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X.—*Further Contribution to the Knowledge of the Family* Tintinnodea. By Dr. Hermann Fol*.

[Plate IV.]

A short memoir published two years ago† in this Journal gave an account of the results of my first observations upon the anatomy and classification of this interesting family of Infusoria. Since then another winter passed at Villafranca,

* Translated by W. S. Dallas, F.L.S., from the 'Bibliothèque Universelle: Archives des Sciences Physiques et Naturelles,' période 3, tome ix. p. 554 (15th June 1883).

Bibliographical Index.

X. R. E. Claparède, Beobachtungen &c. an der Küste von Normandie angestellt. Folio, Leipzig, 1863.

XI. Dr. V. Sterki, "*Tintinnus semiciliatus*, eine neue Infusorienart," Zeitschr. f. wiss. Zool. Bd. xxxii. p. 460, with one plate, 1879.

XII. H. Fol, "Contribution à la Connaissance de la famille des Tintinnodea," Arch. des Sci. phys. et nat. tome v. p. 5, January 1881. Translated in Ann. & Mag. Nat. Hist. ser. 5, vol. vii. p. 237.

XIII. Saville Kent, 'A Manual of the Infusoria,' part v. p. 624 *et seqq.*

XIV. C. M. Vorce, "Is it *Tintinnus*?," Amer. Monthly Micr. Journ. vol. ii. pp. 223, 224, 1881.

XV. O. Bütschli (Reporter), Zoologischer Jahresbericht, 1881, erste Abth. p. 151.

† See Ann. & Mag. Nat. Hist. ser. 5, vol. vii. p. 237.

in 1880–1881, has enabled me to resume this investigation at the point where I had left it, and to make a step in advance in the knowledge of the structure of these animalcula.

Some forms occurred which I had not previously met with. Some further details of structure were able to be elucidated. In the natural sciences method plays a principal part; but it is nowhere of greater importance than in microscopical researches: here the fitness of the investigator consists much less in any particular perspicacity than in the art of bringing into view the points that he wishes to know. Hence the employment of a new method has enabled me to see clearly many things which I had previously been unable to see, or which I had seen imperfectly and misunderstood.

I shall consequently have not only to describe new details, but also to rectify my former data in several particulars. The "Bibliographical Index" contains a memoir (XI.) which had previously escaped my notice, upon an Infusory allied to those described by me, as well as some publications, rather of a critical than a descriptive nature, which have appeared since I prepared the "Bibliographical Index" to my previous article ['Annals,' vol. vii. p. 250].

Method.—The collection of the Tintinnodea in the sea is an easy matter. There is no danger of damaging them at the moment of their capture, seeing that their test, into which they withdraw at the smallest sign of danger, sufficiently protects them. They are pretty robust, and swim briskly about in the bottles several hours after their capture, and at a time when many delicate animals are already dead or disfigured. It is not, however, at the surface of the sea or under a bright sun that we find them in the greatest abundance. In cloudy weather they rise to the surface more readily than in bright weather; and in the daytime they are found chiefly at a depth of several fathoms.

For their capture I employed a net of fine muslin of a conical form attached to a ring about 50 centim. in diameter. The bottom of the net presents a contracted opening, like that of a weel, which opens at the middle of a much smaller net made of silken sieve-cloth with very fine meshes. This latter is attached to a ring equilibrated by a fragment of cork. This net of silken gauze does not injure the animals at all; and it captures at least twice as many as the glass bottle which some naturalists substitute for it. It is easy to understand, in fact, that the impermeable walls of the bottle compel the water to turn in its interior, and cause eddies which carry out a considerable proportion of the captured animals.

With creatures so active and so difficult to observe alive

under a high power, it is of great importance to have a process which enables them to be fixed instantaneously in their natural attitude before they have had time to withdraw into their test, and which preserves faithfully the details of their structure.

I have tried the various reagents most in vogue without attaining my purpose. With weak osmic acid I did not succeed in preserving the cilia of the peristome; and with a stronger dose the body became absolutely opaque: in both cases there was always a strong contraction. Acetic acid, chromic acid, and picrosulphuric acid only gave me a fixation which was too slow, so that the animal died contracted in the bottom of its test. Finally I succeeded with a reagent which is not employed in histology, perchloride of iron; by its means I have obtained a considerable number of specimens of various species fixed in a state of full expansion. These subjects, washed with alcohol, and treated with gallic acid, present a brown coloration which is especially localized upon the nuclei and renders them very visible; the other parts of the animal acquire a light brown tint, which renders them easy to see.

The specimens thus treated may be mounted in Canada balsam, which produces permanent preparations; but they are much more distinct and more instructive if simply placed in glycerine.

By treating in the manner just indicated the whole produce of a capture we can afterwards, on returning home, seek at leisure for the Infusoria, a more or less considerable number of which will be fixed in a state of full extension of the body and peristome, with the cilia and the vibratile palettes preserved in perfection.

Anatomy.—The structure of the test is more complete in certain forms, and presents more difference between the forms than I previously supposed. Tests slightly tinged with gallic acid and mounted in balsam or in glycerine are especially instructive. By compressing the test a little we obtain at the margins perfectly distinct optical sections.

Examined under these conditions with a good homogeneous immersion-lens, the tests of the *Tintinni* prove to be composed of two very distinct layers, as I previously indicated (XII. p. 12 [242]); but what I did not see in fresh preparations is that the layers are symmetrically placed, one at the inner, the other at the outer surface, and separated by a vacant space (Pl. IV. fig. 7). The substance of the test, browned by gallic acid, shows very clearly these two parallel layers, apparently of the same thickness throughout their whole extent.

In *Tintinnus ampulla* this thickness is 0·8 μ. The space which separates these two laminæ is a little thinner than the laminæ themselves, and is divided by a number of little secondary partitions which pass from one lamina to the other. The arrangement of these lamellæ varies according to the species and produces the design which characterizes the test of each species. At the free margin of the test the two laminæ unite by bending round and form only one.

In the genus *Cyttarocylis* the general arrangement is the same, but the laminæ are more separated and the partitions less numerous and stronger, leaving more apparent alveolar spaces (Pl. IV. fig. 10).

Dictyocysta, besides these alveoli, presents perforations of the whole wall.

Lastly, in *Coniocylis*, which I now think may be united with the genus *Codonella*, the wall is simple, of variable and irregular thickness, and incrusted with foreign bodies.

Hence there are no profound differences except between the agglutinant tests with massive walls and the tests with double walls united by little septa. The latter only differ among themselves by the number and arrangement of the septa; the fundamental structure remains the same. I previously (XII. pp. 18, 22 [245, 248]) described the alveolate tests as formed of a sort of trellis, closed only on one side by a continuous membrane. This statement must be corrected in this respect, that the alveoli are found in all parts and enclosed between two continuous membranes.

The animals preserved by the method indicated show clearly various details of structure which escaped me in the animals treated by the usaul methods. In gallic acid the nucleus acquires a dark brown tint, which enables it to be distinguished at the first glance. In *Tintinnus ampulla* and *T. spiralis*, the only two species of the genus that I have met with this time, I have never seen more than a single nucleus, which was of considerable size, and placed either near the middle of the body or further back and towards the peduncle. In my preparations I have also met with many individuals in which I could discover no element of this kind; it is so easy to see when it exists that I incline to believe that in certain phases of existence it is really absent or profoundly modified. In *Tintinnus ampulla* the nucleus is oval, and measures as much as 50 μ in its greatest diameter (see Pl. IV. fig. 7). It is formed by a thick superficial layer, which remains homogeneous in the reagents employed (perchloride of iron, alcohol, and gallic acid), and acquires a uniform brown tint. I have been unable to detect any distinct membrane at its surface.

This layer surrounds a rounded cavity 28 μ in diameter, filled chiefly with a granular matter; we distinguish in it comparatively large granules, which acquire a very dark brown colour and are enclosed in an irregular finely punctate mass.

I have not met with this structure in the nuclei of the other species; but I do not for that reason assert that it is a specific character; I should rather incline to think that this state of the nucleus answers to one of the phases of the existence of our animals. I regret much that I did not this time meet with conjugated individuals; suitably prepared they would have furnished valuable information as to the function of the nuclei during that act.

The sarcode of the body appears to be simply granular, without organization; and, in particular, I have sought in vain for indications of striation or of layers of myoplasm*.

The oral disk and its singular structure particularly attracted my attention this time also; and by means of perfect preparations as regards fixation and preservation I have been able to examine the vibratile circlet at my leisure and under the highest powers. The results obtained differ considerably from those which were furnished by the laborious observation of living animals.

The general arrangement of the vibratile lines is indeed as I indicated; they are curved lines, about twenty in number, which start from the margin and terminate in the interior of the circle. But these lines are only in part formed by isolated cilia; the outer portion of each vibratile line is composed of pretty broad vibratile lamellæ. These lamellæ are slashed at the free margin and divided into filaments; they undulate in the living animal in such a manner as to give exactly the same image as a row of cilia beating one after the other. This appearance, together with the existence of isolated cilia detached from the margin of the lamellæ, led me into an error, but an error the more excusable because the lamellæ occupy only the margin of the disk, and a series of gradually shortening cilia exists upon the line of each palette.

These undulating palettes acquired such distinct contours in perchloride of iron and gallic acid, that without the observation of the living animal one would think one had to do with cuticular products (Pl. IV. fig. 7). The width of the palettes, moreover, is very variable, according to the genera

* In speaking of the absence of striation in the peduncle of the body, a striation which, on the contrary, appears in the peduncle of the *Vorticellæ*, I have used the term "transverse striation." This is a *lapsus calami* which Bütschli has justly pointed out (XV. p. 151); it was of the longitudinal striation that I intended to speak.

and species; and I have remarked that when the palettes are narrow, several large cilia are placed in a row following them. It is therefore very possible that the palettes are to be regarded as representing a series of cilia soldered together. They are not rigid in any of their parts, but absolutely protoplasmic and contractile throughout their whole extent.

Häckel (IX. p. 564, and figs. 8–11) describes his genus *Codonella* as possessing similar vibratile organs; but he represents them as irregular shreds arranged upon the edge of a membrane. I have now observed a form very probably identical with that described by the above distinguished zoologist; and I think I can assert that his interpretation is not correct. In this animal the vibratile lamellæ are narrow; but they have the same general arrangement as in the other Tintinnodea, and are placed upon lines curved into portions of a spiral. Their lateral margins are nearly straight; and their outer margin is divided into cilia. A small number of independent cilia complete the spiral line commenced by each of the undulating palettes. There is consequently nothing in the structure of the vibratile circlet of the *Codonellæ* which justifies their separation as a distinct family from the other Tintinnodea. Moreover these palettes are much wider and more apparent in *Cyttarocylis cassis* than in *Codonella*. Häckel represents that species as possessing in all only two rows of cilia; if he had seen the palettes, as he saw the much smaller ones of *Codonella*, he certainly would not have placed these animals in distinct families.

I had already concluded my study of the anatomy of these Infusoria, and in particular of their vibratile circlet, when by chance I met with an article by Dr. V. Sterki (XI.)—an article anterior to my first memoir, but which was completely unknown to me. I had the pleasure of finding in it a description entirely conformable with my corrected ideas as to the structure of the ciliary circlet. It is therefore to Sterki that belongs the most incontestable priority upon this point; for Häckel's description cannot be regarded as sufficiently exact.

Sterki's description is also interesting in that it makes known to us a freshwater form, of which the structure is the same as that of the marine species, and which shows that the family Tintinnodea is not confined to salt water. This fact will assist us in judging of Sterki's statements (VIII.) which I have already criticised, and especially of certain synonyms which have been very uselessly introduced (XIII.).

As I have already stated, the vibratile lines include both palettes and independent cilia. These cilia are placed in part

within and in part outside of the palettes; the palette being placed on the summit of the edge of the peristome, the cilia are implanted running downwards from it. Those which are outside the peristome are generally strong and nearly as long as the palettes. I have never found more than a single circlet of cilia in this position; it is this that Häckel has represented in his *Codonella* (fig. 8), but giving them an exaggerated length. According to Sterki (XI.) the freshwater *Tintinnus semiciliatus* has several circlets of cilia in this position, descending pretty low down upon the sides of the body. The cilia placed in the interior of the peristome are short and thick, becoming shorter as they approach the middle of the disk.

I have been unable to discover, in any of the species that I have observed, the coating of fine cilia which, according to Claparède and Lachmann and Häckel, covers the outer surface of the body in certain species. I believe I have met with *the same two species* to which the latter ascribes these cilia in his text and in his figures; and I have ascertained that *these cilia do not exist.*

On the other hand, in some species I have met with a structure which I have not satisfactorily succeeded in rendering evident. This is a membrane which proceeds from the body of the animal, being inserted a little below the peristome, and passing thence to the test, to which it is attached along a circular line which occupies about the upper third of the latter. I only infer the existence of this membrane from some images furnished by animals treated with reagents, and in which, moreover, this structure is but rarely preserved; I possess only a single observation made during life, namely upon *Codonella galea.* However, I must add that the images did not appear to me sufficiently clear to be definitely established, and it is a point that I only mention to call the attention of investigators to it. It seemed to me that this membrane is sufficiently ample to permit the complete extension of the animal, and that in the retracted state of the latter it folds in the manner of an Indian-rubber tobacco-pouch, thus completely closing the access to the inner part of the test (see Pl. IV. fig. 14).

In *Codonella ventricosa* (Pl. IV. fig. 12) the free margin of the test is produced into a flexible membranous portion, which opens, in the state of extension, after the fashion of a straight neck, whilst it closes completely when the animal withdraws itself to the bottom of its test, forming a diaphragm over the orifice of the latter. The mechanism by which the animal in retracting itself produces this occlusion can only

be understood if we assume the existence of a delicate membrane starting from this flexible border to become attached around the peristome. I have not seen this membrane; but its existence seems to me probable for the reasons indicated, and by analogy with the species in which the test, being more transparent, has allowed me to see a membrane at the spot indicated.

In *Cyttarocylis cistellula* the margin of the test of adult specimens is also occupied by a prolongation which is less flexible than that of *Codonella ventricosa*, and is generally inclined from without inwards (Pl. IV. fig. 8). It does not appear that this border can shut up completely; and therefore it will only act as a partial diaphragm.

Together with certain common points of structure, the Tintinnodea therefore present a great variety in details, and we must expect in course of time to find a great diversity of forms. Thus, for a few days only, I met with a considerable number of specimens of a species which will be described further on, and which has the habit of attaching its agglutinant test to floating Algæ, which the animal carries about with it.

We know that certain forms which appear to be useful in the struggle for existence are often realized by very different animals and by very diverse means, although the final result may be very similar from the physiological point of view. The Ichthyosaur and the Cachalot, the Pterodactyle, the bird, and the bat are striking examples of this convergence of characters by adaptation. Among marine animals I have shown* that the *Doliolum* of the second generation, with its two kinds of buds, behaves like a Siphonophore, the zoœcium being formed of a locomotive individual comparable to the bells of a *Diphyes*, and of feeding individuals or gasterozooids which nourish the whole colony.

Another of these very frequent forms is that of very slender pelagic animals moved by palettes or cilia placed in the middle of their length. The larvæ of the Zoëa-form of certain Decapod Crustacea are a well-known example of this animal form, which may very well be compared to the boats which are used in rowing matches. The great length has no injurious effect upon the rapidity of natation, just the contrary; but it renders all displacement which does not take place in the direction of the longitudinal axis very difficult. However, the animals which possess this external form have a

* Société de Physique et d'Histoire naturelle de Genève, "Sur la nutrition et la reproduction du genre *Doliolum*, communication faite en 1875;" and "Ueber die Schleimdrüse oder den Endostyl der Tunicaten," Morphol. Jahrb. Bd. i. p. 222 (1875).

faculty which makes up for their want of the power of turning; they have the faculty of swimming backwards as fast and as readily as forwards; and, moreover, they can instantaneously change the direction of their course. The long processes with which they are provided, by striking against foreign bodies, warn the animal of danger, and enable it in good time to effect a precipitate retreat. This singular form is realized not only by the Zoëæ which I have just mentioned, but also by a new Infusorian of the family Tintinnodea. In fact this curious species has the habit of applying its test laterally against the cylindrical cells of an Alga furnished with long processes, which, although foreign to the animal, appear nevertheless to fulfil exactly the same functions as the processes of the carapace of the Zoëæ. Each of the cells of this Alga bears a large process directed forwards, another directed backwards, and shorter lateral processes, between which the Infusorian attaches its test (Pl. IV. fig. 15). The number of Algal cells that the *Tintinnus* transports with it varies from one to four.

The *Tintinni* swim with the aperture of the test in front, and have not at all the habit of moving in the opposite direction; if they do so, it is only exceptionally and for a very short time. Our species, on the contrary, swims just as readily in one direction as in the other; and when the anterior point of the Alga meets with a foreign body, the animalcule takes to flight backwards as quickly as it had advanced.

Another example of convergence of types by adaptation is furnished by an Infusorian the description of which I have been unable to find in any author, although the species is not rare. The aborescent colonies of this Vorticellidan float in the sea; and if one touches them, they contract after the fashion of a Medusa, producing a movement of propulsion of the whole colony.

Classification.—In the still imperfect state of our knowledge of this group I think it most prudent to continue to take the characters of the test as the basis of classification; and I consider myself the more authorized to act thus because the differences of the anatomical characters appeared to me to coincide with the sections that we obtain by taking into account only the test.

Genus I. Tintinnus, Schrank.

Diagn. emend. Test smooth, firm, chitinous, transparent, composed of two lamellæ united by septa which are not very

regular and are placed very close together. A single nucleus in the posterior part of the body. Vibratile lamellæ of the peristome broad, and followed by a considerable number of independent cilia. A circlet of cilia outside the circlet of undulatory lamellæ.

Tintinnus ampulla, auctt. (Pl. IV. fig. 7.)

The inner lamina of the test forms two circular folds at the part where the contours change their direction. The undulatory lamellæ are more powerful in this species than in any of those which I have observed. The vibratile cilia which are implanted in the walls of the œsophagus are particularly powerful and easy to see. The test measures 0·11 millim. in length and 0·1 millim. in breadth. The numbers previously given were erroneous.

Tintinnus spiralis, auctt.

The dimensions that I have indicated for the test in my previous article were not correct, in consequence of an error in the calculation of the magnifying-power. The length of the test is only 0·312 millim. instead of 0·4 millim., and its width at the aperture is 0·068 millim. instead of 0·09 millim.

The two lamellæ of the test are perfectly distinct and united to each other by somewhat irregular septa, which, however, are in general directed from the front backwards with a spiral twist. It is these septa that I formerly described as simple striæ. Between the septa there are longitudinal rows of small points, which are only the optical sections of small pillars passing from one lamina to the other. At the free margin of the test the two laminæ separate a little from one another, thus leaving between them a wider space than elsewhere. Externally the margin of the test is enlarged into a sort of rib, while internally it is regularly cylindrical. The hollow rib is therefore formed by the separation of the outer lamina. The margin itself is hollowed by a furrow produced by a folding of the wall of the test at the spot where the outer lamina passes into the inner one ; this circular fold therefore projects into the cavity of the rib, which it diminishes to this extent.

The peristome bears a circlet of undulatory palettes, which I formerly took for isolated cilia. Outside of these palettes it appeared to me that there was only one independent cilium to each spiral series ; while within there are several cilia gradually becoming shorter. My specimens, fixed by perchloride of iron and coloured by gallic acid, present a single oval

nucleus, situated laterally against the wall of the body, on the side opposite to that where the buccal aperture is placed, nearly in the middle of the length of the body.

Genus II. Cyttarocylis, auctt.

Diagn. emend. Test smooth, firm, transparent, composed of two lamellæ separated by a space at least twice as great as the thickness of each of the lamellæ. This space is divided by very regular septa into a number of small polygonal alveoli, which give the test a trellis-like aspect.

Peristome fringed with undulatory palettes narrower than in *Tintinnus*.

Cyttarocylis cassis.

(*Dictyocysta cassis*, Häck.)

Several hardened specimens presented an oval nucleus, situated about the middle of the length of the body. Fig. 10, Pl. IV. shows the edge of the test, with its septa and its two lamellæ in optical section. The length of the test is 0·22 millim., and its greatest width 0·132 millim.

Cyttarocylis cistellula, sp. n. (Pl. IV. fig. 8.)

The test is rounded, ovoid towards the bottom, while the upper part widens in the form of a funnel. Upon the edge of the funnel there is a membranous portion directed inwards. This membranous portion encloses a pretty wide sinus, and consists of a very delicate and very flexible membranous outer wall, and of an inner wall which forms the continuation of the inner lamina of the shell.

The cells enclosed between the two laminæ of the test and bounded by the little septa of polygonal form are of nearly equal size, except a certain number of cells placed as a zone around the widest part of the test, which are three or four times as large as the other cells. The small cells (I do not employ the word in its histological sense) are, on the average, 3 μ in diameter; the largest ones are as much as 9 μ wide. The length of the test, including the membranous border, attains 0·1 millim.; its greatest width is 0·07 millim. The animal differs but little from that of *C. cassis*.

I met with this species at Villafranca, where it was rather rare during the winter of 1880–81.

Genus III. Dictyocysta, Ehrbg.

Test formed of two lamellæ with septa as in *Cyttarocylis*, but also presenting true apertures; fenestræ wider than the internal cells of the test.

Dictyocysta templum, Häck. (Pl. IV. fig. 9.)

I think I can identify the species I met with at Villafranca with that of which Häckel has given a figure, notwithstanding the more rounded form of the apex of the test, and notwithstanding some differences attributable to errors of drawing. The test in structure much resembles those of the genus *Cyttarocylis*, except that the large fenestræ of the margin and those placed around the widest part of the test are really perforated. I ascertained this fact by placing the test in a drop of glycerine charged with suspended particles, and causing the liquid to flow by means of pressure upon the covering-glass. I then saw the particles pass through the fenestræ, while the experiment has always given me negative results in the case of the large cells of the test of *Cyttarocylis*.

The animal seemed to me to differ very little from that of the latter genus.

This species, the only one of the genus that I have found at Villafranca, only occurred in small numbers.

Genus IV. Codonella, Häck.

(*Coniocylis*, mihi.)

I think I am now sure of the identity of one of the species that I have described under the name of *Coniocylis* with one of Häckel's *Codonellæ*. The diagnosis of the latter, it is true, is defective, since it is based upon a misunderstood character, which, moreover, is common to the rest of the Tintinnodea. Nevertheless I prefer to retain the name proposed by the above-named author, since that name has the advantage of priority. The following is the new diagnosis of this genus:—

Test formed of a single lamina, uneven, embossed or striate, agglutinant, more or less incrusted with foreign bodies. Animal furnished at the peristome with narrow undulatory lamellæ, and possessing two nuclei.

Codonella campanula. (Pl. IV. fig. 11.)

(*Tintinnus campanula*, Ehrbg.; *T. campanula*, Clap. & Lachm.; *Codonella campanella*, Häck.; *Coniocylis campanula*, mihi.)

I think I may identify this species with the one figured

and described by Häckel, notwithstanding the few differences that will be remarked in the form and proportions of the test, because I have now arrived at a certainty that Häckel's drawings were made rather carelessly, and must not be taken "au pied de la lettre."

The two nuclei are placed in the hinder part of the body and attached to the two opposite walls. One of them is generally placed a little behind the other.

I profit by this opportunity to rectify my previous statements as to the dimensions of the test of this species. The length of this test reaches 0·16, and its width at the orifice 0·1 millim.

Codonella ventricosa. (Pl. IV. fig. 12.)

(*Tintinnus ventricosus*, Clap. & Lachm.)

The test is much thicker than that of *C. campanula*, and strongly incrusted with small granules of very unequal size. The constricted edge is smooth; and it is upon this non-incrusted part that the flexible membrane is implanted. The smooth zone resembles a cravat, and the membrane a straight collar rising above it. The figure represents this membrane slightly folded. When the animal expands, the membrane becomes elevated in a cylindrical form; when the animal withdraws to the bottom of its test, the membrane folds inwards and completely closes the entrance to the test. This membrane is incrusted with little brilliant elongated bodies, all directed perpendicularly to the edge of the membrane. The test is 0·075 millim. in length to the base of the membrane, which is 0·015 millim. wide. The greatest width of the test is 0·07 millim.

The animal presents two nuclei placed at the same level towards the middle of the body against the walls.

I found this species in very great abundance at Villafranca.

Codonella nucula, sp. n. (Pl. IV. fig. 13.)

This species much resembles the preceding, except as regards its dimensions. The incrusting bodies are a little more scattered, and the flexible membrane is relatively wider. The length of the test alone is 0·04 millim., that of the membrane 0·015 millim., and the greatest width of the test 0·033 millim.

One might be tempted to take this form for a young state of the preceding species, if it were not that, notwithstanding the great abundance in which these two species occur, intermediate forms are entirely wanting. Moreover I have never,

in any species of Tintinnodea, met with smaller and larger tests, which proves that the test is produced of its definitive dimensions from the first, whatever may be the size of the animal secreting it.

The *Tintinnus Ehrenbergii* described by Claparède (X. p. 1) indeed appears to continue to enlarge its test after having secreted it; but this growth is obtained by the addition of rings, which are not in continuity of form with the first portion of the test.

Codonella galea, Häck. (Pl. IV. fig. 14.)

Although the form and the mode of incrustation of the test do not absolutely agree with Häckel's figures, I think I may identify this species with that of the author cited, and this for reasons already indicated in connexion with *Codonella campanula*.

The test is strongly incrusted with large flattened granules, which nearly all touch each other at their edges. The total length of the test is 0·08 millim., its greatest width is 0·06 millim.; its entrance at the level of the constriction may be closed when the animal retracts itself by a folded membrane, which I have indicated in the figure. The folds meet in such a manner that the central point forms a pointed projection.

I abstain from classing and giving a name to the Infusorian which I have found attached to the algæ (Pl. IV. fig. 15), the observation of the living animal not having furnished me with sufficient information as to the structure of the vibratile circlet and of the test, and the specimens which I had preserved for examination having been destroyed by an accident. It seems probable, however, that this form is allied to the *Codonellæ*. In most of the specimens that I have met with the apex of the test was broken, so that the test was open at both ends; but this injury does not seem to be the least inconvenience to the animal.

It results from the facts that I have just cited that the organization of the Tintinnodea is not much varied, and that nothing can justify the separation of the genera at present known into several families. I have previously indicated what are my motives for retaining the above name for the whole family. Sterki's memoir is particularly interesting as showing us that the freshwater forms do not differ in their organization from the marine forms, and that there is no

plausible reason for reserving this family name for a hypothetical type founded upon defective descriptions. This, however, is what has been done by Saville Kent (XIII. p. 624), who gives the name of Dictyocystidæ to the Tintinnodea, and suppresses the former name because he has not found animals to which he could apply it. The Dictyocystidæ of Saville Kent are simply a synonym of the Tintinnodea of Claparède and Lachmann, a synonym which we may simply set on one side, since the priority belongs incontestably to the name that I have adopted.

This applies also to the genus *Petalotricha*, which Saville Kent seeks to substitute for the name of *Tintinnus*. Here, again, he seems to reserve this latter name for hypothetical animals. It would be superfluous to combat a prejudice; it suffices to demonstrate it.

The families Dictyocystidæ and Codonellidæ, as Häckel has established them, have a better claim on our attention; for these are not simple synonyms. These families are founded upon anatomical differences; and it remains only to learn whether these differences are real or whether they are not rather based upon insufficient observations. I pronounce without any hesitation for the latter alternative. The preceding pages show that the organization of our Infusoria does not vary much, and that even in the arrangement of the peristome, upon which Häckel founded his distinctions, there does not exist any difference sufficient to justify their separation into several families. The genus *Codonella* is the only one that presents well-marked characters, not in its peristome, but in the structure of its test and in the presence of two nuclei at the hinder part of its body. Have these differences more than a generic value? I do not think so, and I regard all the Tintinnodea known at the present day as forming a single tribe and a single family. As regards the position of this family relatively to the peritrichous Infusoria I have already given my opinion, an opinion which my later researches have only confirmed and still more strongly accentuated.

EXPLANATION OF PLATE IV.

Fig. 7. *Tintinnus ampulla*, treated with perchloride of iron and gallic acid and mounted in Canada balsam. × 420.

Fig. 8. *Cyttarocylis cistellula*, the test treated with perchloride of iron and gallic acid and preserved in balsam. × 420.

Fig. 9. *Dictyocysta templum*, the test treated like the preceding. × 420.

Fig. 10. Upper portion of the test, seen in optical section; treated with perchloride of iron, gallic acid, and Canada balsam. × 420.

Fig. 11. *Codonella campanula.* The body and a part of the test; same treatment: × 420.
Fig. 12. *Codonella ventricosa.* Same treatment and same enlargement.
Fig. 13. *Codonella mucula.* Same treatment and enlargement.
Fig. 14. *Codonella galea,* drawn from the living animal. × 420.
Fig. 15. New Tintinnodean, drawn from the life and × 360. The correctness of this figure is not guaranteed as regards the ciliary circlet of the peristome, which could only be studied upon living animals.

XI.—*Descriptions of some new Genera and Species of* Curculionidæ, *mostly Asiatic.*—Part II. By Francis P. Pascoe.

Otiorhynchinæ.

Isomerinthus interruptus.
Gynaria, n. g.
—— nasuta.

Leptopinæ.

Stenocorynus vexatus.

Attelabinæ.

Attelabus corallipes.
—— indigaceus.
Apoderus macropus.

Balaninæ.

Balaninus luctuosus.
—— galbula.
—— cinereus.
—— cuneipennis.
—— productus.

Cioninæ.

Cionus obesus.
Nanophyes finitus.
—— concretus.
—— tarsalis.

Ithyporinæ.

Byrsia, n. g.
—— cerata.

Cryptorhynchinæ.

Acacallis n. g.
—— personata.
Miocalles, n. g.
—— notatus.
Diphilus, n. g.
—— squamosus.
Dipaltosternus Fairmairei.
Osaces, n. g.
—— naso.

Isorhynchinæ.

Telephae propola.

Zygopinæ.

Asytesta antica.

Baridinæ.

Acythopeus luxatus.

Calandrinæ.

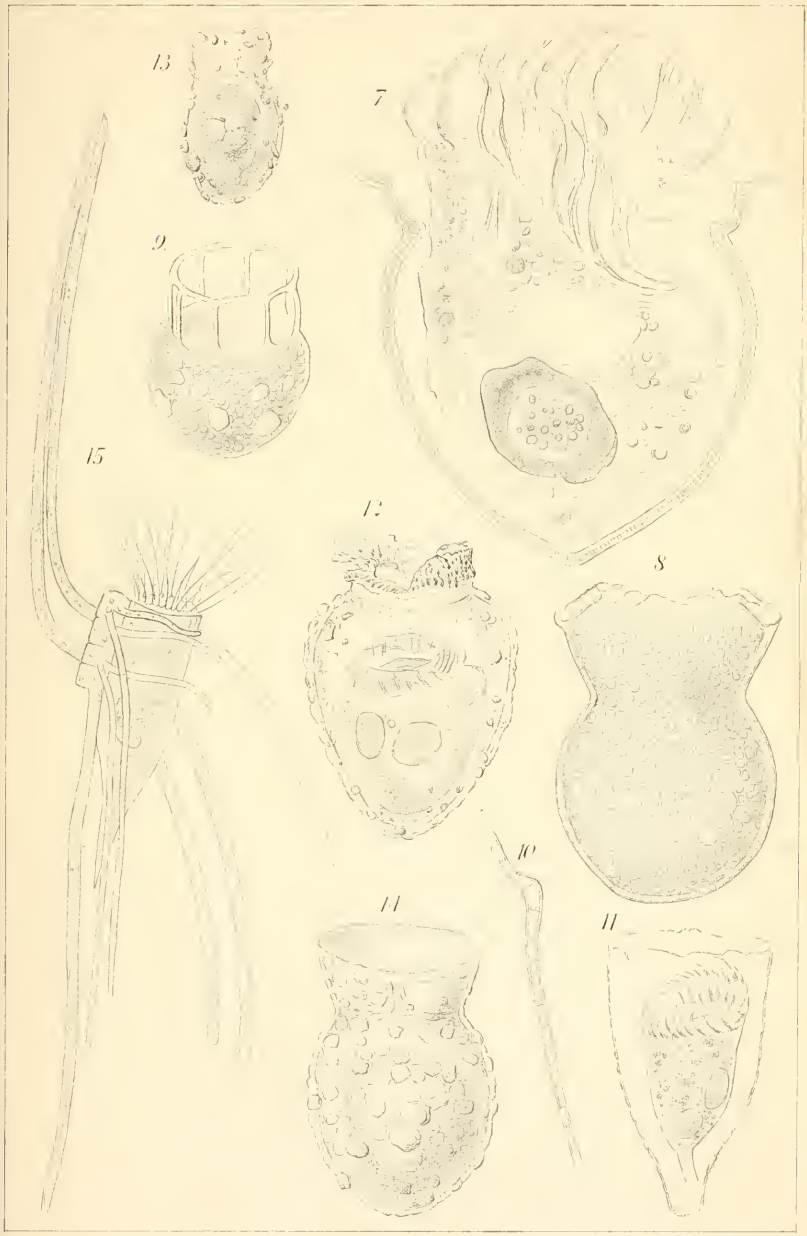
Eugnoristus niger.

Isomerinthus interruptus.

I. ovatus, rufo-fuscus; prothorace elytrisque vittis albidis, his in medio interruptis, ornatis; pedibus testaceis, parce squamosis. Long. $2\frac{1}{2}$ lin.

Hab. Fiji.

Ovate, reddish brown or chocolate-coloured, with stripes of white scales; rostrum short, scaly, head behind the eyes ob-



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