IX.—*British Enchytræids.*

By The Rev. Hilderic Friend, F.R.M.S.

(*Read March* 19, 1913.)

V. *Species New to Science.*

Aided by a Government grant, it has been possible for me during the past year to add greatly to our knowledge of this large and interesting group of microscopic Annelids. It is my purpose, in the present contribution, to describe a few of the species which have been discovered by me in different parts of the country. They are all new to Britain, and as far as I have been able to ascertain, new to science as well. While the bulk of the species belong to genera which have been for some time recognized by our leading systematists, it is pleasing to be able to record the discovery of an indigenous Enchytræid which differs in many important particulars from all the previously known generic types, and this must be for the present regarded as establishing a new genus, which makes a revision of the entire family-characters necessary. The new worm is a true Enchytræid, as we understand that term; but, in order the better to appreciate its place in the family, some preliminary observations on the group in general will be of service.

I.—Enchytræid Characters.

Beddard (*1*)* gave us in 1895 some valuable information on the family, summarizing the studies of such well-known authorities as Claparède, Ude, Vejdovsky, Eisen, and Michaelsen, and in particular adopting the conclusions of the latter writer. In general, we may say that "all the Enchytræidæ have a prostomium; in most there is a single pore upon the prostomium," or between the prostomium and the first segment, represented fractionally by recent writers as 0/1, while in a few forms, chiefly belonging to the genus *Fridericia*, there are dorsal pores as well. Though setæ are entirely wanting in the genus *Anachæta*, there are 4 bundles in each segment in all the other British genera as yet discovered. These are never cleft or forked at the extremity, but are liable to considerable variation in shape, size, number, and arrangement.

The nephridia in this family have a characteristic form. They

* The figures within brackets refer to the Bibliography at the end of the paper.

frequently begin in segments 4–5, and may even be found in the second segment, but do not, as a rule, occur in those segments which have organs of generation. The earlier views on this subject are, however, somewhat modified by the fuller knowledge acquired during recent years. One of the characteristics of the family as hitherto known was based on the position of the reproductive organs. The testes, as a rule, are found in the 11th segment and the ovaries in the 12th. The girdle usually occupies the 12th segment, and it is here that the sperm-ducts open by a reduced spermiducal gland. Usually the duct is more or less elongated, regularly or irregularly coiled, and attached to a funnel whose size and form are very variable and supply admirable species-characters.

Finally the spermathecæ, which are with one exception (*Henlea puteana*) limited to a single pair, are found to open in the furrow between the fourth and fifth segments, and are usually attached to the intestine. These spermathecæ may consist of a simple sac, lying in the cœlom, or a tube; but frequently they possess an ampulla, a number of diverticula, or specialized glands, all of which are of value to the systematist.

In 1895 Michaelsen recognized twelve genera. Beddard did the same, but the two lists differed slightly in their components. In 1900 Michaelsen (*2*) made out thirteen genera, and to this list Bretscher (*5*) has since added a fourteenth, named *Hydrenchytræus*. Of these fourteen genera nine have up till the present been recognized as British. We are now in a position to define the family, so far as the British genera hitherto known are concerned.

II.—Definition and Scheme.

Setæ present in all genera save one (*Anachæta*), in four bundles per segment, not forked, but straight or curved, and varying in number from one in a set up to ten or a dozen. Head pore on prostomium or between prostomium and first segment. Dorsal pores present occasionally (especially in the genus *Fridericia*). Dorsal blood-vessel absent from posterior, usually arising between the sixth and twentieth segments, sometimes with one or more heart-like processes. Blood red, yellow, or colourless. Testes in the eleventh segment and male pores on the twelfth. The girdle also on segment 12 frequently extending over a part or the whole of the adjacent segments. One pair of spermathecæ (except in *Henlea puteana*, which has two pairs), opening between segments 4 and 5, free within, or attached to the intestine, with or without ampulla, diverticula, and glands. Salivary glands often present; nephridia of characteristic form, a pair in each segment, except the most anterior and those which are occupied by organs of generation.

Varying in length from 2–3 mm. to an inch. Only in one or two instances (as *Fridericia magna* Friend) is this length exceeded. The following scheme will enable the student of our indigenous species to find his way through the labyrinth of Enchytræid genera, as set forth in the text-books up till the present time.

1.	Setæ absent	*Anachæta*
	Setæ present	2
2.	Blood colourless	3
	Blood coloured	8
3.	Dorsal pores present	*Fridericia*
	Dorsal pores absent	4
4.	Dorsal vessel from tip of diverticulum	*Buchholzia*
	Dorsal vessel from vascular plexus	5
5.	Œsophagus sharply marked off	*Henlea*
	Œsophagus gradually merging	6
6.	Blind sac in segment six	*Bryodrilus*
	Blind sac wanting	7
7.	Setæ *f*-shaped (sigmoid)	*Mesenchytræus*
	Setæ straight or bent within	*Enchytræus*
8.	Testes massive, not subdivided	*Marionina*
	Testes with pear-shaped divisions	*Pachydrilus*

Beddard remarks that "the family is a very natural one; there appear to be no forms transitional between the group and other Oligochæta. This is satisfactory to the systematist, but it renders the labours of the naturalist who desires to study the inter-relationships of the different groups of Oligochæta extremely difficult." We have now to show that the family is not entirely isolated, since the newly discovered form breaks away from the family traditions, and enables us to see the possibility of new relationships.

III.—A New Enchytræid.

On Saturday, November 23, 1912, I took an expedition to an old hunting ground in Derbyshire, where I first found *Rhyacodrilus falciformis* Bretscher, and other rare Annelids. Here, along with *Fridericia michælseni* Br., and an Enchytræus of much interest, I found a species of Enchytræid which proved not only to be new to Britain, but to depart in many ways from the type. The first two specimens which came under observation were immature. They at once arrested attention by the presence of four, if not five, pairs of septal glands. The usual number is three, and whenever more than three pairs are present, the interest is aroused. By degrees other peculiarities presented themselves, and it became apparent that the species differed from all those with which I had previously become familiar. The third specimen examined was adult, and

now further peculiarities presented themselves. The girdle was advanced two or three segments, though the spermathecæ remained in the normal position. No salivary glands could be discovered either in adult or immature specimens, but a pair of glands of a peculiar type could be traced in young specimens in the segment which the salivaries usually occupy. Further, between the third and fourth pair of septals a new pair of glands, or, in one case at least, an unpaired gland, looking like the diverticulum found in the genus *Buchholzia*, or the œsophageal glands of the *Henleas*, had come into existence. The spermathecæ were fully developed, and were of very characteristic form (fig. 22), as were also the

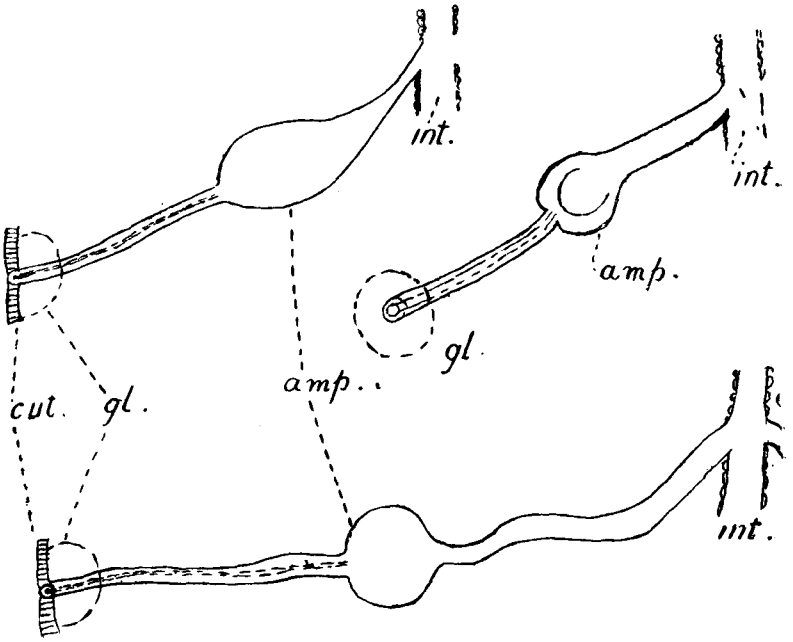

FIG. 22.—Spermathecæ of *C. chlorophilus* Friend. Showing variation.

funnels of the sperm-ducts. The setæ were *f*-shaped or sigmoid, and almost invariably three per set. The nephridia (fig. 23) were striking alike in size, shape, and position; but one of the most remarkable features was the apparently entire absence of a vascular system. In one instance it seemed just possible to detect the presence of some kind of dorsal vessel near the girdle, but the characteristic Enchytræid system was in these specimens, to all appearance, absolutely wanting. This is due to the delicate character of the walls of the blood-vessels.

It will be seen that there are at once certain positive as well as remarkable negative characters to guide one in the analysis. The first is found in the position of the girdle. This organ is normally seen in Enchytræids occupying segment 12, and the only exceptions to the rule are found in *Buchholzia appendiculata* and two species of *Marionina*. One naturally concluded, on seeing the girdle abnormally placed, that it must be one of these species of *Buchholzia* or *Marionina*, but a very little investigation sufficed to show how totally different the one was from the others. This will be made more clear as we proceed. The sperm-funnels and ducts correspond with the girdle. The position of other organs will be set forth in the diagnosis. The shape and number of the setæ, the shape of the brain, the shape and position of the nephridia, the number of septal glands, the large chloragogen cells, the cœlomic corpuscles, and the special glands in front of the spermathecæ, are all additional points of interest.

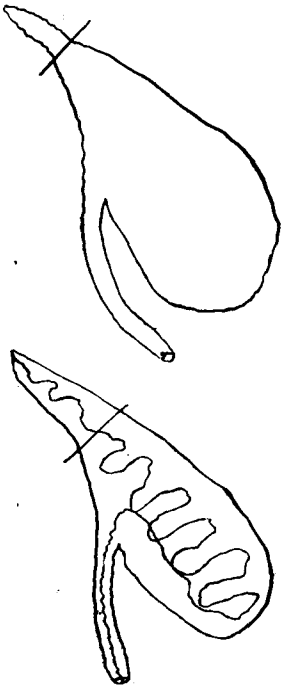

FIG. 23.—Two forms of nephridia, *C. chlorophilus* Friend.

Negatively one may emphasize the absence of salivary glands, of a visible vascular system, and of nephridia in the preclitellian segments.

There are a few striking points yet to be noted before we proceed to the description. In the first place there is a wider difference in length and number of segments between the immature and the adult forms than is usually observed. As a rule a young Enchytræid, though shorter than the adult form, will have nearly or quite the same number of segments. In the case under observation the variation is very noteworthy. In the young worm there are, as usual, no traces of spermathecæ, girdle, sperm-duct and funnel, or other sexual organs, but those species (as *Henlea*) which possess œsophageal glands, or a sudden emergence of intestine into œsophagus, show these alike in youth and maturity. But here what appear at first sight to be œsophageal glands emerge only in the adult in a vacant space between the third and fourth pair of septal glands, while the fifth pair of septal glands, as they appear to be in the young, disappear, or are scarcely discoverable, in the adult, being in all probability transformed into organs of

another kind. It will be seen that there is much to be learned by studying the mature and immature forms side by side. For this reason it may be well, in the first place, to give the characters of the young, then to describe the adult, and finally compare and contrast it with the allied forms, in order if possible to determine its position in the family to which it belongs.

IV.—Chamædrilus chlorophilus g. et sp. n.

Immature Forms.—Length from 5 mm. upwards, with twenty-five or more segments, slender, thread-like, transparent. Setæ *f*-shaped, or sigmoid, present on girdle segment as elsewhere during youth, slender, usually three per set, alike dorsally and ventrally, never more, sometimes only two, equal in length, tending to become somewhat stronger behind than before. Tail very sensitive. Kept in constant motion like the head for purposes of feeling. No other external differences from typical Enchytræid.

Internally the septals at once arrest attention. Four large roundish pairs in segments 4/5 to 7/8. In segment 8, attached apparently to the posterior side of the septum of 7/8, an elongated backward extending pair of glands. Brain narrowing anteriorly, concave behind, longer than its greatest width, and attached to a strong nerve-chain. A pair of club-shaped glands in the third segment replacing the salivary glands, with duct-like processes running backwards beneath the septals. Chloragogen cells large, oval when in situ, but becoming round when detached, and showing sacs full of dark granular matter; often dissolving somewhat rapidly when the animal breaks up. Cœlomic corpuscles large, nucleated. At first any traces of a vascular system anywhere difficult to be found. Later study by new methods showed the dorsal vessel to be postclitellian, it being traced back in one case to the 20th segment. Nephridia commence in segments 9/10.

Mature Forms.—Length about 10–12 mm., but sometimes stretching to 15 mm. when alive, and hardly contracting when preserved. Segments varying from twenty-five to sixty-five or seventy in number. Setæ never exceed three per set, even in fully adult specimens; length not exceeding $\frac{1}{4}$ diameter of body at most; wanting on girdle segment. Tail very sensitive as in youth. Girdle on the 9th segment, but often extending to adjoining segments. Cells of girdle sometimes very indistinct, at other times well formed. Sperm-funnel 2, 3, or 4 times as long as broad, without collar, and attached to long slender duct, opening in segment 9 by almost invisible pores. Brain longer than broad, widest at the posterior, which is incised. Four pairs of septal glands in 4/5 to 7/8, between the two last pairs of which a paired or unpaired

organ appears, probably the testes. This point will be considered again.

The special glands found in young forms in segment 3, and the fifth pair of septal-like glands in segment 8, seem to disappear with maturity. Large chloragogen cells, sparsely found in segments 4 to 7, then in full number to the end of the body. No nephridia in front of girdle; first found in segment 9/10, with very large postseptal, and a duct of similar length springing from behind the septum. Vascular system intensely delicate, and difficult to observe. Spermathecæ large and well defined, with large gland near the opening, but without diverticula; opening into the intestine. Cœlomic corpuscles large and nucleated. No salivary glands.

Found in earth (*Chamæ*) by the stump of a tree, which had been cut down, and not with *Bryodrilus* under the moss of the decaying trunk. Later found in other localities under exactly similar conditions. The intestine often coloured green or yellow by the living algæ, on which it feeds—hence the specific name.

V.—Chamædrilus, Buchholzia, and Marionina.

Buchholz (*4*) in 1863 described an Enchytræid under the name *Enchytræus appendiculatus*, which differed so widely from other species of *Enchytræus* that Michaelsen (*3*) founded a new genus and called it *Buchholzia*. Later another species (*B. fallax* Mich.) was found, and more recently still the genus has been yet further extended. With the exception of *B. appendiculata*, however, the newer species generally have the organs in the normal position. Our new worm, in certain particulars, resembles the aberrant *Buchholzia*, and might at first be thought to be a new species of that genus. The differences, however, are so pronounced that one has only to place them side by side to show the impossibility of coupling them together.

Buchholzia appendiculata.	*Chamædrilus chlorophilus.*
Length 10 mm.	Length 5 to 15 mm.
Setæ 3 to 6 per bundle.	Setæ 2 to 3 per bundle.
Salivary glands present.	Salivary glands absent.
Brain truncated behind.	Brain incised behind.
Girdle on segment 8.	Girdle on segment 9.
Dorsal vessel preclitellian.	Dorsal vessel postclitellian.
Postseptal of nephridium gradually narrowing into a duct.	Duct distinct from the postseptal.
Œsophagus suddenly widening in segment 7.	Œsophagus not widening suddenly.
Spermathecæ with two glands.	Spermathecæ with one gland.

Stress is laid by Beddard and others on the single dorsal diverticulum of the œsophagus in *Buchholzia*, whence arises the dorsal vessel. This diverticulum has been the subject of careful study on the part of Michaelsen, Vejdovsky, and others, and may be readily perceived. In *Chamædrilus* no such organ is anywhere to be found, the dorsal vessel arising some distance behind the girdle.

In some respects, however, *Chamædrilus* more closely resembles the two aberrant species of *Marionina* than *Buchholzia*. In *Marionina* the œsophagus goes gradually into the intestine, but the blood is yellow or red, and the testes are massive. Alike in *M. sphagnetorum* and *M. glandulosa*, we find more than the usual three pairs of septal glands, but in both these species the spermathecæ are free, and not attached to the intestine. The appearance of *Chamædrilus* much more closely resembles that of *Enchytræus buchholzi* than *Marionina sphagnetorum* or any other British worm. Yet it is clearly marked off from the genus *Enchytræus* by a number of important characters.

It remains for us to deal with one or two critical points in connexion with the essential organs. In order, if possible, to determine these with accuracy, I have re-examined the living material, with the following results. In an immature specimen, there appeared a pair of young organs like testes, attached to the septum behind the third pair of septal glands. These gradually develop till they have all the appearance of œsophageal glands such as occur in several species of *Henlea*. The difference in colour between this pair of glands and the septals is due to the presence in the mature Annelid of spermatozoa, whence one infers that they are the testes. The ovaries have not been observed, but one constantly finds ova in every stage of development in the ninth and tenth segments, together with masses of spermatozoa.

From the foregoing we are able to deduce the following characters:—

Chamædrilus chlorophilus. — Length 5–15 mm. Segments ranging from 25–70. Setæ sigmoid, slender, never exceeding three per bundle; four sets in each segment. Brain narrowing anteriorly, incised behind, about 1½ times longer than the greatest width. Four pairs of septal glands; salivaries wanting. Dorsal vessel postclitellian; vascular system extremely delicate and wanting in the usual commissures anteriorly. Œsophagus merging gradually into intestine. Spermathecæ attached to the intestine, and opening in 4/5 with a large gland, without diverticula. Testes in segment 7 between third and fourth pair of septal glands, and having the appearance of œsophageal glands. Girdle usually covering the ninth and half the tenth segment; cells more or less distinct, pore invisible. Sperm-funnels 2, 3, or 4 times as long as broad, attached to a long, slender duct. Nephridia beginning

always in segment 9/10, with large postseptal, and duct of similar length arising at a point behind the septum. Cœlomic corpuscles large, somewhat Henlean in character, nucleated, round or oval. Chloragogen cells sparse in segments 4, 5, and 6, then abundant, large, and filled with dark granular matter. Found in earth, feeding on living algæ. Netherhall, Derbyshire, November 23, 1912; Smisby, near Ashby-de-la-Zouch. (See figs. 22 and 23.)

VI.—New Species of Fridericia.

Although my former paper on this subject (*6*) contained an account of thirty different species of *Fridericia*, the list is still being augmented. During the past year several new species have been found by me in Nottinghamshire and elsewhere, and as they have not yet been described, it is proposed now to supply the necessary details respecting six of them.

1. *Fridericia glandifera* Friend.

This worm closely resembles *F. bulbosa* Rosa, and when first discovered was referred to that species. As further specimens were examined, it was found to differ considerably from the type, and was set down as a well-marked variety. Still more careful study led me to conclude that the variations were at once too many and too constant, and that a new species had been discovered. The following are the characters :—

Length 5–6 mm., sometimes extended to 8 mm. when stretched. Segments 30–35. I have counted 29, 30, 32, 35, and 36 in different specimens. One was 10 mm. in length, and had 40 segments. Including this the average number of segments is 32, and the average length 7 mm. White to the naked eye, with yellowish-brown intestine. Adult forms plentiful during the middle of May, as well as in March; showing girdle, spermathecæ, eggs, and all the other organs. Setæ four in front (about 2nd to 15th segment), innermost pair short; two per set behind, large. Brain longer than broad, with concave anterior and convex posterior. Salivary glands long, unbranched. Three pairs of septal glands normally placed. Girdle with large gland-cells and large pores. Atrial glands also large; sperm-funnel (ampulla) 2–3 × 1, with collar (fig. 24). Girdle extends over segment 12 and half 13. Dorsal vessel usually arising at the septum of 16/17. Cœlomic corpuscles large, oval, nucleated. Nephridia in posterior part of the body with large anteseptal, postseptal twice as large, and duct stout, formed by continuation of the same. In front, however, the nephridia (fig. 26) may produce the duct from the middle of the

postseptal. The first pair was found in 6/7, and they are continued in 7/8, 8/9, 9/10. Head-pore between prostomium and first segment, represented by 0/1. Nerve-chord enlarged in front

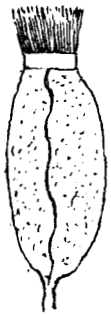

FIG. 24.—Sperm-funnel of *F. glandifera* Friend.

FIG. 25.—Blood-vessel of *F. glandifera* Friend.

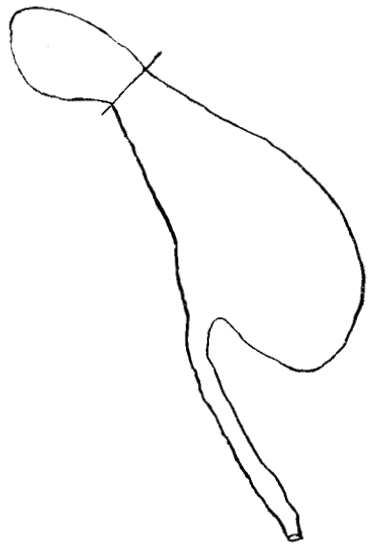

FIG. 26.—Nephridium of *F. glandifera* Friend.

through several segments. Ventral vessel very large, with commissure immediately behind the fork (fig. 25). The spermathecæ have a characteristic form, which will be best understood by

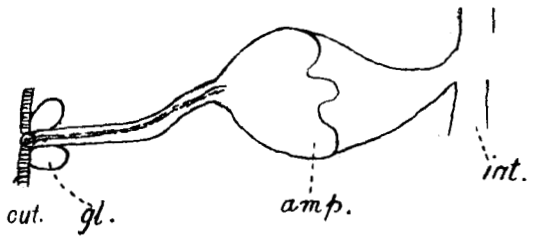

FIG. 27.—Spermatheca of *F. glandifera* Friend.
amp. ampulla; *cut.* cuticle; *gl.* glands; *int.* intestine.

reference to fig. 27. Somewhat stout duct, with a pair of glands at the opening in intersegment 4/5, and a large ampulla without diverticula, somewhat palmate in form. The large glands here

often cause a bulging of the segment. Slight variations occurred in the shape of the brain and of the spermathecal ampulla; otherwise remarkably constant.

Found March 26, 1912, at Rolleston, and May 13, 1912, at Mansfield, Notts. Recorded in Rep. and Trans. Nott. Nat. Soc., 1910–11, p. 40.

2. *Fridericia reversa* Friend.

Length of adult when living 15 mm. Segments 50–65 in number, of a dull grey colour. Setæ in front 4–6, frequently five

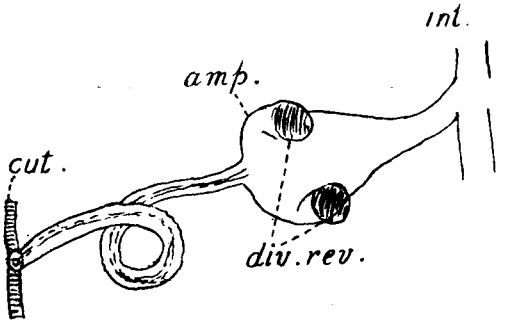

FIG. 28.—Spermatheca of *F. reversa* Friend.

dorsally and six ventrally. The innermost pair very small; the larger hooked within. In posterior segments the setæ are larger, and decline in number from 4 to 3 and 2. Brain longer than broad, convex behind, with a kind of underlap or plate, thin and delicate; nerve-chord enlarged in front. Spermathecæ with moderately long duct, pear-shaped ampulla, and a pair of reversed diverticula (fig. 28). No glands at the opening. Salivaries simple or with very short forks, curving in front of the spermathecæ. Dorsal vessel arises in or near the 21st segment (between 20 and 22). Girdle with papillose glands, rather large and in fairly regular rows. Covering segment 12 and to setæ of 13. Chloragogen cells very light brown, with clear spaces. Cœlomic corpuscles often pointed. Ampulla of sperm-duct large, about 3, 4, or 5 times longer than broad; neck or collar absent, or

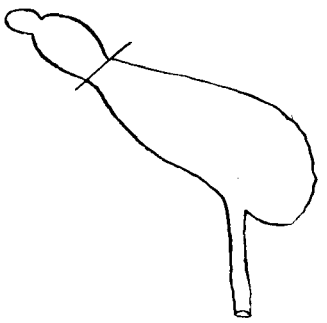

FIG. 29.—Nephridium of *F. reversa* Friend.

very short. Nephridia (fig. 29) of posterior segments with large anteseptal, and duct shorter than postseptal, from the hindermost third of which it springs.

This species is allied to *F. perrieri,* but the differences are numerous and constant ; the reversed sessile diverticula being characteristic. Found in soil on the banks of the Canal in Nottingham, November 7, 1911. Recorded in Rep. and Trans. Nott. Nat. Soc. for 1910–11, p. 41.

I may remark that *Fridericia diachæta* Bretscher and *F. maculata* Issel have also been added to the British lists from Nottingham and other localities during the year.

3. *Fridericia nigrina* sp. n.

To be distinguished from *Enchytræus nigrinus,* which it at first sight closely resembles. Very minute, usually about 3 or 4 mm. in length, with 25–30 segments. Fragile, white to naked eye, with very large opaque cœlomic corpuscles which do not readily break up or dissolve when forced out, as is the case with some others. Setæ always 2 per bundle, large, especially posteriorly, and slightly bent within. None on the ventral side of girdle in the adult worm, which covers the 12th and half the 13th segment, and has large pores and glands at the opening of the very long sperm-duct. Ampulla large, two, three, or even four times as long as broad, with no distinct neck or collar. Dorsal vessel arises about segment 14. Salivary glands could not be seen, and nephridia masked by the large opaque corpuscles. Three pairs of septal glands. Brain small, changing in appearance with the movements of the body. The spermathecæ are remarkable ; the duct is short, without glands at the opening, but with an irregularly shaped ampulla (fig. 30) from which glands or diverticula are given off. Several species of *Fridericia* resemble this in the number of setæ, but the spermathecæ and cœlomic corpuscles at once differentiate it. Distinct from *F. irregularis* Br., though the spermathecæ seem to clearly resemble each other.

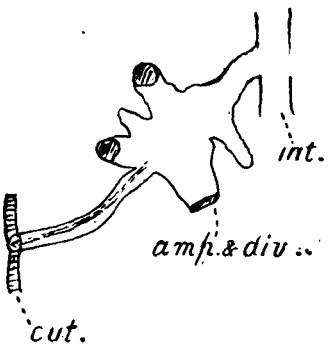

FIG. 30.—Spermatheca of *F. nigrina* Friend.

Found at Hastings, December 21, 1911, and at Stretton-en-le-Field, near Ashby-de-la-Zouch, somewhat earlier in the year. Not previously placed on record.

4. *Fridericia obtusa* sp. n.

Length of living worm 15–18 mm. Stouter than *F. connata*, which was found with it; whitish to the naked eye, but of an opaque, dirty yellow appearance under the Microscope. Strong, stiff, and active. Segments number about 55. Setæ in front 1–2 dorsally and 3 ventrally as a rule, posteriorly 1 dorsally and 2 ventrally; very small in front, larger behind. Girdle not well defined. Epidermis with rows of irregular gland cells. Dorsal vessel arises in segment 16, but without any trace of red blood, such as may be found usually in *F. magna* and irregularly in *F. diachæta*. Chloragogen cells rather large; cœlomic corpuscles very irregular, and frequently massed with a gelatinous substance. Brain convex behind, little if any longer than broad; dorsal pores begin in or near segment 5, the cells (fig. 31) being very conspicuous. Septa very strong and stout. Spermathecæ with very long coiled ducts. No glands at 4/5, and no diverticula observed. Cocaine only quieted it for a little time; the most difficult and obtuse worm I have ever handled in this group. Hence the specific name.

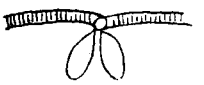

FIG. 31.—Dorsal pore, with guard cells, *F. obtusa* Friend.

Found in sandy soil at Mansfield, Notts, on May 8th, 1912. Now recorded for the first time (*9*).

5. *Fridericia clara* sp. n.

Length 8–10 mm. Segments about 30 in the milk-white adult. Setæ 5–6 in front, decreasing in size from outer pair inwards; 3–4 behind, equal in length in the segments 18 to 30 or thereabouts. Girdle of clear but not well defined cells, in the usual position, without setæ, but with large pores at the opening of the long irregularly folded sperm-ducts, whose funnels are slender, about three times longer than broad, and destitute of collar or neck. Spermathecæ with large pear-shaped ampulla, duct about twice as long, and 5–6 sessile diverticula (fig. 32) between duct and ampulla. Nerve-chord enlarged in front; brain straight behind with a kind of under layer, as in *F. reversa*, narrowing towards the front. Dorsal vessel arising in 12/13 with a clear, heart-like body in the 12th segment. Salivaries slightly branched. Nephridia with large anteseptal and rather long duct arising apparently from

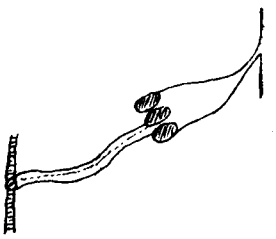

FIG. 32.—Spermatheca of *F. clara* Friend.

the end or near the posterior of postseptal. Resembles *F. udei* in certain particulars, but is distinct therefrom.

Found between Swadlincote and Overseal on the borders of Derbyshire, in the summer of 1911, and now recorded for the first time.

6. *Fridericia lobifera* Vej. var. *minor* Friend.

A number of specimens which I collected at Mansfield in May 1912 seemed at first referable to the species *lobifera*. They presented, however, numerous peculiarities, and did not always appear true to their character. The following details set forth the more important points:—

Length of living worm always 8–10 mm., segments 40 to 45. Slender and white. Setæ always 2 behind, long; in front 4, smaller, and with the inner pair shorter than the outer. Occasionally 5 or 6 ventrally. Dorsal vessel usually arising in 16/17, sometimes in 18/19. Girdle with cells like those of *F. bulbosa*. Long sperm-duct, with large pores at opening, and glands. The ampulla 3 times longer than broad, possessing a considerable collar. Spermathecæ with large ampulla, half-a-dozen or more sessile diverticula and duct without 4/5 glands. Large salivaries extending to the diverticula of the spermathecæ, convoluted, usually unbranched. Brain convex behind, of the usual *Fridericia* type, varying with tension. Nephridia normally in 6/7–9/10, 4 pairs in front of girdle, duct as long as postseptal, not arising from posterior end. 3 pairs of septal glands.

One specimen showed 4 diverticula with short stalks instead of numerous sessiles. The salivaries in this case were much branched, recalling the type. The differences do not seem to be of such a character as to justify the creation of a new species.

Found in sandy soil with *F. michaelseni*, *F. obtusa*, and others. The *Fridericias* are so numerous that only an expert can obtain sufficient knowledge of their characters to determine the species with certainty.

VII.—New Species of Henlea.

Certain additions must already be made to my list of British *Henleas* contributed recently to this Journal (*7*).

1. *Henlea minuta* sp. n.

Length 5–6 mm., small, slender, and transparent. Segments number 35. Setæ equal in length, not resembling those of *Fridericia*, but recalling those of *Buchholzia fallax*, sigmoid; 3–4 in lateral anterior and 4–5 in ventral anterior bundles; 4–6 posteriorly, the largest number being in the middle region of the body

behind the girdle. Large for the size of the worm, none on the girdle segment. Internally we find the brain longer than broad, Henlean in character, i.e. about $1\frac{1}{2} \times 1$, incised behind, narrowing anteriorly. Salivaries (fig. 33) with spathulate posterior, large, in segment 4/5. Cœlomic corpuscles large, cigar-shaped in profile, oval to round, not horny-looking as in some species. Three pairs of septals. Spermathecæ with pear-shaped ampulla about the length of the duct, with no glands at 4/5 opening. No bulb-like enlargement of intestine, no œsophageal glands. Dorsal vessel arising in 7/8, between the last pair of septal glands and the intestine. Large sperm-duct arranged like coils of vermicelli, extending back to segment 15 or 16, and attached to small ampulla, about 2–3 × 1. Large nephridia beginning in 7/8, with small slender anteseptal and large postseptal from the forepart of which a stout duct, about equal thereto, proceeds. Pore of nephridia very clearly seen.

FIG. 33.
Salivary gland of *H. minuta*.

This species approaches *H. rosai*, *H. curiosa*, and *H. attenuata*. From the latter it is distinguished by the number of setæ, the different cœlomic corpuscles, and the shape of the nephridia, as well as by the absence of œsophageal glands. From *H. curiosa* it is at once distinguished by size, nephridia, and spermathecæ; while the nephridia and the setæ distinguish it from *H. rosai*. The differences may be set forth in the following way:—

A. Salivaries present; no œsophageal glands.
  (i) Nephridia without separate duct. Spermathecæ with ampulla near the middle.
    a. Length 20 mm. Segments 55–60. Setæ 4. *H. curiosa*.
    β. Length 5 mm. Segments 25–30. Setæ 5–8. *H. rosai*.
  (ii) Nephridia with separate duct. Spermathecæ with ampulla joining intestine.
    a. Length 5 mm. Segments 30–35. Setæ 4. *H. minuta*.

B. Salivaries present; one pair œsophageal glands.
    a. Length 6–10 mm. Segments 35–40. Setæ 3–5. *H. attenuata*.

Collected by the Boat-house, Sutton Broad Laboratory, August 25, 1911; the mould being kept in a tin till June, 1912, when this species was found mature, though not observed during my investigation of the material at the Laboratory.

2. *Henlea glandulosa* Friend.

Length 10–12 mm., segments 35. Setæ 4–6, those in anterior portion of the body shortest in middle of the bundle, as in *Fridericia*. Three pairs of septals in normal position, 4/5, 5/6, 6/7, the hindmost pair the largest. Girdle cells small; large pores, and prostate or atrial glands on segment 12. Sperm-funnel about 2 × 1, attached to long duct, irregularly coiled. Cœlomic corpuscles large and discoid. No œsophageal glands; intestine enlarged in segment 7, with dorsal vessel arising in front of septum 7/8. Head and brain small, the latter of the usual type, about 1½ × 1, and slightly indented (or concave) behind. Dorsal vessel irregularly branched in the fourth segment, and pulsing in those behind. The spermathecæ have no distinct ampulla, but there are glands at the opening. Anteseptal of nephridia small, postseptal large. No salivaries seen. It resembles in some details *Henlea marina*, but differs from *H. hibernica* and *H. nasuta* in the matter of œsophageal glands. This may be shown thus:—

1.	Œsophageal glands present . . .	*H. hibernica*
	Œsophageal glands absent . . .	**2**
2.	Three pairs of septal glands . . .	**3**
	Four pairs of septal glands . . .	*H. tenella*
3.	Spermathecæ without glands . . .	*H. curiosa*
	Spermathecæ with glands . . .	*H. glandulosa*

Received from the Rev. W. Johnson, Poyntzpass, Ireland, May 1912, in soil at the roots of *Primula*, which were supposed to be suffering through worms. Described in Irish Naturalist, January 1913, p. 9.

3. *Henlea pusilla* sp. n.

A very tiny worm; extending to 2 mm. in length, with about 30 segments. Setæ 3–4 per bundle. White, with yellowish intestine. Three pairs of septal glands in the normal position. One pair of œsophageal glands in segment 8, where the dorsal vessel takes its rise. Cœlomic corpuscles small, and not of the true Henlean type. Brain not concave or incised behind as usual, but convex. Salivaries present in segment 5, sac-like, and undivided (fig. 34). Nephridia large, with posterior end narrowing into the duct (fig. 35), and ciliary movement of the canals plainly visible. Comes near *Henlea attenuata*, from which it differs widely, however, in length, as well as in the shape of the brain, the number of setæ, and the position of the œsophageal and salivary glands.

Found under *Marchantia* by the overflow sluice of the canal,

Nottingham, September 10, 1912, and now described for the first time. A very similar worm found at Netherhall, Derbyshire, November 22, 1912. It was longer (5 mm.), and had 40 segments, but in most other respects agreed with the type.

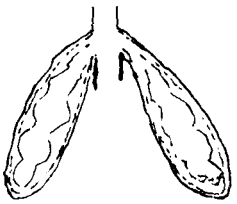

FIG. 34.—Salivary glands of *H. pusilla* Friend.

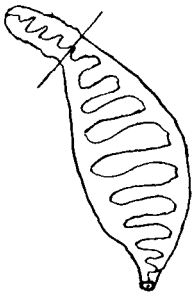

FIG. 35.—Nephridium of *H. pusilla* Friend.

Other recently discovered species remain to be considered at a later date, or will be found described elsewhere (*8*).

BIBLIOGRAPHY.

1. BEDDARD—Monograph of Oligochæta. London 1895.
2. MICHAELSEN—Das Tierreich. Berlin, 1900.
3. „ Enchytræiden-Studien. Arch. Mikr. Anat 1886.
4. BUCHHOLZ—Schr. Ges. Königsb. v. 3 Abh. (1863), p. 93.
5. BRETSCHER—Revue Suisse de Zool. vol. ix. (1901) p. 208.
6. FRIEND—Journ. R. Micr. Soc. 1912, pp. 9–27.
7. „ Ditto 1912, pp. 577–98.
8. „ Zoologist, March 1913, pp. 81–91.
9. „ Trans. Nott. Nat. Soc. 1911–12.