed behind with two spines.*

Ehrenberg merely notices the presence of the mastax, alimentary canal, gastric glands, ovary, contractile vesicle, lateral canals, and two red, frontal eyes.

Müller's very characteristic figure (published 1773) of this Rotiferon is given in outline in Pl. B. fig. 20.

Length, $\frac{1}{240}$ inch. **Habitat.** Near Copenhagen, and Berlin.

STEPHANOPS TRIPUS,[1] *Lord* (112), (Pl. XXXIII. fig. 24).

SP. CH. **Body** *pyriform behind, cylindrical and obliquely truncate in front, with a curved tapering dorsal* **spine** *about the length of the head and trunk;* **foot** *jointless, with two toes, and a short dorsal* **process**; **eyes** *absent.*

Mr. Lord, who discovered this species in 1884, gives (*loc. cit.*) the following account of it. It is obliquely truncate in front; anteriorly cylindrical for about $\frac{1}{3}$ of its length; enlarging thence to about the middle of the body, whence it gradually decreases to the base of the foot: here it is suddenly diminished to a short tapering foot, with two **toes**, and a dorsal **process** springing almost from between them. The toes are about the length of the foot. There are no **eyes**, and the frontal **hood**, seen sidewise, looks like a hook. The **cilia** are in bundles; and a long, tapering **spine** springs from the centre of the dorsal region: the internal organs are difficult to make out: rare.

Length. Not recorded. **Habitat.** A ditch containing *Anacharis* (Lord).

STEPHANOPS LEYDIGII, *Zacharias* (201).

SP. CH. **Body** *spindle-shaped;* **dorsal spine** *exceeding the animal's total length;* **foot** *with two joints, but without dorsal* **process**; **eyes** *two, minute.*

Dr. Zacharias, in his account of *Leydigii*, seems to incline to the opinion that it is identical with *tripus*. There are, however, several points of difference. *Leydigii* has no dorsal process at the end of the foot, above the toes: and its large dorsal spine is as long as the whole animal, while that of *tripus* is not as long as the head and trunk. Moreover *Leydigii* tapers, from the middle of the body, towards both extremities; and is, especially in front, not nearly so bulky an animal. Besides *tripus* is said to have no eyes, while *Leydigii* has two minute red eye-specks: though it is possible, of course, that these may have been overlooked.

Length, $\frac{1}{127}$ inch. **Habitat.** Marsh-water (Zacharias).

STEPHANOPS STYLATUS, *Milne* (186), (Pl. XXXIII. fig. 27).

SP. CH. **Lorica** *flattened; its oval dorsal surface prolonged forward into a spoon-shaped hood, backward to the middle of the foot, and there rounded off without* **spines**; **foot** *long, ending in two long, decurved, and divergent* **toes.**

The **lorica** is transparent, and rather tough than hard. The **corona** is nearly level with the ventral surface. It has a few small cilia round the oral opening, in front of which is a central spoon of uncinate styles. On either side of these a very strong uncinate one is placed, and at their roots a few smaller ones. These styles seem to be ambulatory. From each side of the **head** proceeds backwards and outwards a very long straight style of a soft and flexible character, but not vibratile. Near the bases of these styles are two fairly large green nodules, which can be isolated. The **brain-mass** is occipital. The **mastax** has small trophi somewhat like those of *Notops clavulatus*. The

[1] Mr. Lord did not name this *Stephanops*; so I have given it a specific title from the tripod-like ending of the foot.

contractile vesicle is large, and appears double. When it contracts, its convoluted corded surface seems to go down by the run, in two divisions, right and left of the cloaca. This Rotiferon is very lively, and flits about in the most graceful way, running up the moss in search of food by means of its uncini (Milne, *loc. cit.*).

Length, $\frac{1}{140}$ inch. **Habitat.** Near Glasgow (Milne).

Stephanops ovalis, *Schmarda* (135). See note 1, Supt. p. 8.

Diaschiza acronota, *Gosse* (171), (Pl. XXXI. fig. 29).

[SP. CH. **Lorica** *much elevated, heart-shaped in lateral outline; the* **dorsal cleft** *very manifest;* **head** *globose, prominent;* **foot** *thick;* **toes** *stout, long, nearly straight, tapering;* **eye** *occipital, pale, very large.*

This very remarkable form is another novelty yielded by the mill-stream at Kingskerswell. It seems a very distinct and interesting species; though known, as yet, only by a single dead specimen, in which the eye and the trophi remained in position. The **eye** is a remarkable feature, from its great size, irregular shape, and pale hue. It occupies nearly half the vertical depth of the body, of a very pale salmon-red. In all these points it resembles the organ in *D. pæta*. The **mastax** is small; the **toes** have a backward curve, so slight as to be scarcely perceptible.

Length, $\frac{1}{140}$ inch. **Habitat.** Kingskerswell, lacustrine. P.H.G.]

Diaschiza fretalis, *Gosse* (171), (Pl. XXXI. fig. 28).

[SP. CH. **Lorica** *pyriform in outline, viewed dorsally; gibbous laterally; each plate cut off obliquely behind, and somewhat excavate;* **belly** *nearly flat;* **toes** *long, blade-shaped, regularly decurved, acute;* **head** *furnished with a beak-like projection.*

This form comes very near to *D. rhamphigera*, but the oblique excavation of each of the dorsal lorica-plates is much more distinct, the frontal beak is more slender, nearly evanescent, and does not appear to be a prolongation of the trophi, which, moreover, are somewhat diversely shaped. There is a red **eye** on the inner surface of the brain, which I did not perceive in *D. rhamphigera*; and, above all, it is marine.

Only a single specimen has been observed, and that *dead*; but so recently as to leave the internal organs and viscera well-defined, and *in situ*. It was from a tide-pool at Invergowrie. Both species, if they are distinct, require further study.

Length, $\frac{1}{185}$ inch. **Habitat.** Marine. P.H.G.]

Diaschiza globata, *Gosse* (170), (Pl. XXXI. fig. 30).

[SP. CH. **Body** *sub-pyriform, becoming globose in contraction; front round, girded by a prominent ring;* **lorica** *dorsally cleft by a wide, but shallow furrow, whose edges rise to slight ridges;* **foot** *stout;* **toes** *slender, produced, acute, slightly decurved.*

The shallow dorsal cleft, having a V-shaped section, is well seen, as the creature crawls about the weeds, the edges turned up slightly; while the sides of the lorica end ventrally in straight lines, produced behind into small obtuse points. The integument appears sometimes quite flexible. The bluff rounded **head**, clothed with simple cilia, is surrounded by a prominent ring or collar, not always observable. An occipital **brain** seems destitute of any eye-spot. The toes are delicately attenuated to long points, which, *more generis*, are often thrown back, though the points are decurved.

The little animal is active and restless, moderately swift in swimming, with frequent augmentations of speed, sudden and sustained. It soon dies in a *live-box*; and, in dying, usually contracts itself into a globular form. Sometimes it spins swiftly round and round, in a circle of which the toe-tips are the centre. I have examined some eight or ten specimens, all in water sent by Mr. Hood from his aquarium at Dundee.

Length, $\frac{1}{200}$ inch. **Habitat.** Dundee, lacustrine. P.H.G.]

Diaschiza (?) cupha, *Gosse* (169), (Pl. XXXI. fig. 31).

[SP. CH. *Much compressed;* **dorsum** *squarely gibbous;* **foot** *short, scarcely protruding;* **toes** *long, blade-shaped, slightly recurved, with claws abruptly shouldered.*

This hunchbacked form needs fuller examination. I describe it from a single example, just dead but not decomposed, in water sent from Birmingham. The depth, compared with the width, of the animal is remarkable. The **trophi** are very long, but ill-defined; in the occiput is a short **brain**, carrying a flat, lens-shaped red **eye** on its inner surface. The peculiar shape of the **toes** is shown at fig. 31, *b*. I affix a mark of doubt to the *generic* position, because I could not be *quite* sure of the dorsal cleft.

Length, $\frac{1}{24}$ inch. **Habitat.** Birmingham, lacustrine. P.H.G.]

Diaschiza (?) ramphigera, *Gosse* (169), (Pl. XXXI. fig. 32).

[SP. CH. **Lorica** *elliptical in outline, viewed dorsally; highly gibbous, viewed laterally;* **venter** *flat;* **toes** *stout, long, decurved;* **trophi** *projecting in form of a bird's beak.*

The **front** terminates in an acute hooked beak, which is found to be the extremity of the trophi, and apparently of the incus protruded. The whole **manducatory** apparatus is of unusual dimensions, especially the fulcrum of the incus. (Fig. 32, *b*, represents the trophi seen dorsally; *c*, laterally.) I have not distinctly seen the **dorsal cleft**; but the line which passes along the back, at some distance from the edge, I presume to indicate the bottom of such a cleft; if it is not the base of a high carina. Two examples occurred together in water from one of my window tanks.

Length, $\frac{1}{173}$ inch. **Habitat.** Lacustrine. P.H.G.]

Salpina ventralis, *Ehrenberg* (42), (Pl. XXXIII. fig. 29).

SP. CH. *Occipital spines wanting;* **pectoral** *pair very short;* **lumbar spine** *short, decurved;* **alvine** *pair longer than the lumbar, straight; the* **lorica** *with a stippled collar in front.*

This species closely resembles Mr. Gosse's *macracantha*; but differs from it in having a rather decurved **lumbar** spine instead of a straight one; in its **alvine** spines being proportionally longer; and in having a stippled collar on its lorica surface, which *macracantha* lacks. It is (according to Ehr.) considerably smaller.

Length (of lorica), $\frac{1}{120}$ inch. **Habitat.** Near Berlin.

Salpina bicarinata, *Ehrenberg* (42), (Pl. XXXIII. fig. 30).

SP. CH. **Lorica** *smooth, four* **processes** *in front, three small ones behind,* **alvine** *pair the smaller.*

Very like *mucronata*, only all the **spines** are shorter; and the gaps between the **pectoral** and **alvine** are different. The gap between the pectoral pair is nearly straight with a slight central incision, while the corresponding gap in *mucronata* is very deep.

Length, $\frac{1}{216}$ inch. **Habitat.** Near Berlin.

Salpina polyodonta, *Schmarda* (135), (Pl. XXXIII. fig. 28).

SP. CH. **Body** *sub-triquetrous;* **pectoral spines** *two-pointed; the middle* **hind spine** *blunter than the* **alvine.** *Two rows of* **teeth** *in each uncus.*

This *Salpina* has a lorica differing from that of *brevispina* only in the **pectoral spines.** As will be seen from the figure, each pectoral projection is double-cornered, unlike any other *Salpina*. Schmarda credits the animal with two rows of teeth in each uncus; I think that this must be an error.

Length. About $\frac{1}{100}$ inch. **Habitat.** St. Jago, Chili.

SALPINA MARINA, *Gosse* (169), (Pl. XXXI. fig. 33).

[SP. CH. **Occipital** *spines two, procurved;* **pectoral** *two, short;* **lumbar** *spine short, deep;* **alvines** *stout, separated from the lumbar by an angular sulcus.*

This large species was taken in a tide-pool in the Firth of Tay; the first *Salpina* found in the sea. Its anterior armature is that of *S. mucronata*, but the posterior is peculiar, in that the alvines are stout, nearly straight spines, and that the sinus which divides each from the lumbar point is not rounded, but makes two sides of a rhomboid, with definite angles. The specimen was dead when I found it.

Length (of lorica from points to points), $\frac{1}{136}$ inch. **Habitat.** Marine. P.H.G.]

SALPINA REDUNCA, *Ehrenberg* (42). This is, I think, *S. brevispina*. The only difference is, that its lorica is said to be smooth in front instead of being stippled.

SALPINA AFFINIS, *Herrick* (175). Very like *mucronata*, but with longer occipital and alvine spines.

EUCHLANIS CONICA, *Schmarda* (135), (Pl. XXXIII. fig. 34).

SP. CH. **Lorica** *conical; dorsal occipital edge concave, semi-elliptical; hind dorsal edge with a semicircular notch; three* **teeth** *in each malleus.*

This curious *Euchlanis* adds to the attraction of its unusual shape, **trophi** tinted brown, and a reddish-brown **ovary.** It has a transversely oval red **eye,** and two long **toes**; but no setæ on its **foot.** Schmarda says nothing about the ventral plate, but the figure seems to show a portion of its margin well within that of the dorsal one: neither does he say if the dorsal plate is arched or depressed.

Length (to end of foot), $\frac{1}{83}$ inch. **Habitat.** Fresh-water, near San Juan del Norte, Central America (Schm.).

EUCHLANIS OROPHA, *Gosse* (169), (Pl. XXXI. fig. 34).

[SP. CH. **Lorica** *roof-shaped with sloping sides, but not rising to a ridge, yet cleft for a short distance behind, between two descending extremities.* **Ventral plate** *flat, thin, much smaller in its whole outline than the dorsal;* **foot** *with a single seta or none;* **toes** *thin, blade-shaped.*

This is a noble species, and not uncommon. The posterior fourth of the ovate lorica seems as if pinched-in, and the dorsal edge *of this portion* becomes a low double carina. In fig. *b*, the inner outline is that of this portion, the outer outline represents a transverse section through the highest point in figure 34 *a*.

Length, $\frac{1}{75}$ *inch.* **Habitat.** Lacustrine. P.H.G.]

EUCHLANIS PANNONICA, *Bartsch* (8), (Pl. XXXIII. 33).

SP. CH. **Lorica** *ovately oblong, large;* **foot** *long, without setæ;* **toes** *very short.*

Dr. Bartsch has unfortunately given the rest of his description of this species in Hungarian; but his figure shows a very deep **gap** at the posterior end of the dorsal plate. This character, along with the large **foot** and very short **toes,** entitle *pannonica* to be considered a distinct species.

Length, $\frac{1}{100}$ *inch.* **Habitat.** Hungary (Bartsch).

E. HYALINA, *Leydig* (110). This name has been given by Leydig to a variety of *E. triquetra*, conspicuous for its general lack of colour, its less lofty dorsal ridge, and the notching of the hinder end of the nervous ganglion. The first of these distinctions is probably a temporary one, and the last is to be seen occasionally in other species; I have met with it, for instance, in *pyriformis*. The second, however, makes me think that Leydig's *hyalina* may possibly be the variety of *triquetra* that I have drawn in Pl. XXIII. fig. 4; for, since the publication of vols. i. and ii., Mr. C. Rousselet has sent me some

specimens of a fine *Euchlanis* most closely resembling Ehrenberg's drawings of *triquetra*, and differing from mine in having its ventral plate perfectly flat, and apparently attached closely to the dorsal plate. Certainly it had no flanges bent down like those given in fig. 4 *c*, and its dorsal ridge was decidedly higher.

E. Weissei, *Eichwald* (167), (Pl. XXXIII. fig. 35). Eichwald describes the **lorica** as longer than that of *dilatata*, narrower in front and broader behind. His figure, which I have copied, makes the lorica a narrow truncated oval, the anterior end of which is bounded by a shallow circular arc, and the posterior end hollowed into a deep sinus. The foot has four joints, and very long tapering toes; the **eye** is dark red and nearly triangular. Both description and figure are very imperfect.

Habitat. Ditches at Reval.

E. (?) lynceus, *Ehrenberg* (42), (Pl. XXXIII. fig. 32). SP. CH. "**Lorica** *oval, swollen, enwrapping the body, deeply furrowed, with two anterior spines.*" Ehrenberg says that *lynceus*, though very like the crustacean after which he has named it, is an unmistakable Rotiferon: having (apparently) single-toothed **jaws**, short œsophagus, a thick and almost circular **stomach**, with two **gastric glands**, an obvious **antenna** lying between the spines, a red cervical **eye**, and a long forked **foot**. He further notices that there is, at the anterior end of the dorsal surface, a detached portion of the lorica, which is flattish and triangular, and which bears the two spines on its front edge. Ehrenberg says that the lorica is cleft down the whole length of its ventral surface; and his figure shows a wide gap between its edges.

If the lorica has been rightly described and figured, it would be difficult to say where this creature should be placed; but as Ehrenberg has made mistakes on this very point in the *Euchlanidæ*, it will be as well to leave the name unaltered till the animal has been met with again, and thoroughly studied. It is very unlikely to prove to be a *Euchlanis*.

Length, $\frac{1}{2\,1\,6}$ *inch.* **Habitat.** Near Berlin.

E. (?) bicarinata, *Perty* (124), (Pl. XXXIII. fig. 31). The **lorica** of this Rotiferon, according to Perty, covers only the back and sides of the body, and is absent from a central strip of the ventral surface.[1] It is moderately broad in the middle, diminishing towards either end, truncate and spineless in front, and with its hinder portion like that of a *Salpina*, whose alvine processes had been rounded off. Down the back run two long parallel ridges, which, in Perty's dorsal and side views, are precisely those of a *Salpina*. The **foot** is remarkable for the great length of its middle joint, and the shortness of the last joint and toes. The drawing of the **corona** is incomprehensible, and that of the internal structure little better. Under these circumstances it is impossible to decide to what genus the animal really belongs.

Length (total), $\frac{1}{7\,2}$ inch. **Habitat.** Near Bern.

E. cornuta, *Dujardin* (40)=*Monostyla cornuta* (vol. ii. p. 98).

E. ovalis, *Dujardin* (40)=*E. macrura* (vol. ii. p. 91).

E. hipposideros, *Gosse* (54). Cancelled by Mr. Gosse.

E. emarginata, *Eichwald* (167)= *Cathypna luna* (vol. ii. p. 94).

E. brachydactyla and E. tetraodon, *Schmarda* (134, 135). See note 1, Sup^{t}, p. 8.

E. ampuliformis, *Herrick* (175). Somewhat flask-shaped; **dorsal plate** carinate; **ventral plate** with a cordate posterior opening. **Foot** four-jointed; **toes** half the length of the lorica. Figure and description imperfect.

Apodoides stygius, *Joseph* (96). Dr. G. Joseph discovered this Rotiferon, for which he has formed a new genus, in the stalactite caves of Krainer.

[1] See note, vol. ii. p. 89.

It much resembles a *Euchlanis*; the **lorica** is in two plates, the dorsal, arched and expanded at the sides, which are bent sharply back underneath. The ventral plate is flat, and fills up the gap between the bent-back edges of the dorsal plate. In front, and behind, the lorica is cut away by a half-moon-shaped scollop, and is prolonged at the extremities of each semicircular edge into spines, of which the posterior pair is the longer. The **foot** is four-jointed, and bifurcate. There are no **eyes**; but, on the spots where they should be, are two small hollow protuberances, from which rise two long movable antennæ, with bristle-like ends, stretching forward beyond the corona. Two smaller bristles spring from the spot which in *Euchlanis* bears a spur-like antenna. Dr. Joseph is of opinion that the young **male** and female are precisely alike in structure; but that the male gradually loses the whole of the digestive tract, as it approaches maturity. His account leaves it doubtful whether he is describing a succession of changes that he has watched in the same individual, or whether he is detailing inferences that he has drawn from various individuals observed at different times. Dr. Joseph gives no figure of the animal.

Length, $\frac{1}{50}$ inch.

Genus DAPIDIA, *Gosse* (170).

GEN. CH. *A genus of the* Euchlanidæ, *whose* **ventral plate** *is wanting; the turned-in lateral edges of the* **dorsal plate** *being united only by a flexible and expansible skin.*

DAPIDIA STROMA, *Gosse* (170), (Pl. XXXI., fig. 35).

[SP. CH. *Outline ovate,* **dorsum** *high, rounded;* **lorica** *much exceeding the viscera in width, and turned in beneath with straight margins;* **viscera** *protected exclusively by membrane.*

Dr. Hudson (vol. ii. p. 93) has alluded to my opinion that certain species of *Euchlanis* are generically separable by the character of wanting a ventral plate; the lateral edges of the lorica, which turn in beneath, being united only by flexible and expansible skin. My esteemed colleague differs from me; and, on a matter so exceedingly delicate and difficult to determine, I may be in the wrong. But I am not convinced; and I hope it is not inconsistent with modesty or friendship to record my own judgment.[1] The *species*, I think, is undescribed, whatever its generic place.

The lorica is shaped (if I may use so homely a comparison) like a boat turned bottom up, her bows cut off sharp, her gunwale curved-in, and no keel. Suppose the cavity of the boat to be loaded, *half-way up*, with goods [the viscera], and a tarpaulin [the common skin] to be spread over all, but higher in the middle than at the sides; the head-mass, of living fleshy organs, to be thrust out at the truncate and open bow, filling it; and the foot and toes to represent the rudder;—a fair idea will be conceived of this fine form. There are no foot-setæ.

It may easily be supposed to possess a ventral plate. But what looks like one, on a (nearly) lateral view, is the edge of the farther incurved side of the lorica; when viewed *from behind*, there is no lateral infold or sinus running longitudinally. I have seen numerous examples.

Length, $\frac{1}{65}$ inch. **Habitat.** Lacustrine. P.H.G.]

CATHYPNA DIOMIS, *Gosse* (170), (Pl. XXXI. fig. 38).

[SP. CH. *Generally like* C. luna, *but* **lorica** *much elevated behind, and ending there abruptly; followed by a wide hemispheric joint;* **toes** *slightly blade-shaped;* **claw** *two-shouldered, short, recurved.*

A rather remarkable little form. The **lorica**, broadly ovate, is unusually arched, and abruptly truncate just behind its greatest elevation; whence another wide rounded plate

[1] It was with reference to *Euchlanis deflexa* that I differed from Mr. Gosse; I have not seen *Dapidia stroma.*

descends, as if to make the lorica two-jointed. The **foot** narrow, but a little widened at its end, just protrudes from under this plate, and bears the toes, jointed to it with small round condyles. They are almost rod-shaped, but there is a hardly perceptible curvature of their lateral margins. But the most noteworthy feature is that *both* the lateral margins of each toe are abruptly shouldered; and the little claw-like remainder has the acute tip recurved. The **mallei** are long, strongly elbowed, and unusually slender. An **eye**, of moderate size, richly coloured, lies far down in the occiput. The dorsal plate is coarsely tesselated, as in *C. rusticula*. Several specimens have occurred in water sent to me by Mr. Hood, from Black Loch, near Dundee.

Length (of lorica), $\frac{1}{260}$ inch; (total) $\frac{1}{150}$ inch. **Habitat.** Lacustrine. P.H.G.]

Cathypna latifrons, *Gosse* (170), (Pl. XXXI. fig. 37).

[SP. CH. **Lorica** *broadly ovate, the frontal edges little diminished, both straight; the occipital much wider than the pectoral;* **toes** *broadly blade-shaped, much produced, not shouldered.*

Another of the rarities of the prolific Black Loch. The outline is that of *C. rusticula*, if we suppose the anterior fourth of the lorica to be cut off transversely. But the ventral plate is less in area, *all round*, than the dorsal, especially forward, narrowing more rapidly, and terminating lower down. There is a considerable rounded boss behind, as in both the preceding, below (or within) which are the foot-joints, but not protruded. The **toes** have the inner edge straight, and the outer *much* outcurved; so that, when they are held in contact (as they usually are), the pair present an outline widely fusiform. Then the points are drawn out to great length and tenuity, with an effect very peculiar. The front of the lorica forms two stiff lateral points; within which the margins, both occipital and pectoral, seem to be thinned-off to very delicate membranes, so as to be capable of extension and retraction. When closed, the occipital edge is, I think, straight from point to point, and concave inward. Then the pectoral edge is appressed to the concave dorsal surface (*but at a lower*, i.e. *a hinder, level*); and that so close as to be indistinguishable from it, even by most careful focusing with high powers. The internal organs seem normal.

Length (of lorica), $\frac{1}{260}$ inch. **Habitat.** Lacustrine.

Cathypna ungulata, *Gosse* (170), (Pl. XXXI. fig. 36).

[SP. CH. *Generally like* C. luna, *but occipital edge of lorica nearly straight; pectoral edge indented in the middle;* **toe** *rod-shaped, straight, very slender;* **claw** *one-shouldered, one-third of toe's length.*

This is more than twice as large as *C. luna*. Moreover, the frontal edges of the lorica are nearly *straight*, between very slight lateral points, and *alike*, save that the line of the pectoral edge (fig. 36, *b*) descends from each point to a medial angle, just perceptible. Then, the hind extremity of the dorsal plate allows the partial emission of a great protuberant shelly boss, as in *Monostyla bulla*, behind and beneath which is the globose foot-bulb. Again, the rod-like **toes** are even straighter and slenderer than in *luna*, and the claws are much longer in proportion. Parallel-edged to two-thirds of their length, a right-angled shoulder, on the outer side, reduces the width by one-half; and the remainder (the claw) tapers to a long-drawn acute point (*d*). When rotating, the truncate front is three-lobed, much as in *luna*; but there is seen beyond and above this a very subtile clear glassy **hood**, having a rondo-conic outline, protrusile and retractile.

Length (total), $\frac{1}{85}$ inch. **Habitat.** Woolston pond. P.H.G.]

Distyla Hornemanni, *Ehrenberg* (Pl. XXXIII. fig. 37).

Euchlanis Hornemanni . . . . . Ehrenberg (42).

SP. CH. **Lorica** *smooth, short, semi-orbicular, broadly truncated in front, and without lateral points; the former part of the body soft, flexible, and much elongated;*

capable of being retracted within the lorica; **brain** *long, and cylindrical;* **foot** *very short;* **toes** *straight, ending in small, sharp, unshouldered claws.*

The above characteristics, which I have taken from Ehrenberg's figure and description, remove this animal from the genus *Euchlanis* to that of *Distyla*. Ehrenberg says that, when fully extended, it looks like a *Notommata*. The **mastax** is oval; the œsophagus very short; the **stomach** simple; the **gastric glands** spherical; the **brain** long and cylindrical, with a red **eye** on its hinder end.

Length, $\frac{1}{432}$ to $\frac{1}{240}$ inch. **Habitat.** Near Copenhagen (Ehr.).

DISTYLA LUDWIGII, *Eckstein* (41), (Pl. XXXIII. fig. 36).

SP. CH. **Lorica** *ovate, drawn out into a point behind, and slightly hollowed out in front, between two sharp points; dorsal plate somewhat swollen, tesselated, scabrous; ventral plate flat;* **toes** *long, scythe-shaped, wide apart at the base;* **claws** *not shouldered, short;* **brain** *tri-lobed.*

The fore part of the body is soft and flexible, and of the shape of a truncate cone. The **corona** is feebly developed. The **brain** has one long central lobe, bearing at its hinder end a red **eye** just above the mastax; and two shorter club-shaped lobes, each carrying, on the inner side of its hinder end, a clear cell, coloured red on the inner border. The small upper ends of these two lobes terminate on the corona, in two minute red points.[1]

Four **vibratile tags** are seen on each side (with the lateral canals), in a rather advanced position. The rest of the organisation is normal.

The creature has a habit of constantly twitching its œsophagus from side to side. It generally carries its toes wide apart, but sometimes draws them together and bends them up to the ventral surface.

Length, $\frac{1}{100}$ inch. **Habitat.** Near Giessen (Eckstein).

DISTYLA STRIATA, *Gosse* (169), (Pl. XXXI. fig. 40).

[SP. CH. **Lorica** *as in* D. Gissensis, *but covered with longitudinal sulci; the front margin projecting in two lateral points (which, however, are lost in the protrusion of the head, by the evolution of flexible membrane);* **toes** *slender, straight, more than half as long as lorica, pointed, not shouldered.*

The lateral infold is narrow and nearly closed. The dorsal sulci are about eight in number, slender and superficial: **foot** a long large bulb, not divisible into joints; **toes** long, nearly straight, rods. The dorsal surface is corrugated, besides the sulci; there is a minute **eye**, difficult of detection. Two examples occurred in water sent me by Dr. F. Collins from the pool at Sandhurst Military College.

Length, $\frac{1}{130}$ inch. **Habitat.** Lacustrine. P.H.G.]

DISTYLA LIPARA, *Gosse* (171), (Pl. XXXI. fig. 39).

[SP. CH. **Lorica** *skin-like, flexible, plicate: body flask-shaped, soft and very plump, not pointed behind:* **toes** *large, blade-shaped, not shouldered:* **brain** *simple;* **eye** *minute, occipital.*

This differs, at sight, from its known congeners by its round, manifestly soft, body, properly egg-shaped, specially in its hind parts, scarcely at all flattened, and destitute of the usual inangulation; the edges of the dorsal and ventral plates approaching close in the middle, and diverging at both extremities, so that the rounded surface is scarcely broken. The soft integument is constantly thrown into deep irregular plicæ, which do not appear to be permanent. A great **foot** bears, on a condyliform joint, two toes which are widely blade-shaped, longer than the mastax, acute, but not in the least shouldered

[1] See note, vol. ii. p. 37. Both Mr. Gosse and myself have failed to see many of Herr Eckstein's red spots.

at the tips. They are habitually thrown up under the belly. The **eye** is minute, pale-red, occipital. The **trophi** are normal, long, and capable of being brought to the very front, where they work vigorously. The whole head is protrusile, and very mobile.

The entire animal is transparent and nearly colourless; but the numerous folds and corrugations impart an appearance of a blue-black tinge to the body. The form and outline are subject to slight but continual changes, contracting and expanding. The animal is lithe and active, but not locomotive. A single specimen has occurred in water from Sutton Park ditch, Birmingham, in the orange-coloured sediment which abounds with fine Desmidieæ.

Length (of lorica), $\frac{1}{260}$ inch; (total) $\frac{1}{162}$ inch. **Habitat.** Sutton Park. P.H.G.]

D. MINNESOTENSIS; D. OHIOENSIS, *Herrick* (175). Insufficiently described. The latter is said to have a quadrate plate projecting over the base of the **foot.**

MONOSTYLA MOLLIS, *Gosse* (170), (Pl. XXXI. fig. 41).

[SP. CH. **Body** *oblong, sub-cylindric, clothed with a soft, flexible, corrugated skin, instead of a lorica;* **toe** *rod-shaped, short, thick;* **claw** *obscurely two-shouldered.*

I venture to claim specific rank for this form, which has the same relation to *Monostyla* as *D. flexilis* has to *Distyla* and *Cathypna.* That both are immature conditions would be a natural conclusion, but that, so far as my experience goes, all Loricate Rotifera are hatched with the lorica already developed. And that such is the case with *Monostyla* in particular, the following note will show. The facts, apart from their relation to this question, may be of interest.

In August 1885, an egg of *M. cornuta*, in my live-box, displayed the young moving vigorously within the hyaline egg-shell, slowly revolving. The lorica was already well-defined, evidently without folds, though expansile in retraction, distinctly broad oval in outline, smooth and rotund when viewed lengthwise. The imprisoned animal grew much larger, so that it almost filled the long diameter of the shell, but not nearly its short diameter. Its length was now $\frac{1}{400}$ inch.

After I had watched for about an hour, during which its restless motions had nearly ceased, the frontal cilia were seen vibrating at the very edge, and in a moment more *outside* the edge, of the shell. For an instant it recoiled; but returned again and again to the effort, at each time protruding more and more. At length it pushed fully half out, then hung a moment, as if exhausted. Now another vigorous lashing of the cilia, and out it is bodily, yet still adhering to the shell by the glutinous toe-point, whereby it now drags the shell hither and thither. At last it is quite free, evidently ovate, stiff and smooth, as the normal adult.

These facts, which were recorded during the actual process, seem sufficient to show that, in this Family at least, the chitinous consolidation of the lorica is attained before birth. And the corollary follows, that, in *D. flexilis* and *M. mollis* we have examples of illoricate condition in a loricate family, analogous to *Mastigocerca stylata* in the *Rattulidæ.*

I have examined many specimens from various waters. In one case the animal contracted to a cordiform outline, as if possessing a lorica, which yet was very membranous. When eagerly chewing, not only the **mallei** worked, but a pair of additional horn-like pieces, well in front of the mastax. A very small and indistinct red **eye** is near the occipital extremity of the brain.

Length, $\frac{1}{250}$ to $\frac{1}{200}$ inch. **Habitat.** Lacustrine. P.H.G.]

MONOSTYLA CLOSTEROCERCA, *Schmarda* (135), (Pl. XXXIV. fig. 7).

SP. CH. **Lorica** *depressed, obtusely toothed in front;* **eye** *very small and round;* **jaws** *triangular;* **foot** *spindle-shaped.*

The **lorica** is oval with its anterior portion excised so as to give it a shallow circular

margin. The spindle-shaped **foot** ends in a tapering, finely pointed, claw, and is the really characteristic point in the animal's shape. Its "triangular" teeth are, I fear, due to imperfect observation. No further details are given.

Length, $\frac{1}{250}$ inch. **Habitat.** Freshwater, Quito (Schmarda).

M. MACROGNATHA and M. OÖPHTHALMA, *Schmarda* (135). See note 1, Sup^t, p. 8.

COLURUS DUMNONIUS, *Gosse* (169), (Pl. XXXI. fig. 44).

[SP. CH. **Lorica** *in dorsal aspect a very broad oval, produced behind into two rather short points, separated by a wide but shallow sinus; the ventral line deepens in the middle; the ventral cleft extends around the front to the occiput;* **foot** *robust, with two moderately stout, separable toes.*

Three examples I have seen at different times among fine conferva, much studded with *Licmophoreæ*, from tide-pools at Paignton, near Torquay. One of these had the sides much more parallel than the other. A large pale red **eye** is conspicuous. All had the habit of pivoting on the toe-tips, jerking and posturing.

Length, $\frac{1}{260}$ inch. **Habitat.** Marine; Paignton. P.H.G.]

COLURUS DICENTRUS, *Gosse* (169), (Pl. XXXI. fig. 42).

[SP. CH. **Lorica** *ovato-fusiform; body ending behind in a minute tail of two hooks adnate at their base;* **foot** *stout;* **toes** *long, very slender, more or less decurved throughout.*

I have examined nearly a score of individuals, and am satisfied that this is a true species, in which the peculiar termination of the body (shown enlarged in fig. *b*) is constant, thus differing from *C. amblytelus* and *C. grallator*. The **tail-points** resemble rose-prickles. The appressed **toes** seem a single slender spine, but are often thrown apart. Two red **eyes** are distinct. It is not rare in the Tay tide-pools.

Length, $\frac{1}{185}$ inch. **Habitat.** Tay tide-pools. P.H.G.]

COLURUS GRALLATOR, *Gosse* (169), (Pl. XXXI. fig. 43).

[SP. CH. **Lorica** *much compressed; lateral outline ovate, sub-square behind, without points;* **toes** *half as long as lorica, very slender, straight, readily separated; ventral cleft slightly narrowed in the middle.*

Nearly related to the preceding; but the outline, viewed dorsally, is longer and narrower; there is no protrusion of the body behind the lorica; and the **toes** are quite straight. The frontal **hook** is unusually narrow. I have not been sure of an eye. A dozen examples have occurred from the Tay tide-pools.

Length, $\frac{1}{250}$ inch. **Habitat.** Tay tide-pools. P.H.G.]

COLURUS MICROMELA, *Gosse* (Pl. XXXI. fig. 45).

Monura micromela . . . . . Gosse (169).

[SP. CH. **Lorica** *in dorsal aspect broadly ovate, produced behind into slightly projecting points, separated by a shallow rounded sinus; in lateral aspect the quadrant of an oval; foot small;* **toes** *of uniform excessive tenuity.*

I have had, for thirty-six years, drawings of a species which I had marked (with "?") as *Monura dulcis*. Very recently, in water from Slough, what seems the same form, now figured, has occurred, and that repeatedly. The excessive tenuity of the toes[1] is the most striking feature; and then the round sinus between the lorica-points. No eye is visible. The general figure is that of *Col. bicuspidatus*.

Length, $\frac{1}{250}$ inch. **Habitat.** Lacustrine. P.H.G.]

[1] In page 367 of the *Journ. Roy. Micr. Soc.*, 1887, Mr. Gosse says "I have seen the toes widely expanded. The species must therefore be transferred to *Colurus*."

COLURUS LEPTUS, *Gosse* (170), (Pl. XXXI. fig. 46).

[SP. CH. **Lorica**, *in dorsal aspect, long oval; in lateral aspect, abruptly excavate behind; dorsal hind points, acute; ventral cleft close, insensibly expanding to a long pyriform foot-orifice;* **toe** *a slender style, apparently undivided;* **foot** *and toe about half as long as lorica; one large* **eye** *in occiput.*

A marked character, very easily recognisable, is the hind excavation of the **lorica**, as if a slice had been cut clean out. Examples with this peculiarity are quite common, both from weedy fresh waters, and from rock-pools on our northern and southern coasts. And I can trace no difference between them, save that the marine examples may be a trifle stouter in outline. The **toe** is a slender produced point, I will not say indivisible, but not, in my experience, divided. Several oil-globules are usually present in the dorsal part of the visceral cavity.

Length. Extended, $\frac{1}{300}$ inch. **Habitat.** Lacustrine and marine. P.H.G.]

METOPIDIA PYGMÆA, *Gosse* (171), (Pl. XXXI. fig. 47).

[SP. CH. **Lorica** *ovate, much elevated, the back rounded, the edges overhanging; hind margin rounded; ventral surface flat;* **foot** *stout, long*; **toe** *apparently single, small, acute.*

This seems the smallest of the genus; smaller than *emarginata*, or than *triptera*, which latter was in sight at the same time, for comparison. It is very transparent and colourless, the viscera only just discernible; the **trophi**, though working, were but shadowy lines. The extremity of the lorica is neither pointed, nor sinuate, but evenly round: its overhanging margins are remarkable, recalling *Notholca scapha*. There are two clear colourless globules at the very front, remote from each other, probably eyes. The frontal **hook** is carried rather close to the front, and seems incapable of independent motion; it is visible in a dorsal view, as a line parallel to the front. Two minute air-bubbles were in the alimentary canal of the individual examined; but no particles, nor stain, of food, though the tiny creature was industriously picking all the time it was under observation—an hour or more. It was active and restless, creeping about the floccose, but rarely swimming, and then laboriously. A single specimen occurred in a phial of *Utricularia* sent by Mr. W. R. Hood, from the middle of Ireland.

Length. Extended, $\frac{1}{350}$ inch. P.H.G.]

METOPIDIA OVALIS, *Ehrenberg*, (Pl. XXXIV. fig. 2).

Lepadella ovalis[1] . . . . . Ehrenberg (42).

SP. CH. **Lorica** *depressed, oval, narrowed in front; dorsal plate truncated at both ends, its margin not excised.*

Ehrenberg draws the ventral plate with a deep, square excision in front, and a small arched one behind. He notices that the **unci** are one-toothed; the **gastric glands** circular; the **œsophagus** short, and the **eyes** absent.

Length, $\frac{1}{210}$ inch. **Habitat.** Paris, Copenhagen, Berlin (Ehr.).

METOPIDIA EMARGINATA, *Ehrenberg* (Pl. XXXIV. fig. 6).

Lepadella emarginata . . . . Ehrenberg (42).

SP. CH. **Lorica** *depressed, oval, broad in front; dorsal plate excised at both ends.*

Length (without the foot), $\frac{1}{48}$ inch. **Habitat.** Berlin (Ehr.).

METOPIDIA (?) SALPINA *Ehrenberg* (Pl. XXXIV. fig. 4).

Lepadella (?) *salpina* . . . . . Ehrenberg (42).

SP. CH. **Lorica** *oblong, prismatic, obtusely triangular with a dorsal crest.*

This should possibly be referred to Mr. Gosse's genus *Diplax*. The **lorica** is ren-

[1] The reasons for uniting the genera *Lepadella*, *Squamella*, and *Metopidia* have been given in vol. ii. p. 106.

dered uneven by fine depressions; and the posterior end of the crest projects somewhat beyond the base of the foot.

Length (of lorica), $\frac{1}{216}$ inch. **Habitat.** Berlin (Ehr.).

METOPIDIA CORNUTA, *Schmarda* (Pl. XXXIV. fig. 3).

Lepadella cornuta . . . . . Schmarda (135).

SP. CH. **Lorica** *oval; its anterior margin with two great spines.*

Body yellowish grey. A deep gap separates the two curved frontal horns. The **unci** are one-toothed. Schmarda says that there are two **contractile vesicles** at the foot; and he draws two small vesicles in that position. Unfortunately he does not say whether he has seen them contract or not; nor whether they did so independently of each other. The only similar case of such a construction, that I am acquainted with, is that of *Conochilus volvox* (according to Cohn, vol. i. p. 90, foot note).

Length (total), $\frac{1}{100}$ inch. **Habitat.** Brackish water, New Orleans (Schm.).

METOPIDIA OBLONGA, *Ehrenberg* (Pl. XXXIV. 5).

Squamella oblonga . . . . . Ehrenberg (42).

SP. CH. **Lorica** *elliptical, or ovately oblong, hyaline;* **toes** *long, slender;* **eyes** *four.*

There are two or three teeth in each **uncus**; the **gastric glands** are pear-shaped; and there are four frontal **eyes** arranged in the angles of a parallelogram. Ehrenberg has seen a **contractile vesicle**, and lateral canals.

Length (total), $\frac{1}{216}$ inch. **Habitat.** Berlin (Ehr.).

HEXASTEMMA MELANOGLENA, LEPADELLA MUCRONATA, L. SETIFERA, SQUAMELLA QUADRIDENTATA, *Schmarda* (135). These possibly may be *Metopidiæ*, but see note 1, Sup^{t}, p. 8.

MONURA DULCIS, *Ehrenberg* (42), (Pl. XXXIV. fig. 9).

SP. CH. **Lorica** *ovate, obliquely truncate behind, acute;* **eyes** *distant.*

The dorsal outline (a long narrow oval, truncate at both ends), the pointed termination of the lorica (seen at the side view), and the wide separation of the eyes, sufficiently distinguish this species; which, Ehrenberg thought, might be marine as well as lacustrine.

Length, $\frac{1}{285}$ inch. **Habitat.** Near Berlin; possibly Cattaro (Ehr.).

Genus DISPINTHERA, *Gosse* (171).

GEN. CH. **Body** *sub-cylindric, inclosed, in part, within a* **lorica** *open in front and in rear, apparently cleft down the venter; head and foot habitually protruded;* **head** *distinct, protected by horny plates, but without a frontal* **hook**; *two cervical* **eyes.**

DISPINTHERA CAPSA, *Gosse* (171), (Pl. XXXI. fig. 48).

[SP. CH. **Lorica** *in most parts soft and flexible;* **foot** *stout;* **toes** *two, furcate, thick, straight, tapering, acute.*

This apparently new form I found in the sediment of water dipped by Mr. Bolton from "ditch No. 2," in Sutton Park, Birmingham, crowded with fine Desmidieæ. The facies strikes one as very peculiar, and difficult to explain. The **front** is capable of much protrusion, in a conical form, where a globose tubercle is visible, but only occasionally, and a similar one, but more constant, on the occiput (or rather crown of the head), just below the point of the occipital sheath. The **lorica** is discernible chiefly about the head; it there projects into several points, which seem very flexible, but constant. When the head is far retracted (which is seldom), an array of spears is left bristling up. Now and then, at the pectus, the integument is seen to fall into a flap, or

hanging lip, to be presently withdrawn. The principal **shield** protects the back of the head, but does not form an arching hood, or frontal hook. The **trophi**, in several good views, seemed of the pattern (fig. 39 of my Mem. "On Manduc. Org.," *Phil. Trans.* 1856) assigned to *Notomm. gibba*. The whole facies recalls one of the smaller *Notommatæ;* yet the two well-defined eyes remove it from them; besides the manifest lorica. It seems to approach the marine genus *Mytilia*, but not very close.

Only a single specimen occurred, in June. It was active and busy, constantly turning and wheeling about, but little given to locomotion. It suggests the odd notion of a creature carrying its great clumsy head in a bandbox.

Length, $\frac{1}{250}$ inch. **Habitat.** Lacustrine. P.H.G.]

Monura bartonia, *Gosse* (171), (Pl. XXXI. fig. 49).

[SP. CH. **Lorica** *ovate, moderately compressed, dorsal outline (viewed laterally) one-third of a circle, ending in triangular points, which have the dorsal side slightly excavate; one* **eye** *frontal;* **toe** *straight, slender, acute, more than half as long as the lorica, shouldered dorsally.*

The genera *Colurus* and *Monura* (if, indeed, they are not one) appear to contain a large number of species, peculiarly difficult to define satisfactorily. Yet this and the following are, I think, to be distinguished. The **toe** and **foot** together are nearly equal in length to the lorica. I could find no trace of a median line in the toe. Its extreme length and tenuity are notable. Each posterior point of the lorica forms an equilateral triangle, clearly defined from the general area of the lorica, by a line—the base of the triangle. These two triangular termini are of excessive delicacy, and may easily escape a cursory notice. On the extreme front, under the frontal hook, is a small dark crimson **eye**, like a wart on the face.

Its manners are those of so many of its fellows, remaining long totally withdrawn between the closed lorica-plates in front, pivoting and swaying on the toe-tip incessantly for hours. I first obtained it, in the spring of this year, from a pond known as the Reservoir, at Barton, near Torquay. Since then I have met with single specimens from many localities, and in abundance in the Kingskerswell mill-stream.

Length (from hook to toe-tip), $\frac{1}{173}$ inch. **Habitat.** Barton; Kingskerwell. P.H.G.]

Monura loncheres, *Gosse* (171), (Pl. XXXI. fig. 50).

[SP. CH. **Dorsal outline** *narrowly ovate,* **lateral** *nearly semicircular;* **lorica** *rounded behind, with a median angular notch;* **toe** *shouldered dorsally, excessively long and slender.*

The most striking points in this beautiful species are its great depth (from back to belly), making about a half-circle, and the tenuity of the **toe**, which seems indivisible. This runs to so exceedingly fine a point as to escape notice, except with the most delicate focusing; even with a quarter objective, and the best possible light. The foot, of two condyliform joints, and the toe, together, are fully equal to the lorica in length; viz. $\frac{1}{400}$ inch. The ventral cleft is narrow, straight-sided, slightly approximate in front, and reaching round to the occiput, posteriorly to a short acute sinus whose sides form a right angle. There is a brilliant ruby **eye** about the middle of a saccate brain, and therefore cervical.

I have examined a number of examples, at different times, in sea-water obtained by Mr. Hood from the Invergowrie tide-pools. In one of these I timed the period of emptying the **contractile vesicle** to be just three minutes. It had this peculiarity, that the emptying was but partial on each occasion; that the bladder suddenly diminished its volume, but not to a point, *nor nearly*. The animal's posturing manners are exactly the same as described in the preceding species.

Length (total), $\frac{1}{200}$ inch. **Habitat.** Invergowrie tide-pools. P.H.G.]

Mytilia pœcilops, *Gosse* (171), (Pl. XXXI. fig. 51).

[SP. CH. **Lorica** *pergamentaceous, very flexible, constantly thrown into irregular folds, whence the outline is very variable; the face, in particular, is capable of great protrusion in wide plicate membranes; prevalent figure, foot, and toes, much as in* M. teresa.

Though this has many features in common with *tavina* and *teresa*, particularly the foot and toes, it has important peculiarities. The *dorsal* outline is like that of the latter, the lateral that of the former; but *both* more rough and uncouth. The skin thrown irregularly into coarse rude folds, occurring at intervals at every part, precludes any fixed form, so that the figure accurately copied has become in a few minutes, though gradually, flagrantly incorrect. The **front** is large and broadly truncate, capable of pushing out, from its lower part, great membranous sacs and folds, which slowly change every moment, and the use of which is inexplicable. These expansions do not appear to be ciliated. The **mastax** and **trophi** are as in its congeners; there is an ample brain, which carries a cervical red **eye**. The whole back is ridged—tectiform, not keeled.

I have observed numerous examples in sea-water from the Invergowrie tide-pools. They have all been remarkably heavy and sluggish in manners, little given to locomotion, wholly lacking the sprightly vivacity of the kindred species, and unusually intolerant of captivity. The abdominal viscera are generally of a rich orange-brown hue, and the whole tissues are more or less suffused with the same colour.

Length (lorica), $\frac{1}{240}$ inch. **Habitat.** Invergowrie, tide-pools. P.H.G.]

Mytilia producta, *Gosse* (171), (Pl. XXXI. fig. 53).

[SP. CH. **Skin** *flexible, plicate;* **body** *slender, very extensile;* **eye** *single, frontal;* **foot** *and toes nearly as in* M. teresa.

The **lorica**, flexible in *M. pœcilops*, is perhaps even more so in this species, and recognisable only at the posterior extremity, where each lateral plate can be traced, as, with a rounded end, it curves under the trunk, to approach its fellow-plate, leaving a narrow ventral cleft. The **face** is quite truncate, slightly oblique, not abnormally developed. When gliding rapidly along a seaweed, the animal is very worm-like, the body and the foot, about equal in length, forming two successive cylinders, the latter half as thick as the former. But both, especially the **foot**, are capable of sudden elongation at will. Thus the creature has a facies which distinguishes it from either of its congeners. Perhaps it comes nearest to *teresa*. The **toes** are even broader proportionally; together much exceeding the width of the foot whence they issue. The **eye** is conspicuous, nearly frontal, but changes its position with the brain. The whole animal is colourless, but very full of folds and corrugations. Very long **mucous glands** proceed from the toes through the whole of the foot.

The species first occurred to my observation on May 7, 1887, on very fine seaweeds (*Ceramium*), which I gathered in the deep cup-like pool in limestone rock at Oddicombe Point. I met with about half-a-dozen examples.

Length, $\frac{1}{100}$ inch. **Habitat.** Marine, Devonshire. P.H.G.]

Mytilia teresa, *Gosse* (169), (Pl. XXXI. fig. 52).

[SP. CH. **Body** *truly oval;* **toes** *together wider than foot; each toe large, long, ovate, abruptly produced to a long, slender, acute point.*

This very pleasing species I have found in some abundance, in water dipped for me out of tide-pools in various parts of Torbay by my little granddaughter, with whose name I honour it. It has a very distinct red **eye** in the occiput. The large bulbous **toes** are peculiar. It is a sprightly creature, playing actively among confervoid algæ, often pivoting on its toes, like a *Cathypna*, jerking and bowing; it is less locomotive than *M. Tavina*.

Length, $\frac{1}{200}$ inch. **Habitat.** Marine, Torbay. P.H.G.]

PTERODINA REFLEXA, *Gosse* (169), (Pl. XXXI. fig. 54).

[SP. CH. **Lorica** *elliptical in outline, the two longitudinal halves bent upward and backward, at a considerable angle; the dorsal surface being evenly furrowed, the ventral rounded.*

The angular character is not noticed on a dorsal view, but becomes conspicuous in the act of turning. *P. valvata* bends its leaves *downward*, on hinges, at will. *P. reflexa* bends its halves *upward*, on a medial line which is not hinged, but permanent. It is somewhat like a butterfly, sitting, with half-opened wings, on a flower in an autumn noon. The internal structure is normal.

Length (of lorica), $\frac{1}{220}$ inch. **Habitat.** Smallheath, Birmingham. P.H.G.]

BRACHIONUS BREVISPINUS, *Ehrenberg* (42), (Pl. XXXIV. fig. 17).

SP. CH. **Lorica** *smooth, with six sharp unequal* **occipital spines**, *and four stout* **posterior spines**, *of which the middle pair is the shorter.*

This Rotiferon closely resembles *B. Bakeri*, from which it differs mainly in the smoothness of its **lorica**, the length and shape of the **spines** (all very variable characteristics), and the form of its **gastric glands**; each of the latter of which consists of two oval lobes.

Length, $\frac{1}{60}$ inch. **Habitat.** Near Berlin (Ehr.).

BRACHIONUS POLYCERUS, *Schmarda* (135), (Pl. XXXIV. fig. 13).

SP. CH. **Lorica** *broad, nearly six-sided; eight* **occipital spines**, *the outmost pair rough; four* **posterior spines**, *the outer pair very long, the inner pair short.*

The **lorica** is flat and yellowish, and its pair of **occipital spines**, which are next to the outmost, cross these latter very curiously. Both the pairs of **posterior spines** curve inwards; the middle pair very much so.

Length (of lorica), cir. $\frac{1}{100}$ inch. **Habitat.** Kingston, Jamaica (Schmarda).

BRACHIONUS ANCYLOGNATHUS, *Schmarda* (135), (Pl. XXXIV. fig. 14).

SP. CH. **Lorica** *broad, narrowed in front;* **occipital spines** *six; the* **pectoral margin** *undulated, with two* **lateral spines**; *four* **posterior spines**, *the two outer the longer.*

Schmarda describes the shape of the **lorica** (which will be best understood from the figure), and adds that the **corona** is reddish, and three-lobed; the **eye** transversely oval.

Length, $\frac{1}{100}$ inch. **Habitat.** Stagnant water near Quito (Schmarda).

BRACHIONUS INERMIS, *Schmarda* (134), (Pl. XXXIV. fig. 18).

SP. CH. **Lorica** *smooth, anterior margin slightly concave; no* **spines** *either in front or behind.*

From a slight sketch of a solitary specimen found in Egypt.

Length, $\frac{1}{100}$ inch. **Habitat.** Nile overflow, Monfalut (Schmarda).

BRACHIONUS LATISSIMUS, *Schmarda* (134), (Pl. XXXIV. fig. 15).

SP. CH. **Lorica** *very broad, rough; six unequal* **occipital spines**, *none behind.*

The figure of this Egyptian *Brachionus*, as given by Schmarda, is very striking. The **lorica**, which is rough and of unusual breadth, is widest behind, and gradually narrows to the anterior margin, so that it has a trapezoidal shape. The posterior corners are rounded off, and the foot-opening is a shallow concavity. The anterior margin is scol-

loped so as to have six short pointed spines, with broad bases; the middle and outmost pairs being rather the longest.

Length, $\frac{1}{50}$ inch. **Habitat.** Irrigation water in Egypt (Schmarda).

Brachionus pustulatus, *Schmarda* (135), (Pl. XXXIV. fig. 16).

SP. CH. **Lorica** *broad, covered with papillæ, the middle part of the dorsal surface raised in the shape of a rhombus;* **occipital spines** *six; the* **posterior spines** *four, equal.*

The **pectoral margin** is nearly straight, with a slight notch in the middle; no **toes** observed on the foot. [Probably retracted. C.T.H.]

Length (of lorica), $\frac{1}{160}$ inch. **Habitat.** St. Juan del Norte, Central America (Schmarda).

Brachionus longipes, *Schmarda* (135), (Pl. XXXIV. fig. 20).

SP. CH. **Lorica** *trapezoidal;* **occipital spines** *six;* **pectoral margin** *without spines;* **foot** *double the length of the body.*

Of the six **occipital spines** the middle are the longest, and are curved outwards; the outer somewhat shorter and turned inwards; and the intermediate the shortest, and almost perpendicular. The **pectoral margin** is slightly curved, and has a small notch. The foot-opening, in the lorica, is semicircular, and without processes. The **toes** are short.

Total length, $\frac{1}{110}$ inch. **Habitat.** Near Pasto, New Granada (Schm.).

Brachionus Leydigii, *Cohn* (21), (Pl. XXXIV. fig. 19).

SP. CH. **Lorica** *sub-quadrate with six nearly equal* **occipital spines**; *the* **pectoral margin** *arched, with a sharp notch in the middle; the hind end triangular, obtusely excised; the dorsal surface marked with polygonal tessellations, which are themselves covered with a fine network of markings; the* **foot** *transversely contractile; the* **ephippial egg** *rough with papillæ.*

The most noticeable points about this *Brachionus* are its tessellate dorsal plate, and its foot. The former has twenty-one tessellations, arranged in five vertical rows (two lateral of four each, two next of five each, and a central row of three), while the latter, according to Cohn, admits of being greatly compressed *transversely*, so as to look like a thin band. The **lateral canals** also have unusually large loops and coils. The **contractile vesicle** is large, and so are the egg-shaped **gastric glands.**

Length (total), cir. $\frac{1}{70}$ inch.

Brachionus budapestinensis, *Daday* (208), (Pl. XXXIV. fig. 25).

SP. CH. **Lorica** *rough, tessellated dorsally and ventrally, rounded and spineless behind;* **occipital spines** *four, the middle pair curved downwards and outwards.*

This species is remarkable for the unusual shape of the tessellations of the **lorica**, especially on the dorsal side, where they are all bounded by curved lines. The minute papillæ of the lorica occur on all the spines. The **gastric glands** are pear-shaped with their pointed ends directed forwards; and the inner surfaces of the **rami** are wavy, each showing six undulations.

Length. Not recorded. **Habitat.** Neighbourhood of Budapest (Daday).

Brachionus quadratus, *Rousselet* (Pl. XXXIV. figs. 11, 12).

SP. CH. **Lorica** *nearly square, rough with minute, irregular, polygonal areolations;* **dorsal plate** *arched, sloping from behind forwards;* **occipital spines** *six, the middle pair the longest;* **ventral plate** *nearly flat, with an undulating mental edge; three short spines, one mid-dorsal and two lateral, round the foot opening.*

This fine *Brachionus* was found by Mr. C. Rousselet, this year, in Epping Forest. The lorica when seen by $\frac{1}{4}$ inch obj. with dark field illumination, is as beautiful as it is

singular; resembling very fine lace. Two low ridges run from its posterior dorsal edge, on either side of the median line, to the projecting spines; and, from the central strip contained between them, the lorica slopes rapidly to the edge of the ventral plate. There are faint traces of large tessellations along these two ridges. The **foot** is remarkable; for it has the false joints of a *Noteus* and, near the base, the usual transverse wrinkling of a *Brachionus*: the **toes**, too, are not only unusually long, but are themselves retractile like those of a *Philodina*.

Length (of lorica), $\frac{1}{87}$ by $\frac{1}{120}$ inch. **Habitat.** A pond in Epping Forest (Rousselet).

Brachionus militaris, *Ehrenberg* (42), (Pl. XXXIV. fig. 23).

Brachionus conium . . . . . Atwood (2).

SP. CH. **Lorica** *tessellated, both surfaces covered with raised points; ten* **spines** *in front, of which four are on the dorsal margin, four on the ventral, and two where the margins meet; also four spines behind, the middle pair (between which the foot issues) being of marked unequal length.*

Ehrenberg says that *militaris* has a rough lorica, and no fewer than twelve **spines** in front; but Cohn (*loc. cit.*) describes it as tessellated, and as having only ten spines in front.[1] Curiously enough, of the two figures in which Ehrenberg appears to intend to show all the spines, one has only ten spines in front, and the other eleven. Cohn's figures make the lorica distinctly unsymmetrical throughout, a feature almost lost in those of Ehrenberg. The two middle front dorsal spines are longer than any of the other anterior ones; they are generally curved downwards, and are not unfrequently twisted awry; Mr. Atwood's figure (*loc. cit.*) shows them bent, half way up, at right angles to their usual direction. The posterior, unequal pair, which guard the exit of the foot, have the right hand spine (dorsal view) much the longer of the two; and the outer posterior pair, at the angles of the lorica, are also of unequal length.

This Rotiferon has a very large **contractile vesicle**; which, according to Cohn, occupies, when fully expanded, two-thirds of the body-cavity. He also describes it as consisting of two chambers,[2] and states that, on mixing a little indigo in the water, he has seen fine particles of the pigment drawn up through the cloaca into the contractile vesicle, and again expelled from it over the same path.

Mr. D. Bryce, who found this *Brachionus* lately near London, says, "the foot-orifice seems to be twisted on one side, so that the spines bounding it are in different planes; the left-hand and smaller spine being altogether depressed below the right-hand one, and pointing slightly downwards. The solitary dorsal **antenna** is moderately stout, and furnished with very distinct long setæ; but I could not make out the paired lateral antennæ. The **eye** is large, and situated at the hinder end of a large **brain.** The **gastric glands** are triangular. The animal is fond of rotating, in one spot, round its longer axis, just like *Synchæta tremula*, though I could see no trace of an anchoring 'cable.'"

Length (of lorica), from $\frac{1}{100}$ to $\frac{1}{130}$ inch (D. Bryce). **Habitat.** Berlin (Ehrenberg); near London (D. Bryce); Queensland (V. G. Thorpe); Philadelphia, U.S. (Leidy).

Brachionus polyacanthus, *Ehrenberg* (42), (Pl. XXXIV. fig. 24).

SP. CH. **Lorica** *smooth; with four long* **occipital spines**; *the* **pectoral margin** *six-toothed;* **posterior spines** *five, the two outer of which are very long.*

[1] Mr. V. Gunson Thorpe, Surgeon, R.N., and Mr. D. Bryce have obliged me with characteristic drawings, which they have made, of specimens found by the former at Brisbane, and by the latter near London. Each of these observers figures the tessellations, the ten anterior spines, and the general lack of symmetry of the lorica. Professor Leidy also has favoured me with an excellent drawing of the dorsal surface from an American specimen.

[2] The contractile vesicles of *Asplanchna Ebbesbornii*, of *Scaridium eudactylotum*, and of other Rotifera, have also this chambered appearance; which is due to the constriction of the surface by very fine muscular threads.

The **pectoral margin**, in Ehrenberg's drawing, cannot strictly be said to show spines; but it is notched so as to have six very small projections. The four **occipital spines** are of nearly equal length; and the very long **posterior spines** spring from the outer corners of the dorsal surface. Three short spines surround the opening for the foot. Cohn thinks that Ehrenberg has made a mistake in giving this *Brachionus* three spines round the foot-opening, and has himself described (21), as *polyacanthus*, a *Brachionus* which has only two spines at the foot-opening.

It is clear, however, from his description and drawing, that Cohn's animal is the variety of *B. pala* given in Pl. XXVIII. fig. 3. Ehrenberg says that the **unci** are four-toothed, and the **gastric glands** nearly circular. He makes no remark about the **foot**, but draws it jointed, like that of *B. militaris* or *Noteus quadricornis*.[1]

Length, $\frac{1}{100}$ inch. **Habitat.** Berlin (Ehr.).

B. COSTULATUS, *Eichwald* (167), (Pl. XXXIV. fig. 21). SP. CH. **Lorica** *with six short nearly equal* **occipital spines**, *and diminishing to a rounded, spineless end, behind; longitudinal ridges run from the tip of each spine to the points of a zig-zag transverse ridge just below the level of the eye;* **foot** *with four to six toes.* I give this description from Eichwald's, but it is difficult to believe in a *Brachionus* with half-a-dozen toes. The transverse ridge is the boundary of a series of tessellations which cover the lorica, but which are not given in the drawing, as they were rendered obscure by the viscera and contained food. Near St. Petersburg.

B. PLICATILIS, *Mobius* (117)=*B. Mülleri.* There are two remarkable statements in Herr Mobius' otherwise able memoir, which I think must be errors. In the first place, he considers the free end of the dorsal antenna to be the mouth. This needs no comment. In the second, he draws, and describes, no fewer than four other dorsal antennæ, viz. the two usual antennæ on the lumbar regions, and two more in the neck, on either side of the mastax. These latter are due, I think, to some error of observation. Certainly there was nothing of the kind in the specimens of *Mülleri* that I obtained from brackish ditches in Bedminster, near Clifton.

B. CHILENSIS, *Schmarda* (135)=slight var. of *B. Bakeri.*

B. TESTUDO, *Ehrenberg* (43); B. BIDENS, *Plate* (126); B. MINIMUS, *Bartsch* (8).

All these appear to be examples of *B. angularis.*

B. JAMAICENSIS; B. NICARAGUENSIS; B. SYENENSIS; *Schmarda* (135, 134). All these three species of Schmarda's seem but varieties of *urceolaris.*

B. DIACANTHUS, *Schmarda* (135); B. DECIPIENS, *Plate* (126); B. MARGOI, *Daday* (32).

All these appear to be varieties of the very variable form *B. pala*; see vol. ii. p. 117.

B. LOTHARINGIUS, *Imhof* (179)=*B. dorcas.*

B. HEPATOTOMUS, *Gosse* (54)=*B. Mülleri.*

B. GLEASONII=*Anuræa Gleasonii*, Up de Graf (149), (Pl. XXXIV. fig. 22). SP. CH. **Dorsal plate** *of lorica rough, arched, oblong-square in outline, with the two posterior corners cut off, and four curved* **spines** *projecting from the four angles thus formed;* **anterior margin**, *of each plate, spineless, but with a median projecting cusp; a curved* **spine** *on the mid-dorsal line;* **ventral plate** *smooth, flat.*

This curious creature was discovered at Elmira in 1883 by Dr. Up de Graf, who states that the ventral plate ends in a long tapering straight spine. Mr. C. M. Vorce, however, to whom I am indebted for a drawing, says that this so-called spine is only a jointed foot, like that of *Noteus.*

[1] I had thought of removing *B. militaris* and *B. polyacanthus* from the genus *Brachionus*, on account of their jointed, unwrinkled foot, like that of a *Noteus.* But after I had seen Mr. Rousselet's *B. quadratus*, with its jointed foot, wrinkled at the base, I thought it better to make no change; especially as I have never seen *B. militaris* or *B. polyacanthus.*

Genus SCHIZOCERCA, *Daday* (207).

GEN. CH. *A genus of the* Brachionidæ, *with a long* **foot** *ending in a fork of two unequal branches, each terminated by a pair of unequal toes.*

SCHIZOCERCA DIVERSICORNIS, *Daday* (207), (Pl. XXXIV. fig. 10).

SP. CH. **Body** *long, wider in front, tapering behind;* **lorica** *smooth, with four* **anterior spines**, *the middle pair small, broad-based, the marginal pair long, sharp, curved; ventral* **margin** *excised in the middle; two unequal* **posterior spines**, *the right much the longer, sharper, and incurved; the left shorter and broader.*

The **lorica** is a long oval; it really has only two anterior spines, one on either side, at the junctions of the occipital and mental edges. The two so-called middle spines are formed by the edges of the usual dorsal notch (for the dorsal antenna), and by those of the shallow circular excavations in the lorica, on either side of the notch. The posterior spines are even more unequal than those of *B. militaris*; and the forked foot with its two pairs of unequal toes reminds one of those of *Philodina macrostyla* (Pl. XXXII. fig. 6 *b*).

Length, $\frac{1}{165}$ to $\frac{1}{123}$ inch. **Habitat.** Neighbourhood of Budapest (Daday).

ANURÆA QUADRIDENTATA, *Ehrenberg* (42), (Pl. XXXIV. fig. 29).

SP. CH. **Lorica** *oblong, tessellated; with four* **occipital spines**; *rounded and spineless behind.*

Length (of lorica without the spines), $\frac{1}{216}$ inch. **Habitat.** Berlin (Ehr.).

ANURÆA SQUAMULA, *Ehrenberg* (42), (Pl. XXXIV. fig. 28).

SP. CH. **Lorica** *obtusely quadrate, smooth, with six* **anterior spines**; *rounded and spineless behind.*

The only peculiarity noticed by Ehrenberg is its "very large, sparkling, round, red, **eye.**"

Length, $\frac{1}{216}$ to $\frac{1}{240}$ inch. **Habitat.** Copenhagen, Ingoldstadt, Berlin (Ehr.).

ANURÆA FALCULATA, *Ehrenberg* (42), (Pl. XXXIV. fig. 26).

SP. CH. **Lorica** *oblong, rough; with six* **anterior spines**, *the middle pair sickle-shaped; rounded and spineless behind.*

Ehrenberg says the **gastric glands** are large.

Length, $\frac{1}{144}$ inch. **Habitat.** Berlin (Ehr.).

ANURÆA BIREMIS, *Ehrenberg* (42), (Pl. XXXIV. fig. 32).

SP. CH. **Lorica** *linear, elongated, with four* **occipital spines**; *dorsal surface very smooth, with two sharp, moveable, oar-shaped processes, one on each side.*

There are three teeth in each **uncus**, round **gastric glands**, and a red, round, sparkling **eye.** The **side spines** are weak and pliable.

Length, $\frac{1}{144}$ inch. **Habitat.** Sea-water, near Kiel (Ehr.).

ANURÆA STIPITATA, *Ehrenberg* (42), (Pl. XXXIV. fig. 27).

SP. CH. **Lorica** *subquadrate or triangular, ending behind in a simple spine; six* **spines** *in front;* **dorsal plate** *tessellated.*

The points of difference between this species and *cochlearis* are given in vol ii. p. 124. Ehrenberg notices that *stipitata* has a great red cervical **eye**, and further says that he once saw something like an **antenna** (Respirationsröhre) on the *ventral* side, when looking at the animal sidewise. His figure shows the creature with its head

drawn into its lorica, and a very broad, stout, clove-shaped antenna hanging over the middle of the mental edge of the lorica. It is, of course, just possible that the dorsal antenna might take such a position, if the head were much curved to the ventral surface: but I have never seen anything like it.

Length, $\frac{1}{180}$ to $\frac{1}{240}$ inch. **Habitat.** Berlin (Ehr.).

ANURÆA TESTUDO, *Ehrenberg* (42), (Pl. XXXIV. fig. 31).

SP. CH. **Lorica** *quadrate; with six straight and nearly equal* **spines** *in front, and two short spines behind; both* **dorsal** *and* **ventral plates** *rough, the former tessellated.*

This species differs from *aculeata* in the near equality in length of the front **spines,** the shortness of the hind ones, and the roughness of the ventral surface, all characters of somewhat doubtful constancy. Ehrenberg says that there are four teeth in each **uncus,** that the **gastric glands** (unlike those of *serrulata*) have no stalks to attach them to the stomach, and that the **eye** is transversely oval. He also says that besides a smooth-surfaced **egg** he has seen a faceted one; which latter he supposes to be ephippial.

Length, $\frac{1}{210}$ to $\frac{1}{240}$ inch. **Habitat.** Berlin (Ehr.).

ANURÆA VALGA, *Ehrenberg* (42), (Pl. XXXIV. fig. 30).

SP. CH. **Lorica** *quadrate; with six* **spines** *in front, of which the two mid-spines are the longest, and two unequal spines behind;* **dorsal** *and anterior portion of* **ventral plate** *rough, the former also tessellated.*

Another species resembling *aculeata.* Ehrenberg says, however, that the teeth in its **uncus** are five in number, while those in *aculeata* are many. The **gastric glands** are egg-shaped; and the red **eye,** transversely oval.

Length, $\frac{1}{210}$ inch. **Habitat.** Berlin (Ehr.).

ANURÆA SCHISTA, *Gosse* (171), (Pl. XXXI. fig. 55).

[SP. CH. **Lorica** *oblong, tapering to a short spine behind;* **dorsal plate** *tessellated in polygonal areas on each side of a mesial ridge, and punctured;* **ventral plate** *much shorter, produced into a projecting sharp point, divided from the dorsal by a deep cleft.*

It has relations with *stipitata* and *cochlearis*; in tessellation agreeing with the latter, and with *tecta.* The anterior **spines** are straight. It is evidently an approach to *Notholca,* but I do not see the ridges and furrows descending from the spines. The **tessellæ** are somewhat coarse and ill-defined. The straight short antlers, and the great descending point of the ventral plate, distinguish it at once from every known species. This point is a stiff taper spine: sometimes it projects obliquely (*b*); then, in a moment it is jerked in, so as to be quite hidden, only to be as rapidly thrown out again. Even in a dorsal view it can be clearly seen, through the transparent tissues. I believe I have seen, on two occasions, a discharged egg, carried under the belly, in the manner of *tecta,* &c. The **eye** is a ball of deep red, of enormous size. A very large **contractile vesicle,** when full, forces up the other viscera to the middle of the body: when, often, the well-defined contrast between the dark turbid contents of the intestine, and the crystal clearness of the bladder, is curious and striking. The bladder has no effect on the ventral spine, whose movements are manifestly voluntary. It is a sprightly active swimmer.

Length, $\frac{1}{162}$ inch. **Habitat.** Birmingham. P.H.G.]

A. LONGISTYLA, *Schmarda* (135)=*A. cochlearis* (vol. ii. p. 124).

A. REGALIS, *Imhof* (179)=var. of *A. aculeata* (vol. ii. p. 123).

A. INERMIS, *Ehrenberg* (42); like *Notholca acuminata,* but without frontal spines; and with a feeble bent lorica, and indistinct longitudinal striæ: Ehrenberg only saw one specimen, and it is difficult to say what it was.

NOTHOLCA FOLIACEA, *Ehrenberg* (Pl. XXXIV. fig. 35).

Anuræa foliacea . . . . . Ehrenberg (42).

SP. CH. **Lorica** *oblong, with six* **spines** *in front, and tapering to one spine behind;* **dorsal and ventral surfaces** *with longitudinal ridges and a rough zone in front.*

This *Anuræa* of Ehrenberg's will fall into Mr. Gosse's new genus of *Notholca*. Ehrenberg gives few details of its structure, but notices that there are four teeth in each uncus, and that there is an obvious brain lying under the eye.

Length, $\frac{1}{180}$ inch. **Habitat.** Berlin (Ehr.).

NOTHOLCA HEPTODON, *Perty* (Pl. XXXIV. fig. 34).

Anuræa heptodon . . . . . Perty (124).

SP. CH. **Lorica** *an elongated oblong, with a wavy striated surface; with six* **spines** *in front, and tapering to a short, sharp, slightly upturned spine behind;* **dorsal plate** *convex;* **ventral** *concave, and so set that its side view of the lorica is not wedge-shaped but box-like.*

This *Notholca* was discovered by Perty at Bern, and described from a solitary specimen. Mr. T. Smithson Spencer has lately found what, I think, is the same creature, at Rochdale, and has favoured me with a drawing of it. Both observers describe the **lorica** as unfaceted and with wavy longitudinal ridges and outline.

Mr. Spencer says that a membrane connects the two plates behind; and that he has seen them drawn together, with the membrane projecting, in a fold, between them.

Length, $\frac{1}{144}$ inch. **Habitat.** Bern (Perty); Rochdale (T. S. Spencer).

NOTHOLCA STRIATA, *Ehrenberg* (Pl. XXXIV. fig. 33).

Anuræa striata . . . . . Ehrenberg (42).
Anuræa baltica . . . . . Eichwald (45).

SP. CH. **Lorica** *linear, elongated, with six* **spines** *in front, and rounded behind;* **its dorsal plate** *with twelve longitudinal striæ.*

Müller discovered this *Notholca* in sea-water at Copenhagen in 1779, and gave three figures of it, of which one is probably a mistake for *Anuræa biremis*; as it shows two curved spines on the under surface of the lorica. Ehrenberg found it both in fresh water and in the sea, and noticed that the membranaceous **lorica** changed its form with the contractions of the body. He also observed three teeth in each **uncus**, and a **nervous ganglion** close to the red **eye**. Eichwald's *Anuræa baltica* is probably the same animal. Eichwald's figure and description give only six longitudinal striæ; the two mid-striæ stop short just above the mastax; and the other four stop at the margin of a semicircular opening in the ventral plate. Probably the viscera obscured his view; moreover he admits that occasionally he could see twelve longitudinal striæ.

Length, $\frac{1}{120}$ inch to $\frac{1}{144}$ inch. **Habitat.** Copenhagen (Müller); Berlin (Ehr.).

NOTHOLCA JUGOSA, *Gosse* (169), (Pl. XXXI. fig. 59).

[SP. CH. **Lorica** *ovato-rhomboid, highly elevated, broadly truncate before, narrowly behind; ridges and furrows strongly marked, ending before they reach the hind margin.*

This, of all the *Notholcæ*, seems to come the nearest to Ehrenberg's figure of *Anuræa striata*; of which he says, it is marine at Copenhagen, associating with *Pter. clypeata* and *Brach. Mülleri*, species with which *jugosa* is commonly found in the tide-pools of the Firth of Tay and of the Devon coast.

Length, $\frac{1}{190}$ inch to $\frac{1}{130}$ inch. **Habitat.** Marine. P.H.G.]

NOTHOLCA RHOMBOIDEA, *Gosse* (169), (Pl. XXXI. fig. 58).

[SP. CH. **Lorica** *rhomboidal, with lateral angles rounded, the front produced and truncate;* **dorsal** *and* **ventral plates** *separated behind by a short cleft.*

The ridges, in this species, can with difficulty be discerned, especially as the rotating head is habitually protruded, which the creature does not retract for the shock of any tap or shake of the instrument that I can give. There is a long wrinkled œsophagus, a great saccate **stomach**, a distinct intestine, with the cloaca at the very extremity of the lorica : the **branchial bands** are distinct, but no contractile vesicle. It is not uncommon, with the preceding.

Length, $\frac{1}{160}$ inch to $\frac{1}{143}$ inch. **Habitat.** Marine. P.H.G.]

NOTHOLCA SPINIFERA, *Gosse* (169), (Pl. XXXI. fig. 57).

[SP. CH. **Lorica** *broadly sub-rhomboidal ; the* **dorsal plate** *often less than the* **ventral** *and separated by a wide and deep cleft ; at each angle of junction is seated a short spine so hinged as to be concealed within the cleft, or widely projected, at will.*

An interesting and attractive species. The whole interior is often richly coloured, especially the enormous **stomach.** An ample **contractile vesicle** is present. The hind outline in some examples is evenly rounded ; in others an inangulation marks both plates. Ehrenberg's figure of *Anur. biremis* may be compared with this ; but it differs in important details ; and his text gives no help. I received this also from the Tay tide-pools.

Length (of lorica), $\frac{1}{120}$ to $\frac{1}{100}$ inch. **Habitat.** Tay tide-pools. P.H.G.]

NOTHOLCA POLYGONA, *Gosse* (169), (Pl. XXXI. fig. 60).

[SP. CH. **Lorica** *roundly pear-shaped, truncate in front ; the central pair of the* **occipital spines** *stout, the other two pairs almost obsolete ;* **ventral plate** *forming a square box, with sloping, many-angled sides.*

A remarkable form. The **dorsal plate** is a half-oval, the ventral nearly flat. The latter is very peculiar : a kind of sub-cubic box, open at the summit, runs down to about three-fourths' length, and then proceeds, in pyramidal form, to a point at bottom ; and this appears to contain the viscera. Each side is covered-in by a plate of two planes, but appears to be empty. On those parts of the arched dorsal plate which answer to these empty lateral chambers, run down very delicate flutings, while the broad medial part is quite clear and smooth. All the angles are distinct. The only example seen was dead, but showed a crimson **eye** and a normal **mastax.**

Length, $\frac{1}{160}$ inch. **Habitat.** Kingswood pool, near Birmingham. P.H.G.]

NOTHOLCA LABIS, *Gosse* (171), (Pl. XXXI. fig. 56).

[SP. CH. *Almost the very counterpart of* N. scapha, *save that the outline is a longer oval, and the* **lorica** *is prolonged into a short, broad, truncate* **tail** *behind.*

One of the discoveries of Mr. Hood of Dundee, who finds it numerous in a pool in Emmock Wood, near that city. He has repeatedly sent me specimens, but hitherto all have been dead on arrival. The little **tail** to the lorica reminds one of the handle of a dust-pan, if so homely an illustration can be tolerated. The ridges and furrows from the frontal spines are almost obliterate.

Length, $\frac{1}{216}$ inch. **Habitat.** Lacustrine, near Dundee (J.H.). P.H.G.]

Genus GOMPHOGASTER, *Vorce* (210).

GEN. CH. **Lorica** *thick, box-like, enclosing the animal completely, except for a narrow slit-like opening upon the anterior ventral portion, cuneate in both dorsal and lateral aspects, triangular in transverse section, the ventral side the apical ;* **foot** *jointed, and usually retracted within the lorica ;* **toe** *apparently single ;* **corona** *apparently single, cilia robust, set in a single (?) marginal row, disc not much expanded beyond lorica when extended ; a stout retractile horn-like* **process** *protruded from each dorso-lateral corner of the lorica, when corona is extended.*

GOMPHOGASTER AREOLATUS, *Vorce* (210), (Pl. XXXIV. fig. 36).

Plœsoma lenticulare . . . . . Herrick (175).

A single specimen was found by Mr. Vorce in 1882; it was taken living in filterings from the water of Lake Erie, at Cleveland, Ohio. **Lorica** thick and strong, dark coloured, marked all over with areolar depressions, very much resembling the markings of *Hemiaulus*; sides slightly concave, a deep plicate furrow across the back at the widest part, from which two deep sub-central furrows, and two shallow sub-marginal furrows, extend upon the dorsal surface to the posterior tip of the lorica; lateral margins of the dorsal front of lorica slightly produced, making the corners prominent. **Foot** stout, two-jointed; toe apparently single; retractile **horns** very slightly clavate. **Eye-spot** not observed, but if present would be usually concealed by the dark lorica. Cilia of the **corona** robust, in a single (?) marginal row. Animal very active and strong, pushing its way among masses of diatoms and flocculent matter, and when entangled freeing itself by vigorous kicks with its strong foot.[1] Mr. Herrick (who found this animal several times in a reservoir near Hebron, Ohio) says that there is a ventral prominence on the **head**, bearing several long setæ; that the **trophi** are feeble; the **eye** cervical, and seated on a considerable ganglion; and that the **foot** has two appressed toes.

Length, cir. $\frac{1}{100}$ inch.

DOUBTFUL AND REJECTED GENERA.

Genus ARTHROCANTHUS, *Schmarda* (134).

A genus formed to contain the varieties of *Brachionus pala* with long posterior processes on the lorica (vol. ii. p. 117; Pl. XXVIII. fig. 3).

Genus ASCOMORPHA, *Perty* (124).

The same as Mr. Gosse's genus *Sacculus*.

Genus BORTHRIOCERCA, *Eichwald* (167).

The only species, *affinis*, is evidently some Rotiferon belonging to the *Rattulidæ*, but the figure and description are too vague for its identification.

Genus CYCLOGLENA, *Ehrenberg* (42).

A genus formed by Ehrenberg to take *Notommatæ* with more eyes than three, in a cluster, in the neck. There are two species, *lupus* (Pl. XXXIII. 15) and *elegans*. The former has a cluster of red specks in the neck. It is like *N. aurita*, but has no auricles, and is said to vary in length from $\frac{1}{144}$ to $\frac{1}{4}$ inch—which seems incredible.

The latter, Ehrenberg himself marked as a doubtful species. It is $\frac{1}{200}$ inch in length, and the drawing (from which little can be learnt) shows a row of spots stretching from above the stomach for a quarter of the animal's length: these could scarcely be eyes. It was found in Nile water: *lupus*, at Berlin.

Genus CYSTOPHTHALMUS, *Corda* (23).

In this genus there is but one very doubtful Rotiferon, *C. Ehrenbergii* (Pl. XXXII. fig. 22). This creature reminds one of a *Taphrocampa*. It is grub-shaped, tapering at both ends, and divided into fourteen or fifteen segments by muscular rings. The last two segments are of very much smaller radius than the preceding one, and form a sort of tail. There are a few **cilia**, surrounding a buccal orifice, on the ventral surface. This opens into a short buccal funnel leading to a pear-shaped sac (fig. *b*), round the inner walls of which are arranged four pairs of jaws, like curved **rami** on a dumb-bell-shaped fulcrum. A shorter, ringed œsophagus connects this sac with a simple conical

[1] The whole of the above description, of this very curious Rotiferon, has been taken from Mr. C. M. Vorce's interesting paper (210), read before the American Society of Microscopists in 1887.

stomach. This latter bears no **gastric glands**, and ends in a very short intestine with a cloacal opening on the ventral surface, just before the tail. The **eye** is a refracting lens, resting on a top-shaped mass of purple-red pigment; and the whole is enclosed in an egg-shaped transparent capsule.

The only other organ is what appears to be a large, cylindrical, two-lobed **ovary**, lying on either side of the stomach. If the animal be a Rotiferon, it is very badly described. Herr Corda found it, in 1834, at the weirs between the islands of the Moldau, below Prague.

Length, $\frac{1}{144}$ inch.

Genus DIPLOTROCHA, *Schmarda* (134).

Formed by Herr Schmarda to receive a free-swimming Rotiferon, *D. ptygura*, found at Cairo. Its pear-shaped body is surmounted by a short cylindrical head, and tapers, continuously with a wrinkled foot, to two short toes. The corona, according to Schmarda, consists of two complete parallel circles of cilia surrounding the upper and lower margins of the cylindrical head. There is a pair of long narrow teeth curved towards each other; a short circular stomach; and a red, semilunar, cervical eye. No other details are given, and no mention is made of the position of the mouth, so that it is impossible to say what this creature really was. As it was only about $\frac{1}{100}$ inch in length, it might have been some young Rhizotan. Schmarda's figure is of little value.

Genus DIURELLA, *Eyferth* (46).
Genus HETEROGNATHUS, *Schmarda* (135).

Each of these includes several genera of the family *Rattulidæ*. Of the latter, four species, viz. *brachydactylus*, *diglenus*, *macrodactylus*, *notommata*, said to be new, are given by Schmarda; but see note 1, Sup^t, p. 8. Of the former, *tigris* and *rattulus* have been mentioned vol. ii. pp. 65, 67; while *stylata* (46), and *insignis* (Herrick, 175), I cannot determine.

Genus HYDRIAS, *Ehrenberg* (42).

This genus contains one species, *cornigera*, a Philodine without eyes, proboscis, or spurs; and with its corona divided into two separate circles of cilia, each placed on a separate projection of the body. This kind of corona has been attributed, by numerous observers, to various Rotifera that do not possess it: in fact, no such corona is known. Ehrenberg found this Rotiferon in standing water in Africa; but it is too imperfectly observed to be admitted.

Genus MACROTRACHELA, *Milne* (186).

Mr. Milne proposes this genus for three-toed *Philodinadæ*, having the pre-intestinal part of the body decidedly longer than the post-anal. All the species are *Callidinæ* and have already been described (see Index), except *musculosa* and *tridens*, which are doubtful species.

Genus MONOLABIS, *Ehrenberg* (42).

This genus of Ehrenberg is intended to contain such *Philodinadæ* as have no proboscis, but have two frontal eyes, and a spurless foot with two small toes. There are two species, *conica* and *gracilis*; the former has the shape of a stout flattened cone, tapering to a foot continuous with the body, and bearing two minute toes; the latter is of similar shape, but much more narrow and slender. *Conica* has three transverse teeth in each ramus, and a *ventral* antenna: *gracilis* has two transverse teeth in each ramus, but no antenna at all.

It is obvious that whatever these Rotifera may have been, they were not *Philodinadæ*. The absence of the proboscis, of the characteristic sliding joints in the foot and body, and of the spurs on the foot, sufficiently show this. Possibly they were young Rhizotans; but the ascription, to one of them, of a single *ventral* antenna, makes it more than probable that the animals were imperfectly observed.

Genus NOTOGONIA, *Perty* (124).

The only species, *N. Ehrenbergii* (Pl. XXXIII. fig. 38), has a lorica widening backwards from the front, and with its hind edge bounded by three concave curves. A three-jointed foot bears two bristle-like toes. Perty draws an oval mastax and says that the jaws are "rounded and strong"; and the teeth, "two or three." The two eyes are wide apart in front, "very small and faintly red." He describes also, and figures, a pair of curved organs which protruded frequently from the front of the head.

Length, $\frac{1}{170}$ inch. **Habitat.** Near Belp (Perty).

Genus OTOGLENA, *Ehrenberg* (42).

Ehrenberg defined his genus *Otoglena* as containing animals, of his family *Hydatinæa*, with one sessile cervical eye, two stalked frontal eyes, and the foot forked. The genus included only one species, viz. *O. papillosa*, and I have little doubt from his description that it was a male Rotiferon, possibly that of *A. myrmeleo*, to the female of which Rotiferon he himself says it had much resemblance. The **body** was bell-shaped, swollen, and rough with papillæ; the **trophi** were apparently absent; the **vascular system** was obvious; the red cervical **eye** was attached to an oval nervous ganglion with two dark appendages; there was a long loop in the neck, and what Ehrenberg calls a "respiratory opening" in the middle of the back, but which no doubt was one of the usual setiferous pits in which the antennæ often end. Ehrenberg says that there was a somewhat clotted **stomach**, and a very thin intestine; but probably these were the **sperm-sac** and penis. The **foot** was conical, small, with very small toes. Ehrenberg never met with it but once.

Length, $\frac{1}{96}$ inch. **Habitat.** Berlin (Ehr.)

Genus PLAGIONATHA, *Dujardin* (40).

In this genus Dujardin places together *Notommata lacinulata*, *Distemma setigerum*, *Rattulus tigris*, *Diglena catellina*, *Notops hyptopus*, &c.: on account of a supposed similarity in their trophi.

Genus TETRASIPHON, *Ehrenberg*.

In Pritchard's *Infusoria* (4th edition, 1861) the following description is given of *T. hydrocora*, the only species of the genus. "Very large, hyaline, with two prominent tubular occipital organs, and other two near the termination of the back; gastric glands four, globose; jaws bidentate, with the oblique rotary organ of *Pleurotrocha*. Foot with slender, long, and acute toes; eye occipital. **Length**, $\frac{1}{36}$ inch, and upwards. Berlin."

It is possible that this may have been *Copeus spicatus*; for although the latter has only *two* gastric glands, yet each of these is so deeply divided into two lobes, that there often seem to be four. On the other hand, the trophi of *C. spicatus* are not bidentate; moreover no mention is made of the gelatinous covering, in which *spicatus* is so often enveloped.

Genus THEORUS, *Ehrenberg* (42).

A genus founded on the presence of two groups of supposed eyes, in the neck of a Notommatoid Rotiferon. Ehrenberg describes these so-called eye-points as colourless vesicles, but it is most improbable that they should be eyes at all. There were as many as six vesicles in each group. Mr. Milne (186) has seen a similar group of vesicles in each of the gastric glands of his *Stephanops uncinatus*.

Genus TYPHLINA, *Ehrenberg* (42).

The only species, *T. viridis*, was found by Ehrenberg at Cairo. He describes it as a very small animal, $\frac{1}{720}$ inch, without eyes, proboscis, or spurs, but with a sessile corona.

Genus TYPHLOTROCHA, *Schmarda* (135).

The only species, *T. zygodonta*, was found by Schmarda, in standing water, at S. Juan del Norte, Central America; and was placed by him among the *Hydatinæa*. It is somewhat like *Floscularia campanulata*. The body is nearly cylindrical; is surmounted in front by a five-lobed funnel-shaped cup, and terminated behind by a long toe-less narrow foot. Schmarda says nothing of the approach to the alimentary canal (so striking a part of the structure of the Floscules), but merely notices that the lobes are closely edged with cilia, of which two are very long. He says that the mastax is a transverse ellipsoid; and that the ovary stretches down to the bottom of the long foot. It is hardly possible that all these statements should be correct.

ADDENDA.

FLOSCULARIA CORONETTA, (var.). Mr. Thos. Whitelegge found, in 1885, in Sydney, N.S.W., a variety of *coronetta* which had the tips of its lobes, on their inner sides, expanded into flat discs. The figure (Pl. XXXIV. fig. 1) I owe to the courtesy of Mr. W. Burne Poole, who found the creature in a small pond in the Botanical Gardens of Adelaide.

FURCULARIA GAMMARI, *Plate* (209), (Pl. XXXIV. fig. 8). An ecto-parasite discovered by Dr. Plate on the branchial laminæ of *Gammarus pulex*. There is nothing remarkable in its structure except a pair of unusually long foot-glands.

CORRIGENDA.

Vol. i., p. 91, l. 32; for *Cephalosiphon* read *Conochilus*.
Vol. ii., p. 7, l. 40; under T. BREVISETA, *Gosse*, place (Pl. XIII. fig. 7.)
Vol. ii., p. 47, l. 32; for (Pl. XVII. fig. 14) read (Pl. XVII. fig. 10.)

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(*Continued from vol. ii. p.* 142.)

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INDEX OF THE FAMILIES, GENERA, AND SPECIES DESCRIBED IN THE SUPPLEMENT.

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PLATE XXXI.

1. Philodina microps . . . *a*, dorsal view; *b*, lateral.
2. Callidina pigra . . . . dorsal view.
3. Asplanchna eupoda . . . lateral view.
4. Synchæta longipes . . . dorsal view.
5. Taphrocampa selenura . . dorsal view.
6. Notommata limax . . . *a*, dorsal view; *b*, lateral; *c*, brain and eye.
7. Notommata ovulum . . . dorsal view.
8. Notommata theodora. . . *a*, dorsal view; *b*, lateral.
9. Notommata potamis . . . dorsal view.
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11. Proales othodon. . . . dorsal view.
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14. Furcularia molaris . . . dorsal view.
15. Furcularia sterea . . . dorsal view.
16. Furcularia sphærica . . . dorsal view.
17. Furcularia eva . . . . *a*, lateral view; *b*, dorsal.
18. Furcularia melandocus . . *a*, dorsal view; *b*, toes.
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21. Diglena rosa . . . . dorsal view.
22. Diglena silpha . . . . lateral view.
23. Diglena pachida . . . ventral view.
24. Diglena suilla . . . . lateral view.
25. Distemma platyceps . . . lateral view.
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27. Mastigocerca bicristata . . lateral view.
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29. Diaschiza acronota . . . lateral view.
30. Diaschiza globata . . . *a*, lateral view; *b*, dorsal.
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38. Cathypna diomis . . . *a*, base of lorica, foot and toes, dorsal view; *b*, toes, lateral.
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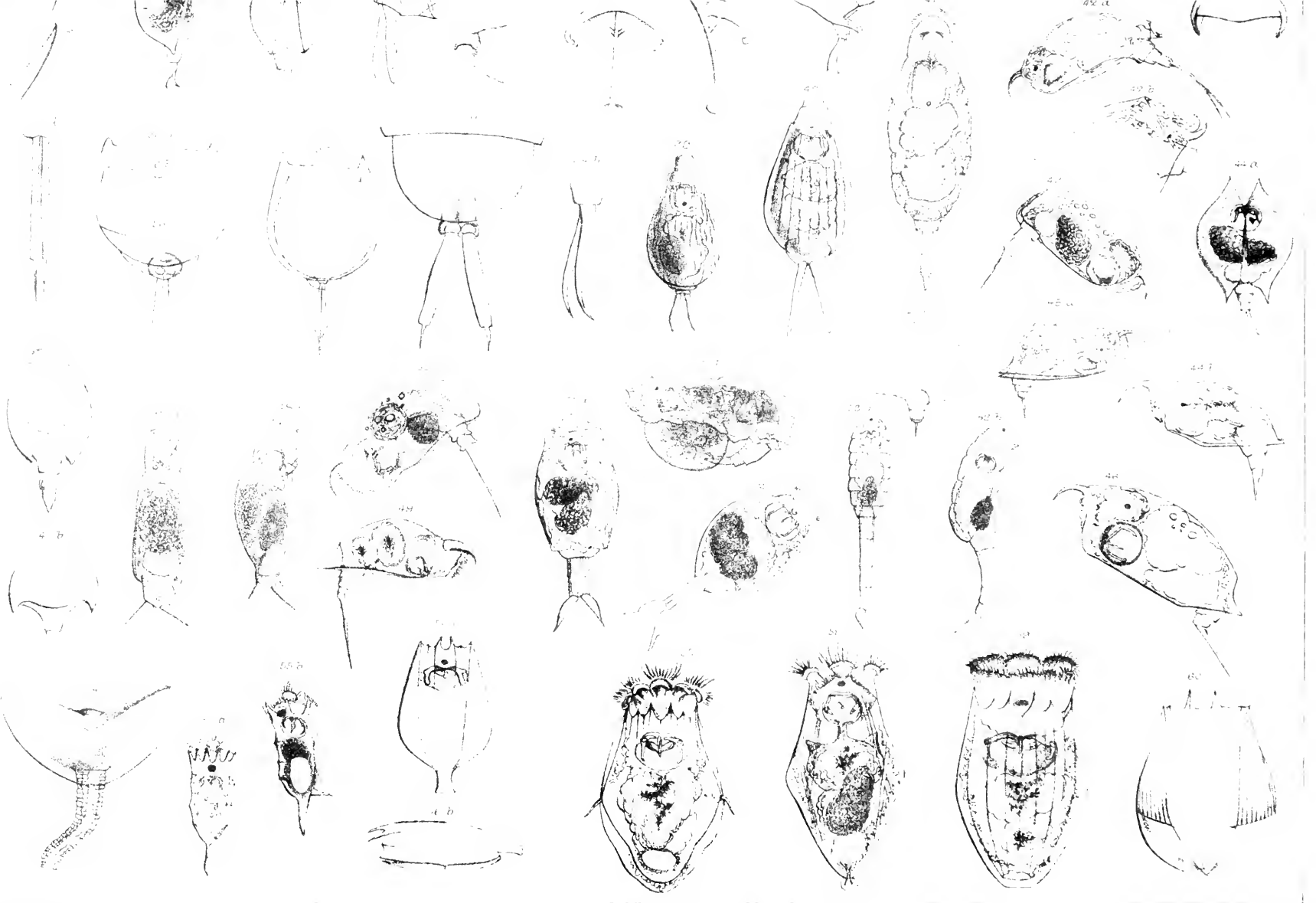
40. Distyla striata . . . . dorsal view.
41. Monostyla mollis . . . dorsal view.
42. Colurus dicentrus . . . *a*, lateral view; *b*, ditto, enlarged.
43. Colurus grallator . . . lateral view.
44. Colurus dumnonius . . . *a*, dorsal view; *b*, lateral.
45. Colurus micromela . . . *a*, lateral; *b*, transverse section.
46. Colurus leptus . . . . lateral view.
47. Metopidia pygmæa . . . *a*, dorsal view; *b*, transverse section.
48. Dispinthera capsa . . . *a*, dorsal view; *b*, lateral.
49. Monura bartonia . . . lateral view.
50. Monura loncheres . . . lateral view.
51. Mytilia pœcilops . . . *a*, dorsal view; *b*, lateral.
52. Mytilia teresa . . . . dorsal view.
53. Mytilia producta . . . *a*, dorsal view; *b*, lateral.
54. Pterodina reflexa . . . posterior view.
55. Anuræa schista . . . . *a*, dorsal view; *b*, lateral.
56. Notholca labis . . . . *a*, dorsal view; *b*, lateral.
57. Notholca spinifera . . . dorsal view.
58. Notholca rhomboidea . . dorsal view.
59. Notholca jugosa. . . . dorsal view.
60. Notholca polygona . . . dorsal view.

*** All these figures were drawn by Mr. Gosse to illustrate his three papers (169, 170, 171) in the *Journ. Roy. Micr. Soc.*, 1887.



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...dma, 2; Lilliana, 3; Asplanchna, 3; Synchaeta, 4; Taphrocampa, 5; Notommata, 6-8; Diglena, 9-12; Furcularia, 13-19.
...ta, 20-21; Stephanops, 22; Metopidia, 23-24; Diaschiza, 25-28; Salpina, 33; Euchlanis, 34; Dalyidia, 35; Cathypna, 36-38; Distyla, 39-40;
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PLATE XXXII.

1. Floscularia Millsii	expanded	Kellicott
2. Floscularia chimæra	ventral view	Thorpe
3. Megalotrocha semi-bullata	head: *a*, expanded; *b*, contracted	Thorpe
4. Limnias cornuella	*a*, group; *b*, head from above	Hudson
5. Discopus synaptæ	foot: *a*, lateral; *b*, ventral	Zelinka
6. Philodina macrostyla	coated with floccose: *a*, lateral view; *b*, foot showing four toes	Gosse
7. Philodina setifera	foot, above spurs, showing setæ	Schmarda
8. Rotifer elongatus	dorsal view	Weber
9. Rotifer trisecatus	dorsal view	Weber
10. Rotifer megaceros	foot, showing two pairs of spurs	Schmarda
11. Callidina aculeata	dorsal view	Milne
12. Callidina symbiotica	*a*, group in *Frullaria*; *b*, hinder extremity, lateral view; *c*, toes, dorsal	Zelinka
13. Asplanchnopus myrmeleo	*a*, female, lateral view	Hudson
„ „	*b*, male, lateral view	Western
14. Asplanchna Sieboldii	male	Leydig
15. Asplanchna intermedia	male, lateral view	Hudson
16. Triphylus lacustris	*a*, lateral view; *b*, mastax and trophi	Hudson
17. Copeus Ehrenbergii	dorsal view	Ehrenberg
18. Proales Werneckii	*a*, inhabited gall of *Vaucheria*; *b*, adult female, dorsal view; *c*, the same with gastric glands absorbed	Balbiani
19. Notommata onisciformis	dorsal view	Perty
20. Notommata torulosa	dorsal view	Cohn
21. Albertia vermiculus	dorsal view	Dujardin
22. Cystophthalmus Ehrenbergii	*a*, lateral view; *b*, jaws	Corda
23. Sacculus hyalinus	*a*, lateral view; *b*, *c*, eye	Kellicott
24. Sacculus saltans	obliquely ventral view	Bartsch
25. Sacculus germanicus	dorsal view	Leydig

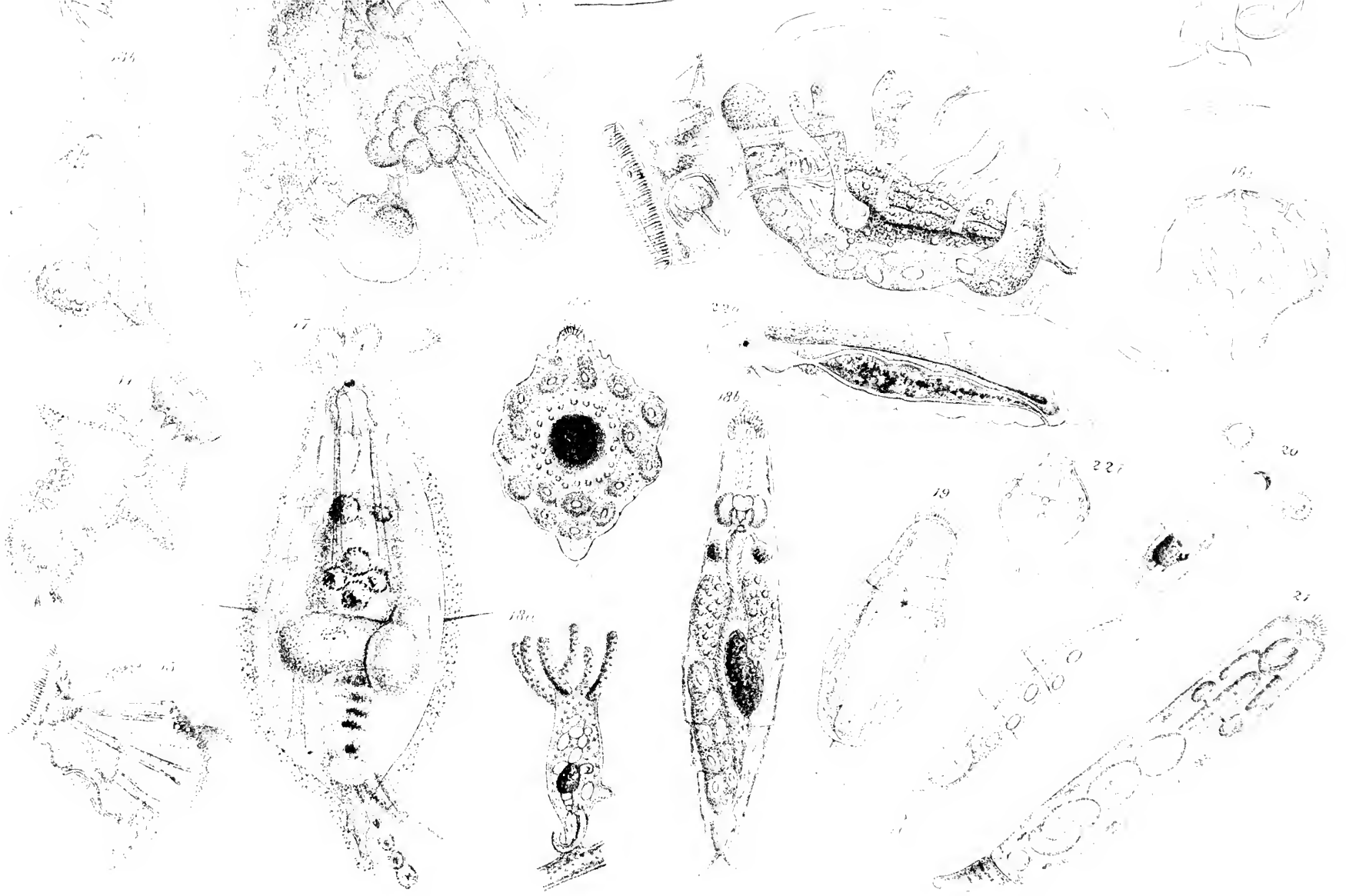

PLATE XXXIII.

1. Asplanchnopus myrmeleo	trophi, from above	Hudson
2. Asplanchna priodonta	trophi: *a*, from above; *b*, lateral view	Hudson
3. Asplanchna Krameri	trophi, from above	Kramer
4. Asplanchna Brightwellii	trophi, from above	Hudson
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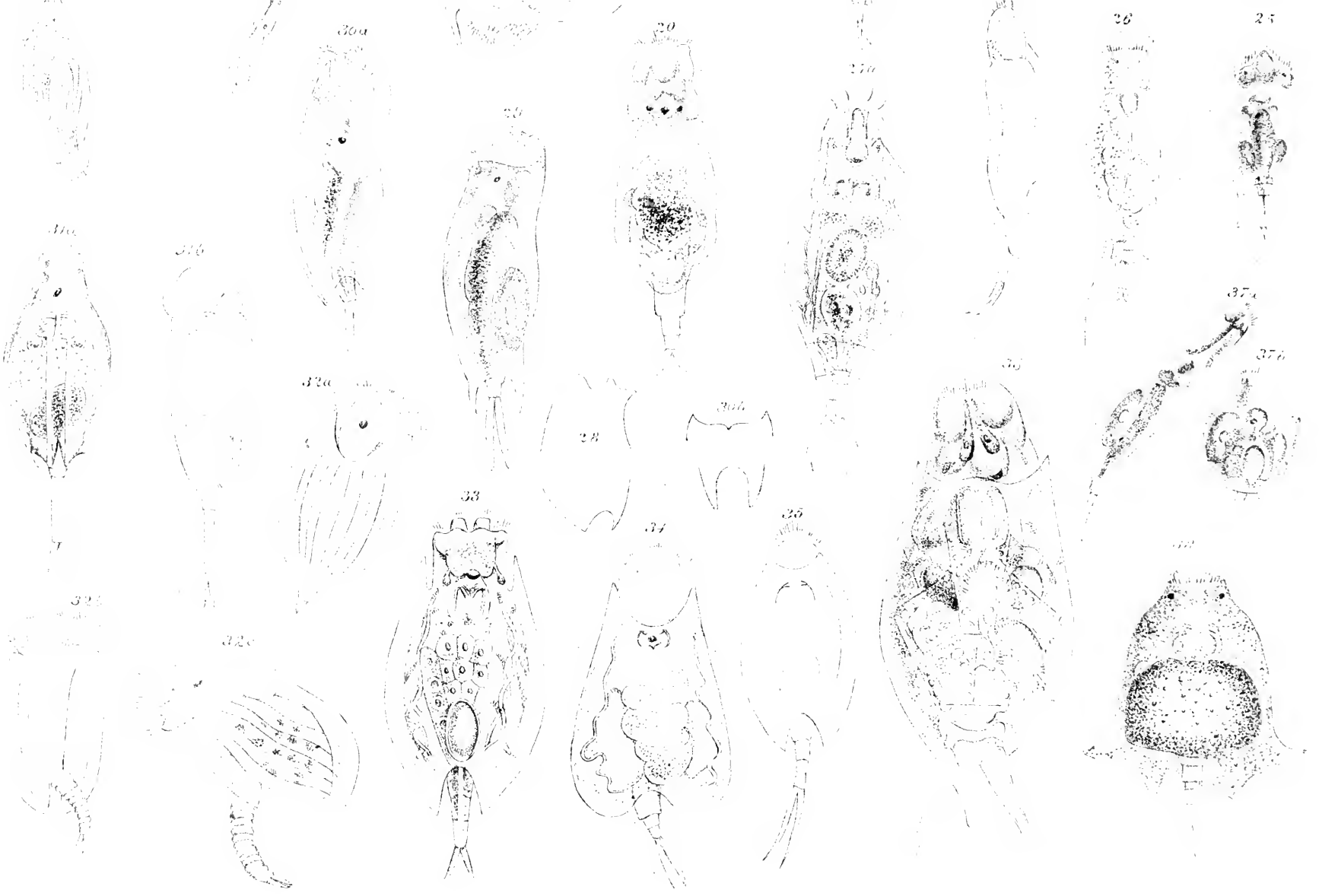
10. Eosphora digitata	dorsal view	Ehrenberg
11. Diglena conura	dorsal view	Ehrenberg
12. Diglena capitata	lateral view	Ehrenberg
13. Diglena uncinata	*a*, dorsal view; *b*, lateral	Milne
14. Diglena mustela	lateral view	Milne
15. Cycloglena lupus	dorsal view	Ehrenberg
16. Distemma marinum	dorsal view	Ehrenberg
17. Distemma forcipatum	dorsal view	Ehrenberg
18. Distemma setigerum	lateral view	Ehrenberg
19. Distemma forficula	lateral view	Ehrenberg
20. Triophthalmus dorsualis	dorsal view	Gosse
21. Mastigocerca cornuta	lateral view	Eyferth
22. Paraseison asplanchnus	lateral view	Plate
23. Stephanops armatus	dorsal view	Hood
24. Stephanops tripus	lateral view	Lord
25. Stephanops cirratus	dorsal view	Ehrenberg
26. Stephanops longispinatus	dorsal view	Tatem
27. Stephanops stylatus	*a*, dorsal view; *b*, latera	Milne
28. Salpina polyodonta	extremities of lorica, lateral view	Schmarda
29. Salpina ventralis	lateral view	Ehrenberg
30. Salpina bicarinata	*a*, lateral view; *b*, ventral ends of lorica	Ehrenberg
31. Euchlanis bicarinata	*a*, dorsal view; *b*, obliquely dorsal	Perty
32. Euchlanis (?) lynceus	*a*, dorsal view; *b*, lateral; *c*, ventral	Ehrenberg
33. Euchlanis pannonica	dorsal view	Bartsch
34. Euchlanis conica	dorsal view	Schmarda
35. Euchlanis Weissii	dorsal view	Eichwald
36. Distyla Ludwigii	ventral view	Eckstein
37. Distyla Hornemanni	*a*, dorsal, contracted; *b*, lateral, expanded	Ehrenberg
38. Notogonia Ehrenbergii	dorsal	Perty
39. A Rotiferon, with *rounded* toes, discovered by Mr. J. E. Lord (112)		Lord



ANCHISTUS, 1; CHROMOPLEURA, 2-7; EOSPHORA, 8-10; DIGLENA, 11-14; CYCLOGLENA, 15; PICTEMMA, 16-18; TRICHOTRIDA, 19; MACROCHAETUS, 20; PARADICRANOPHORUS, 21-22; STEPHANOPS, 23-27; SALPINA, 28-30; EUCHLANIS, 31-35; DISTYLA, 36-37; NOTOMMATA, 38

PLATE XXXIV.

1.	Floscularia coronetta (var.)	head, expanded	Poole
2.	Metopidia ovalis	*a*, dorsal view; *b*, ventral	Ehrenberg
3.	Metopidia cornuta	dorsal view	Schmarda
4.	Metopidia (?) salpina	*a*, dorsal view; *b*, ventral; *c*, lateral	Ehrenberg
5.	Metopidia oblonga	dorsal view	Ehrenberg
6.	Metopidia emarginata	dorsal view	Ehrenberg
7.	Monostyla closterocerca	dorsal view	Schmarda
8.	Furcularia gammari	lateral view	Plate
9.	Monura dulcis	lateral view	Ehrenberg
10.	Schizocerca diversicornis	ends of lorica, and foot	Daday
11.	Brachionus quadratus	lateral view	Rousselet
12.	„ „	dorsal view	Rousselet
13.	Brachionus polycerus	dorsal view	Schmarda
14.	Brachionus ancylognathus	dorsal view	Schmarda
15.	Brachionus latissimus	dorsal view	Schmarda
16.	Brachionus pustulatus	dorsal view	Schmarda
17.	Brachionus brevispinus	*a*, dorsal view; *b*, ends of lorica	Ehrenberg
18.	Brachionus inermis	dorsal view	Schmarda
19.	Brachionus Leydigii	dorsal view	Cohn
20.	Brachionus longipes	dorsal view	Schmarda
21.	Brachionus costulatus	dorsal view	Eichwald
22.	Brachionus Gleasonii	dorsal view	Vorce
23.	Brachionus militaris	*a*, ventral view	Cohn
	„ „	*b*, lorica, dorsal	Bryce
24.	Brachionus polyacanthus	*a*, dorsal view; *b*, anterior edges of lorica	Ehrenberg
25.	Brachionus budapestinensis	dorsal view	Daday
26.	Anuræa falculata	dorsal view	Ehrenberg
27.	Anuræa stipitata	*a*, dorsal view; *b*, anterior edges of lorica	Ehrenberg
28.	Anuræa squamula	*a*, dorsal view; *b*, anterior edges of lorica	Ehrenberg
29.	Anuræa quadridentata	dorsal view	Ehrenberg
30.	Anuræa valga	dorsal view	Ehrenberg
31.	Anuræa testudo	dorsal view	Ehrenberg
32.	Anuræa biremis	*a*, ventral view; *b*, anterior edges of lorica	Ehrenberg
33.	Notholca striata	dorsal view	Ehrenberg
34.	Notholca heptodon	dorsal view	Spencer
35.	Notholca foliacea	*a*, dorsal view; *b*, anterior edges of lorica	Ehrenberg
36.	Gomphogaster areolatus	*a*, dorsal view; *b*, ventral; *c*, lateral; *d*, from above; *e*, ditto, at the middle	Vorce
37.	Asplanchnopus syrinx	*a*, lateral view; *b*, trophi	Ehrenberg


27a
27b
20
25
30
30a
30
29a
29
22
31
31a
35a
30b
30c
32a
32b
33
34
37

THE ROTIFERA;

OR

WHEEL-ANIMALCULES.

BY

C. T. HUDSON, LL.D. CANTAB.

ASSISTED BY

P. H. GOSSE, F.R.S.

WITH ILLUSTRATIONS.

IN TWO VOLUMES.

TEXT.

LONDON:
LONGMANS, GREEN, AND CO.
1886.

Cæcam mihi in cunctis fidem haberi haud postulo; id tantum optans, ut continua indagatione ac studio mea aliquando confirmentur, aut me a vero aberrasse demonstretur. Perscrutatoris vel exactissimi, et quamvis summam adhibeat, attentionem fugere aliquando quædam possunt; et casus nonnunquam fortuito nobis offert, quæ intensissima sæpe cura frustra quæsivimus.—J. Baster.

C'est dans les livres de la Nature, qu'on doit lire, quand on veut travailler sur l'Histoire Naturelle; mais on ne peut pas y lire, quand on veut. Il faut des lieux, des saisons et des circonstances favorables pour faire des observations nécessaires. Quelques fois à la vérité on peut aider à faire naître des circonstances heureuses, mais plus souvent il faut que le hazard nous serve.—Réamur.

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PLATES.

LONDON:
LONGMANS, GREEN, AND CO.
1886.

Those viewless beings,
Whose mansion is the smallest particle
Of the impassive atmosphere,
Enjoy and live like man:
And the minutest throb,
That through their frame diffuses
The slightest, faintest motion,
Is fixed, and indispensable,
As the majestic laws
That rule yon rolling orbs.

SHELLEY.

Qui curiosus postulat totum suæ
Patere menti, ferre qui non sufficit
Mediocritatis conscientiam suæ,
Judex iniquus, æstimator est malus
Suique naturæque; nam rerum parens,
Libanda tantum quæ venit mortalibus,
Nos scire pauca, multa mirari jubet.

GROTIUS.