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THE AUTHORS OF THE SEVERAL PAPERS ARE SOLELY RESPONSIBLE FOR THE SOUNDNESS OF THE OPINIONS GIVEN AND FOR THE ACCURACY OF THE STATEMENTS MADE THEREIN.

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PROCEEDINGS.

Art. I.—*Preliminary Account of Synute pulchella, a New Genus and Species of Calcareous Sponges.*

By Arthur Dendy, D. Sc., F.L.S.

[Read March 12, 1891.]

The sponge which forms the subject of the present communication exhibits a very interesting modification of the usual Sycon type of Calcisponge organisation. If we imagine a colony of the Sycon genus *Ute*, whose component members, growing more or less vertically upwards side by side, have become fused together completely, so that the whole colony forms a single vallate mass in which the individuals can only be recognised externally by their oscula, we have then a tolerably accurate conception of the new genus *Synute*. The fusion of the Sycon individuals of which the colony is composed is complete (extending right up to the oscula) and universal, and by no means partial or accidental, and the entire colony is protected on the outside by a thick common cortex consisting mainly of huge oxeote spicules.

Vosmaer* gives the following diagnosis of the genus *Ute*:—"Tubarskelet gegliedert oder nicht. Peripherisches Skelet hauptsächlich aus grossen, in Schichten gelagerten Stabnadeln bestehend."

We may diagnose the genus *Synute* as follows:—"Sponge forming a colony of Sycon individuals completely fused together into a single mass invested in a common cortex.

* "Porifera," Bronn's Klassen und Ordnungen des Thierreichs, p. 372.

Tubar skeleton articulate or inarticulate, cortical skeleton formed chiefly of huge oxeote spicules arranged in several layers and lying parallel to the long axes of the Sycon individuals."

For the single species at present known I propose the name *Synute pulchella.*

Synute pulchella (n. sp.)

General Appearance and Canal System.

The colony (of which a single specimen only has as yet been obtained) resembles in general form a small specimen of Mr. Carter's *Teichonella prolifera.** It consists of a number of stout vertical walls, nearly a quarter of an inch in thickness, which branch or divide in such a way that the upper surface of the sponge presents a characteristic mæandriniform appearance. Along the mæandering ridge which forms the upper surface of the sponge small oscula are arranged, nearly always in a single row. These oscula are less than 1 mm. in diameter and they have no oscular fringe, neither are they raised on papillæ, for the fusion of the Sycon individuals (one of which corresponds, of course, to each osculum) is complete up to the very top. The sides of the walls exhibit a beautifully striated appearance, due to the large oxeote spicules of the cortex, which can be distinguished with the naked eye, although they do not project beyond the surface. The entire colony is somewhat constricted towards the base, so that the fused individuals composing it tend to radiate outwards and upwards from a common centre. The whole colony is about 38 mm. in greatest width and 18 mm. in height. It is attached to the surface of another, much larger, non-calcareous sponge, and in spirit is of a pale grey colour, nearly white.

The canal system, apart from the fusion of the Sycon individuals, closely resembles that of *Ute argentea* as figured by Poléjaeff.† A horizontal section of the colony

* Figured in my paper "On the Anatomy of *Grantia labyrinthica* Carter, and the so-called Family Teichonidæ." *Quarterly Journal of Microscopical Science*, January 1891. Plate I, Fig. 6.

† Challenger Calcarea. Plate IV, Fig. 3.

shows a number of circular spaces scattered at intervals, generally, but not always, in a single row. These are the gastral cavities of the Sycon individuals cut across. Each is completely surrounded by the thimble-shaped flagellated chambers, or radial tubes, which radiate outwards from the gastral cavity. On the adjacent sides of two neighbouring gastral cavities the radial tubes are shorter than on the outer sides.

The inhalant pores are not visible to the naked eye and are merely narrow interstices between the outer spicules of the cortex, leading into irregular canals which pierce the cortex to reach the flagellated chambers, exactly as in *Ute argentea.* At their lower ends the gastral cavities of the fused Sycon individuals communicate with one another, indicating that this peculiar form of Sycon colony has arisen from fusion of adjoining individuals of a branching colony such as *Sycandra arborea.*

The flagellated chambers or radial tubes are approximately octagonal in transverse section, while the much smaller interspaces between them are square. The gastral (exhalant) openings of the chambers are protected by very well developed membranous diaphragms. Each gastral cavity has also a single large well-developed diaphragm situate just within the osculum.

The Skeleton.

The skeleton, as in *Ute argentea,* is very complex and may be divided into Cortical, Tubar, Gastral and Oscular portions.

The Cortical Skeleton.—This consists (1) of very large, fusiform oxeote spicules, slightly curved, fairly symmetrical in shape and gradually and sharply pointed at each end. Size when fully developed up to about 3·0 by 0·14 mm. These are arranged parallel to the long axes of the gastral cavities and in several layers; (2) Between the above are a few smaller oxea and great numbers of comparatively small triradiates. The latter although apparently disposed in the utmost confusion and frequently of irregular shape, generally show a marked tendency towards the sagittal type, the oral angle being decidedly wider than the lateral. The rays are conical and gradually sharp-pointed and measure about 0·072 by 0·01 mm. The basal ray may be of about the same length or shorter or longer than the others, and is perhaps generally directed somewhat downwards towards the base of the sponge; (3) On the surface of the sponge, outside the giant oxeote spicules, is a layer of very minute oxea arranged at right angles to the surface and hence also at right angles to the large oxea, and each with one end projecting very slightly, if at all, beyond the ectoderm. These oxea are very slender, measuring at most about 0·07 by 0·003 mm. They are very gradually sharp-pointed at their inner ends and somewhat hastately sharp-pointed at their outer ends. They are straight or only slightly curved.

The Tubar Skeleton.—The tubar skeleton is articulate and thus differs from that of *Ute argentea.* It is composed of sagittal triradiates arranged according to the usual Sycon plan, and the number of joints depends, of course, upon the length of the chamber; sometimes there may be as many as a dozen. The sub-gastral sagittal triradiates, forming the proximal joint of the skeleton, are, as usual, rather different in shape from the remainder of the sagittal spicules constituting the tubar skeleton. The oral angle is nearly 180°; the oral rays are slightly curved away from one another towards the basal ray, they are conical, gradually sharp-pointed, and measure about 0·084 by 0·01 mm. The basal ray is straight, conical, very gradually sharp-pointed, measuring about 0·14 by 0·01 mm. There is a more or less gradual transition between these sub-gastral sagittal triradiates and the more distally placed spicules of the tubar skeleton. The oral rays first become approximately straight and spread out nearly at right angles to the basal ray; then, further away from the gastral cavity, they begin to curve towards one another away from the basal ray, and the oral angle is somewhat reduced. At the same time the basal ray becomes shorter, until it is only about the same length as the orals (now about 0·07 mm.) All the rays still remain conical and gradually sharp-pointed.

The Gastral Skeleton.—This consists of quadriradiates and triradiates, backed by the oral arms of the sub-gastral sagittal triradiates. The quadriradiates are stout sagittal spicules having the apical ray projecting outwards and slightly upwards into the gastral cavity. The oral angle is a good deal wider than the lateral, and the oral rays often markedly longer than the basal, measuring, for example, 0·15 by 0·014 mm., as against 0·084 by 0·014 mm. The disproportion, however, is not always so great as this, nor are the spicules always so large. The rays are stout, conical and gradually sharp-pointed, and the oral rays curve slightly away from one another. The apical ray is usually short and stout, conical, gradually sharp-pointed and nearly straight, although inclined upwards; usually only about 0·056 mm. long, rarely a good deal longer. Amongst these quadriradiates are found a number of sagittal triradiates, while at a short distance below the osculum the quadriradiates gradually disappear, leaving triradiates only. We may call these latter the sub-oscular gastral triradiates. The sub-oscular gastral triradiates are arranged very regularly, like an articulate tubar skeleton, with the basal rays all pointing away from the osculum. They are all sagittal; at first (*i.e.*, away from the osculum) the basal ray is the longest and the oral rays are nearly straight, diverging at a very wide angle. All the rays are conical and gradually sharp-pointed. The oral rays measure about 0·1 by 0·01 mm. and the basal about 0·14 by 0·008 mm. On approaching the osculum these sagittal triradiates gradually become smaller and their shape gradually changes, the basal ray becoming very short (much shorter than the oral rays) and the oral rays spread out almost in a line with one another. The rays are still conical and gradually sharp-pointed. In the extreme form, found just within the osculum, the oral rays may still measure about 0·1 mm. in length while the basal is reduced sometimes to 0·02 mm. and is also much slenderer than the orals.

The Oscular Skeleton.—This consists of a closely packed layer of long, slender oxea arranged vertically side by side around the osculum, but the greater part of the spicule is imbedded in the wall of the gastral cavity, so that there is no conspicuous oscular fringe. These oxea, except for their much greater size, resemble the small surface oxea of the cortical skeleton. They are long and slender, usually gradually sharp-pointed at their inner ends and irregularly hastate at their outer ends. They measure about 0·3 by

0·01 mm. For the greater part of their length these spicules are imbedded amongst the sub-oscular gastral triradiates and they extend some way below the oscular diaphragm.

The specimen upon which the above account is based was dredged by Mr. J. Bracebridge Wilson, M.A., in the neighbourhood of Port Phillip Heads, Victoria.

Art. II.—*On a New Species of Dictyonema.*

(With Plates I and II.)

By T. S. Hall, M.A.

[Read March 5, 1891.]

The first specimen I saw of this fossil was a fragment given to me in 1889 by Mr. Clark, a student in geology at the Working Men's College. In company with Mr. G. B. Pritchard, I paid a visit to Lancefield, where the specimen had been found, and about five miles north-east of the township we found the quarry. The rock is a soft black slate, dipping at a very high angle, and containing a great deal of iron pyrites, both in nodules, and in disseminated grains. The rock is marked lower silurian on the geological map, and is very near the boundary of the upper silurian which lies to the eastward We were fortunate in finding numerous fragments of the fossil preserved in a white talcose material and accompanied by graptolites. In turning over a heap of *débris* from the quarry, I found the large slab I have figured covered with mud, but still distinctly showing that I had secured a specimen exhibiting the centre of the polyp-stock. One of the fragments found by Mr. Pritchard fitted on to the larger piece as shown in the lower left hand of Figure I.

Dictyonema is closely allied to the graptolites, but the chitinous supporting rod, so characteristic of the latter, is wanting in the former.

Genus Dictyonema.

Sub-Order—Campanulariæ; Order—Hydroida.

Zittel ("Handb. d. Pal., Bd. I.") gives a definition of the genus which I translate as follows:—"Hydrosome, funnel pannier or fan-shaped, with numerous branches almost parallel, strong, forked and united by cross threads. The ends of the branches are free, and are then set on one side with pointed hydrothecæ. The latter appear very perishable and are exceedingly seldom preserved."

D. GRANDE (n. sp.)

Polyp-stock large, flat, with perhaps the exception of the central portion, which, judging from the distorted condition in which it is preserved, was slightly cup-shaped. The centre is formed by a thread about 2 mm. in length. From each end of this are given off two branches, which, at about 1 mm. from their point of origin, bifurcate nearly at right angles, thus producing eight branches. The outer edges of the branches forming the right angles are straight, and at about 5 mm. from their origin unite, enclosing an elongated fenestrule. The inner edges curve sharply and unite, enclosing a circular fenestrule about 3 mm. in diameter. After this, branches about 1 mm. wide radiate in every direction from the centre, branching dichotomously as they go, and no anastomosis occurs. The branches are united by cross bars which as a rule run nearly at right angles to them, but are in a few cases oblique. The bars are broadened at their junction with the branches, as in the Canadian species described by Prof. James Hall (Can. Org. Rem., Dec. II), and are about 1 mm. wide at their middle. The cross bars cease their appearance at from 2 to 4 cm. from the distal end of the branches which then become very flexible and attenuated. The distance between two adjacent bifurcations of the same branch varies from about 1·5 to 7·5 cm. The fenestrules enclosed by the radiating branches and the cross-bars are generally about 5 mm. wide, and vary from 5 to 25 mm. in length, those towards the centre being smaller and more circular in outline.

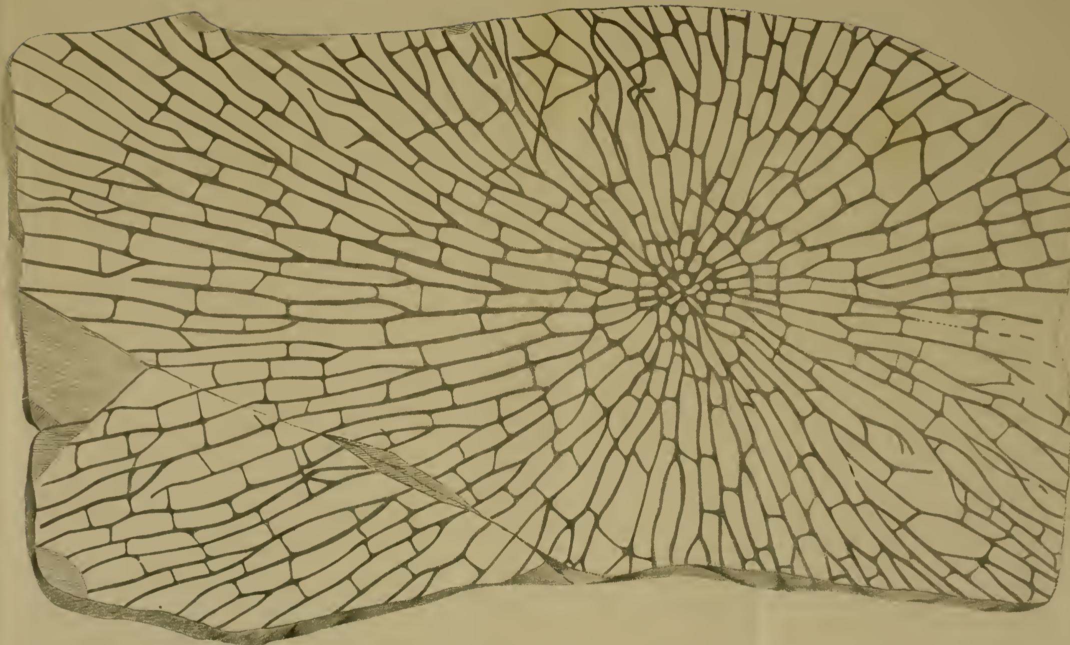
The diameter of a perfect specimen has not been determined, and the hydrothecæ are not visible in any of the specimens.

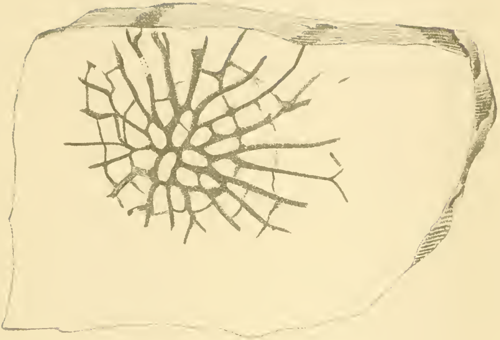
My best thanks are due to Professor W. Baldwin Spencer for his advice during the preparation of this paper.

DESCRIPTION OF FIGURES.

1. Central portion.
2. Fragment showing termination of branches.
3. Central portion of another specimen.

The figures are natural size.





Art. III.—*Notes on the Lower Tertiaries of the Southern Portion of the Moorabool Valley.*

(With Plates III and IV.)

By T. S. Hall, M.A., and G. B. Pritchard.

[Read March 5, 1891.]

The occasion of the visit of the University Science Club to Geelong for their long-vacation trip enabled us to make some observations on the geology of this locality.

The course of the stream, from its sources to the eastward of Mount Warrenheip down to its junction with the Barwon at Fyansford, near Geelong, is across the eastern portion of the great volcanic plain of South Western Victoria. Like most of our streams flowing through basaltic country, it has cut a deep and narrow valley of its own, and has in many places exposed the underlying deposits. In the upper part of its course, these underlying deposits are of lower silurian age, while in its lower part they consist of tertiary strata.

Our observations dealt principally with the older tertiary deposits, and extended from the railway viaduct, near Batesford, down to the junction of the stream with the Barwon at Fyansford.

Granite.

The oldest rock exposed is the granite, an outcrop of which, about a square mile in extent, occurs at the Dog-rocks near Batesford. Another outcrop, a few yards in extent, occurs where the Maude Road crosses Sutherland's Creek at Darriwill, ten miles from Geelong; and probably granite occurs at no great depth beneath the surface everywhere between the Dog-rocks and the granite hills of the You Yangs.

Lower Tertiary.

Half a mile below the viaduct, on the left bank of the stream occurs a section which is noted as fossiliferous in the geological quarter-sheet. This section is marked (9) on the plan. Lately a small road cutting along its base has afforded easy means of better examination of the beds. The section is fairly typical of all that occur in the valley. The lower portion consists of a dark grey clay, containing a great deal of shelly matter. This becomes yellower as it passes upwards, and contains a slight admixture of sand. Concretionary masses of calcareous material make their appearance, and in places form compact irregular bands. Fossils, especially gastropods, are more plentiful at the base of the series, while in the upper part lamellibranchs, and also brachiopods occur, the gastropods being exceedingly rare. We record 122 species from this locality.

There is no doubt that the deposit represents but one series of beds. The passage from one kind of sediment to another is a gradual and not a sudden one. The beds merge into one another in such a way as to leave but little doubt that the process of sedimentation was continuous, and though certain fossils abound more in certain parts than in others, the difference is due to a variation in the sea bottom, due to different material being deposited, and to the depth at which the deposit took place, and not to a great difference in age, as the lamellibranchs and brachiopods of the upper beds occur also in the lower members of the series.

Near the Dog-rocks, the polyzoal limestone makes its appearance, and in one or two places forms low cliffs on the river bank. The beds when examined at a distance show a slight dip, which is approximately to the south east. We were, however, unable to measure its amount and direction accurately. The lowest beds exposed are at the upper quarry (see plan 8). The rock here is almost entirely made up of foraminifera, which lie at all inclinations to the bedding plane. A sample of the rock was forwarded to Professor Tate, and by him submitted to Mr. W. Howchin. This gentleman states that the great mass of the rock is made up of individuals of *Orbitoides mantelli*, and he suggests the name *Orbitoides limestone* for the formation. The other conspicuous genera, which however are relatively few in number, are *Amphistegina*, *Operculina*, and *Gypsina*. The rock is very friable and is quite distinct from the overlying polyzoal limestone which, however, contains similar foraminifera freely scattered through it, though its great bulk consists of polyzoa and spines and plates of echinoderms, together with a few lamellibranch shells; 14 species are recorded from this locality.

The base of the section is hidden by the drift of the valley, but judging from the close proximity of the granite, it is of no great depth.

The hill section is as follows:—

Basalt	75 ft.
Incoherent sandy material, with calcareous concretions	50 ,,
Yellow clay, with calcareous concretions	5 ,,
Polyzoal limestone	25 ,,
Orbitoides limestone	20 ,,
Total ...	175 ft.

The change from the limestone to the yellow clay at this point is a sharp and not a gradual one. The grey clay which, as before mentioned, is so abundant in gastropoda, is absent, having thinned out towards the granite on the flanks of which the deposit rests.

The polyzoal limestone at the places marked (7) and (8) in plan is of a lighter tint than that of the well-known Waurn Ponds rock, being in places of a dazzling whiteness; but fossil evidence shows the two deposits are of the same age. We record 16 species from the filter quarries (see plan). Near Madden's (see plan 6) a cliff section shows the following interesting characters:—The polyzoal limestone forms the base of the cliff. This rock in its upper portion is in most places of a crystalline texture, and very few perfect shells are to be found in it, the fossils being represented principally by casts. A similar state of things occurs on Sutherland's Creek near Maude, though in the latter place gastropods, especially cowries, are plentiful; while in the true polyzoal rock, they are extremely rare. Above the limestone comes the clay bed. This for the first few feet is full of polyzoa, resembling those of the lower rock. The beds then pass up in the usual manner into sandy calcareous clays with nodules, and are capped by basalt.

Though the line of demarcation between the polyzoal rock and the grey clay is sharp, still, as has been just mentioned, the foraminifera persisted during the time required for the deposition of the first few feet of the clay. The muddiness of the water, however, was apparently inimical to the growth of polyzoa in the profusion in which they had previously existed, and they soon ceased to be the typical forms of life in the locality, and the gastropods made their appearance in greater numbers. The effect of the variation in the sediment on the fauna has been alluded to when dealing with the section near the viaduct.

The section is as follows:—

Basalt	60 ft.
Incoherent sandy material, with concretions	20 ,,
Yellow clay, with concretions ...	50 ,,
Grey clay	20 ,,
Polyzoal limestone	30 ,,
Total ...	180 ft.

The hill side is covered by a fairly deep soil, but in a few places, especially where rabbits have burrowed, the underlying rock is exposed. Fossils are scarce, but by dint of a few hours' careful searching, we succeeded in securing examples of thirty-five species, which will be found recorded in the list given.

Below Madden's, the river valley widens out to about three-quarters of a mile. The bed of the stream is formed by the polyzoal limestone for a distance of about half a mile below the section just described, and the rock is carved into miniature caves and hollows by the stream. The top of the limestone approaches the level of the river as we go down stream, owing to the dip of the beds, and at last it disappears under the bed of the stream, its place being taken by the overlying grey clay. Just above Griffin's (see plan 5), where the clay first makes its appearance in the river bed, fossils are plentiful. The banks of the stream are steep and slippery, so that it is a matter of some difficulty to work at the beds. The top of the clay bed is only about a couple of feet above the summer level of the river, and its eroded surface is covered by a gravel wash some ten or twelve feet in thickness.

The fossils found here were remarkable for their size, being far larger than examples of the same species occurring elsewhere in the valley. We record 113 species from this locality.

For about half a mile below this the river bank exposes an almost continuous section of the clay bed, but this at last disappears, and is overlain by the gravel wash which covers the greater part of the valley.

To the northward on the hill side bounding the valley at (3) and (4), small exposures of the yellowish clay were seen, but only a couple of fossils were obtained. The hill side is thickly masked by soil, principally derived as a pluvial wash from the basalt above. In the places mentioned, however, small gullies have exposed the tertiary rock, though the exposures were so small that we could do no more than satisfy ourselves that the beds were continuous in that direction. Near Coghill's (see plan 2), the stream which has hitherto held a general south-easterly course, bends away to the southward. At this point, a very steep cliff is formed, exposing a section, which attracted the attention of the officers of the Geological Survey. At the base of the cliff occur billowy hillocks formed by the weathering of a small landslip.

The geological survey sheet gives the following section:—

Black loam, with estuary shells and nodules of limestone	8 ft.
Lava	30 ,,
Loose sand	6 ,,
Sandy clays, with miocene tertiary fossils	56 ,,
Total ...	100 ft.

This section, however, seems to need several modifications. The upper surface of the basalt is wackenitic in character, and passes up into the surface soil, and we could not find any trace of the estuary deposit referred to. After a prolonged search, about a dozen specimens of shells were discovered lying close to one another, on the face of the slope towards the cliff. These were all recent species, and are not peculiarly estuary shells. Their colours were perfectly preserved, and they did not appear to have been long in the position in which they were found. The shells were of species of large size, and no examples of small shells were found. The height of the place above the sea is about 200 ft., and there is no evidence elsewhere, of such a great elevation of the coast within recent times. It seems probable that the shells were carried there by human agency, as similar collections of shells forming the "kitchen middens" of the blacks, are not unknown in other places. A careful examination of the soil did not show any quartzose sand, and the ant-heaps near the spot are covered with small pieces of scoriaceous basalt. Had there been any quartz sand in the deposits, traces of it would certainly have been found on the ant-heaps. Limestone nodules occur, but they are not unknown in decomposed basalt nearer Melbourne, and similar masses may be found near the railway cutting in Royal Park, the lime being probably derived from the decomposition of a lime felspar. A few angular fragments of quartz and quartzite were found on the surface, but are exceedingly scarce. There is certainly no evidence of a marine deposit overlying the basalt anywhere near this locality.

With regard to the 6 ft. of loose sand mentioned on the quarter-sheet, as underlying the basalt, this seems very local in its development. In most places, the clay beds which, as before mentioned, become more sandy in their upper portion, are directly overlain by the basalt, but in a few spots, loose sand does occur. There is no difference in colour between the loose sandy beds, and those containing a small admixture of clay, both being fawn-coloured. The bed of sand is marked Older Pliocene on the map, and is represented as having a continuous outcrop for miles up the valley. The evidence for its separation from the underlying beds is exceedingly slight.

We record 106 species from this locality.

From Coghill's to the Orphanage Hill, the ridge on the left bank maintains a fairly uniform height of about 200 ft. above the river, and falls away gradually on the eastward towards Corio Bay. The country on the right bank had evidently suffered extensive denudation before the basalt outflow took place. The survey quarter-sheet shows the basalt coming right down to the river's edge, from Coghill's to Fyansford (its upper surface being only about 50 ft. or 60 ft. above), while on the other bank, the base of the basalt is about 170 ft. above the river. It is possible, however, that the face of the hill is merely covered by the *débris*, and that the flow is not as deep as shown. For instance, the road-cutting leading westward from the Fyansford Bridge gives an exposure of the tertiary strata a few feet in extent, at a height of about 40 ft. above the stream. The exposed rock is the yellow clay, with calcareous nodules, so constantly occurring near the top of the series in the neighbourhood. The only fossil we found was an oyster; but a more careful search would probably yield more forms. The tendency of the basaltic *débris* to completely mask a hill side, thus giving an erroneous view of the depth of the flow, is well shown in various places in the valley; and here, when walking along the river bank a few days before noticing the outcrop above. we had no idea that the geological boundary needed a correction. The difference in the level of the basalt on the two sides of the valley is a marked one. Standing on Orphanage Hill, far below the level of the base of the flow, one can see for miles over the basalt plain to the westward; and extensive denudation must consequently have taken place both before and after the outflow of igneous rock.

The geological quarter-sheet gives 10 ft. of loose sand underlying the basalt. This in the map is coloured yellow, indicative of Older Pliocene, and the outcrop is shown extending far up the valley. There is, however, but little doubt as before mentioned, that the deposit is of the same age throughout, and no sufficient grounds exist for dividing it into two parts. The change from clay to sand is a gradual one, which can be traced as we go up the hill on any of the sections exposed in the valley. The change in the character of the sediment naturally affected the inhabitants of the sea, but the fossils which occur in the sandy strata occur in the argillaceous beds as well, and no new forms appear.

The Orphanage Hill section is a very typical one. The grey clays at the base become yellow as they pass upwards, and calcareous nodules and bands make their appearance in the more arenaceous rock near the summit. The beds have been energetically searched for fossils by some of the Geelong collectors, and consequently good specimens are now somewhat difficult to procure. However, as a result of visits on various occasions, we have procured specimens of 192 species from the locality.

In speaking of the polyzoal rock of Western Victoria, Mr. Dennant * mentions that at Muddy Creek the limestone

* "Proc. A.A.A.S.," 1890, p. 442.

occurs at a lower level than do the gastropod beds, though the actual contact cannot be seen. In South Australia, also, Professor Tate* states that the polyzoal rock is the older of these two members of the series. The evidence we have adduced shows that in this locality as well, the sequence of the beds, as might have been expected, is similar. The deposit at Orphanage Hill, and consequently its extension up the valley of the river is usually spoken of as Oligocene, though coloured Miocene in the quarter-sheet; while the Waurn Ponds rock, which, like the Batesford limestone, is true polyzoal rock, is called miocene. This is, however, a reversal of the true sequence, for the limestone is undoubtedly the underlying member of the series. In his exhaustive examination of the Muddy Creek beds, Mr. Dennant† states that the whole series must be referred to eocene age, and the list of fossils we give, shows that no very marked difference if any at all exists between the ages of the gastropodous clays in the two localities.

Other Tertiary Deposits.

We paid but little attention to the other tertiary deposits. The basalt capping the hills is a portion of the extensive flow of our western plains. The source of the rock is not apparent at any rate in the immediate neighbourhood.

The river valley is covered in most places by drift, varying from fine sand to coarse gravel, consisting principally of quartz. Near Madden's, some greenstone pebbles were obtained, resembling those of the Barwon drift, both above and below the junction with the Moorabool. In the case of the former stream, they are probably derived from the gabbro outcrop, marked on the survey map as occurring about six miles above the junction; but the origin of the pebbles in the Moorabool is not clear. The drift is marked on the geological map as being of pliocene age.

Our thanks are due to Mr. J. Dennant, F.G.S., F.C.S., &c., for his kind assistance in the identification of many of the fossils.

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* "Trans. Roy. Soc. S. Aust.," 1884.

† "Trans. Roy. Soc. S. Aust.," 1888, and "Proc. A. A. A. S.," *loc. cit.* See also "Trans. Roy. Soc. Vict.," 1891, p. 63.

The following shows the number of specimens recorded from each of the localities dealt with in the paper :—

TABLE I.

Filter Quarries	...	...	16
Upper Quarry	...	...	14

TABLE II.

Orphanage Hill	...	...	192
Coghill's ...	...	...	106
Griffin's ...	...	...	113
Near Madden's	...	...	35
Near Viaduct	...	...	122

The whole number of species is 295, and of these the mollusca and brachiopoda amount to 264.

In comparing the latter with eocene fossils of Muddy Creek, as recorded by Mr. Dennant, we find 145 common to both deposits, and as 102 of the remainder have been only determined generically, being as yet undescribed, it will be seen that the agreement between the beds is exceedingly close.

TABLE I.

Name of Specimen.	Locality where Obtained.	
	* Filter Quarries.	Upper Quarry.
Foraminifera.		
Orbitoides mantelli	x	x
Amphistegina sp.	...	x
Operculina sp.	...	x
Gypsina sp.	...	x
Corals.		
Placotrochus deltoideus, Duncan	x	...
,, elongatus, Duncan	x	...
Flabellum gambierense, Duncan	x	...
Isis sp.	x	...
Echinodermata.		
Pericosmus gigas, McCoy	x	x
,, sp.	x	...
Clypeaster gippslandicus, McCoy	x	x
Monostychia australis, McCoy	x	...
Brachiopoda.		
Waldheimia garibaldiana, Davidson ...	x	x
Magasella compta, Sow	x	...
,, woodsiana (?), Tate	x	...
Terebratulina davidsoni, Etheridge	...	x
Lamellibranchiata.		
Pecten murrayanus, Tate	x	x
,, polymorphoides, Zittel	x	...
,, subbifrons, Tate	...	x
Spondylus pseudo-radula, McCoy	...	x
Nucula sp.	...	x
Ostræa sp.	x	x
Gasteropoda (a few casts)	...	x
Pisces.		
Lamna sp.	x	...

* NOTE.—These quarries are both in the Polyzoal Rock, and are marked Filter Quarries (7), and Upper Quarry (8), on the plan.

TABLE II.

NAME OF SPECIMEN.	LOCALITY WHERE OBTAINED.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Foraminifera.					
Orbitoides mantelli	...	...	x	x	...
Other genera and species ...	x	...	x	x	x
Corals.					
Placotrochus deltoideus, Duncan ...	x	x	x	...	x
„ elongatus, Duncan ...	x	x	x	...	x
Flabellum gambierense, Duncan ...	x	x	x	...	x
„ victoriæ, Duncan ...	x	x	...	x	x
Notocyathus viola, Duncan ...	...	x	x	...	...
„ australis, Duncan ...	...	x	x	...	...
„ sp.	...	...	...	x	...
Trematotrochus (?) sp.	...	...	x	...	...
Balanophyllia australiensis, Duncan	x	x	...	...	x
Other species	x	x	x	x	...
Echinodermata (indeterminate casts; also spines)	x	x	x	x	x
Crustacea	...	x	...	x	...
Polyzoa (various species)	x	x	x	x	x
Salenaria sp.	...	...	x	...	...
Brachiopoda.					
Waldheimia garibaldiana, Davidson	x	x	x	...	x
„ insolita, Tate ...	...	x	...	...	x ?
„ corioensis, McCoy ...	...	x	...	...	x
Terebratula vitreoides, T. Woods ...	x	x ?	...	...	..
Terebratulina scoulari, Tate ...	...	x ?	...	...	...
„ sp.	...	x	x	...	x
„ davidsoni, Etheridge	...	...	...	x	...
Lamellibranchiata.					
Pecten murrayanus, Tate ...	x	...	...	...	x
„ sturtianus, Tate	x	...	...	...	x
„ semilaevis, McCoy ...	...	...	...	...	x

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Lamellibranchiata—continued.					
Pecten yahlensis, T. Woods ...	...	...	...	...	x
,, zitteli, Hutton	...	...	...	...	x
,, sp.	x	...	...	2 sp. (frag.)	x
,, foulcheri, T. Woods ...	x	...	...	...	...
,, gambierensis, T. Woods ...	...	...	x	...	...
Spondylus pseudoradula, McCoy ...	x	x	x	...	x
Dimya dissimilis, Tate	x	x	...	x	x
Pectunculus m'coyii, Johnston ...	x	x	x	x	...
,, cainozoicus, T. Woods	x	...	x	...	...
Limopsis belcheri, Adams and Reeve	x	x	x	x	x
,, aurita, Brocchi ...	x	x	...	x	x
Lima bassii, T. Woods	x	...	...	...	...
,, linguliformis (?), Tate ...	x	...	...	...	...
Leda vagans, Tate	x	x	x	x	x
,, obolella, Tate	x	...	...	...	...
,, apiculata, Tate	...	x ?	...	...	x
,, sp.	x	...	...	...	x
,, sp.	...	...	...	x	...
Trigonia tubulifera, Tate ...	x	x	...	...	...
Barbatia celleporacea, Tate ...	x	...	...	...	x
Macrodon cainozoicus, Tate ...	x	...	...	x	x
Cardita gracilicostata, T. Woods ...	x	x	...	x	x
,, compacta, Tate	x	x	x	...	x
,, scabrosa (?), Tate ...	x	...	...	...	x
,, sp. nov. (?)	x	...	...	frag.	...
,, polynema, Tate	x	...	...	...	...
,, delicatula, Tate	x	x	x	...	...
,, sp.	...	...	...	...	x
Nucula tumida, T. Woods ...	x	x	x	...	...
,, morundiana, Tate ...	x	...	...	...	...
,, atkinsoni, Johnston ...	...	...	...	...	x
Chama lamellifera, T. Woods ...	x	...	x	...	x
Myodora tenuilirata, Tate ...	x	...	x	...	x
Semele vesiculosa, Tate	x	...	...	...	...
Cytherea eburnea, Tate	x	x	x	...	x
,, sp.	x	...	...	...	...
Chione sp.	x	...	x	...	x
,, sp. (nov.)	...	...	x	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Lamellibranchiata—continued.					
Chione sp.	x	...	...	...	...
Crassatella dennanti, Tate ...	x	...	x	...	x
,, astarteformis, Tate ...	x	x	x	...	x
Ostræa hyotis	x	...	...	...	x
,, sp.	x	x	...	x	x
Cardium antisemigranulatum, McCoy	x	...	...	...	...
,, sp.	x	...	...	...	...
Cucullaea corioensis, McCoy ...	x	...	x	...	...
Corbula ephamilla, Tate... ...	x	x	x	...	x
,, pixidata, Tate	x	x	x	...	x
Hinnites corioensis	...	x	...	...	x
Modiola sp.	...	...	x	...	...
Gasteropoda.					
Typhis laciniatus, Tate	...	...	x	...	...
,, sp.	x	x	...	...	x
,, m'coyii, T. Woods ...	x	...	...	...	...
,, evaricosus, Tate	...	...	x	...	...
Murex lophoessus, Tate ...	x	...	...	...	...
,, velificus, Tate	x	...	...	...	x
,, amblyceras, Tate ...	x	x	...	...	...
,, trochispira, Tate ...	x	...	...	...	...
,, camplytropis, Tate ...	x	...	...	...	...
,, eyrei, T. Woods... . .	x	...	...	...	...
,, asperulus, Tate	x	x	...	...	x
,, sp.	...	...	...	...	x
Trophon polyphyllus, T. Woods ...	x	x	...	...	...
Ranella prattii, T. Woods ...	x	x	x	...	x
Rapana aculeata, Tate	x	...	x ?	...	...
Triton cyphus, Tate	x	...	x	...	x
,, tumulosus, Tate	x	...	x	...	x
,, woodsii, Tate	x	x	x	...	x
,, gemmulatus, Tate ...	...	...	...	...	x
,, tortirostris, Tate	...	...	x	...	x
,, textilis, Tate	x	...	...	...	...
,, sp.	x	...	...	...	...
Fusus dictyotis, Tate	x	...	...	...	...
,, craspedotus, Tate ...	x	x	...	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Fusus acanthostephes, Tate ...	x	x	...	...	x
,, foliaceus, Tate	x	...	x	...	...
,, aciformis, Tate	...	...	x	...	...
,, senticosus, Tate	x	...	...	...	...
,, hexagonalis, Tate ...	x	...	...	...	...
Fasciolaria cryptoploca, Tate ...	x	...	...	...	...
,, decipiens (?), Tate ...	x	...	...	...	...
,, rugata, Tate	x	x	x	...	...
,, cristata, Tate ...	...	...	x	...	...
Peristernia subundulosa, Tate ...	x	...	...	...	x
,, lintea, Tate	...	...	x	...	...
Sipho sp.	..	x	2 sp.	...	...
,, asperulus, Tate	x	...	...	...	x
Siphonalia, sp.	x	...	...	...	...
Dennantia ino, T. Woods ...	x	...	...	...	...
,, cingulata (var.), Tate ...	x	x	x	...	...
Leucozonia sp....	...	x	...	...	...
Nassa tatei, T. Woods	x	x	x	x	x
Voluta hannafordi, McCoy ...	x	...	x	...	...
,, antiscalaris, McCoy ...	x	x	...	...	x
,, strophodon, McCoy ...	x	x	...	...	x
,, ancilloides, Tate	x	...	...	...	...
,, m'donaldi, Tate ...	x	...	...	...	...
Voluta costellifera, Tate ...	x	...	...	...	x
,, (volutoconus) conoidea, Tate	x	...	...	...	...
,, pseudolirata, Tate ...	x	...	...	...	...
,, cathedralis, Tate ...	x ?	...	...	.	...
,, sp. nov.	...	...	...	...	x
,, polita, Tate	...	...	...	...	x
,, sp.	...	...	...	...	x
Lyria harpularia (?), Tate ...	x	...	...	...	...
Mitra atractoides, Tate	x	...	...	...	...
,, alokiza, T. Woods ...	x	...	...	...	...
,, ligata, Tate	x	x	x	...	x
Marginella woodsii, Tate ...	x	x	...	..	x
,, propinqua, Tate ...	x	x	x	...	x
,, wentworthi, T. Woods	x	...	juv.	x	x
,, inermis, Tate ...	x	...	...	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Marginella (juv.)	x	...	...	...	...
,, micula (var.), Tate ...	...	...	...	...	x
,, sp.	...	...	...	...	x
Oliva, sp.	x	...	...	...	...
Ancillaria pseudaustralis, Tate ...	x	...	x	...	...
,, sp.	x	...	...	...	...
,, sublaevis (?), T. Woods	...	x	...	..	...
Harpa sp.	x	...	...	...	...
Cancellaria varicifera, T. Woods ...	x	x	..	...	x
,, sp.	...	...	...	x	...
,, laticostata, T. Woods ...	x	...	...	..	x
Terebra platyspira, Tate ...	x	...	...	...	...
Pleurotoma haastii, Hutton ...	x	x	x	...	x
,, murndaliana, T. Woods	x	x	...	...	x
,, clarae, T. Woods ...	x	x	x	x ?	x
,, sp.	x	x	x	...	...
,, ...	2 sp.	...	...	...	...
,, ...	...	...	6 sp.	...	...
,, ...	...	4 sp.	...	...	...
,, ...	...	...	...	...	4 sp.
Drillia trevori, T. Woods ...	x	x	x		x
,, integra, T. Woods ...	x	x	x	..	x
,, ...	6 sp.	...	...	...	...
,, ...	...	6 sp.	...	...	...
,, ...	...	...	2 sp.	...	...
,, ...	...	...	...	...	1 sp.
Mangelia	7 sp.	...	..	..	...
,, ...	...	3 sp.	...	...	...
,, ...	...	...	4 sp.	...	...
,, ...	...	...	...	...	5 sp.
,, bidens, T. Woods ...	x	x	x	...	x
Bela sp.	x	...	...	...	...
Conus hamiltonensis, Tate ...	x	...	...	...	...
,, (aff. pullulescens), T. Woods	...	x	...	...	...
,, sp.	x	..	...	...	...
,, ligatus, Tate	x	...	x	...	...
Cypraea eximia, McCoy	x	...	juv.	x ?	x
,, gigas, McCoy	x	frag.	x	...	frag.

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near
Gasteropoda—continued.					
Cypraea leptorhyncha, McCoy ...	x	x	...	...	x
,, contusa, McCoy ...	x	...	...	...	x ?
,, pyrulata, Tate	x	...	...	...	...
,, subsidua, Tate	x	...	...	...	...
,, subpyrulata, Tate ...	x	...	...	...	...
,, sp.	...	x	..	...	x
,, sp.	...	...	x	...	...
Trivia avellanoides, McCoy ...	x	x	x	...	x
Cassis exigua, T. Woods ...	x	...	...	...	frag.
Semicassis transenna, Tate ...	x	...	...	...	...
Cassidaria sp.	x	...	...	...	...
Natica hamiltonensis, T. Woods ...	x	x	x	...	x
,, gibbosa, Hutton	x	x	x	...	...
,, polita, T. Woods ...	x	x	x	...	x
,, auriculata, Tate, m.s. ...	x	..	...	...	...
,, (?) sp. (nov.)	...	..	...	...	x
Crepidula sp.	x	...	...	...	...
Calliostoma sp.	x	...	2 sp.	x	...
Astele sp.	...	...	...	...	x
Xenophora agglutinans, Lam. ...	x	...	...	...	x
Solarium acutum, T. Woods ...	x	...	..	...	x
Scalaria sp.	x	...	...	...	...
Turritella murrayana	x	x	x	...	...
,, ...	4 sp.	...	...	1 sp.	...
,, ...	...	3 sp.	...	...	...
,, ...	...	...	4 sp.	...	...
,, ...	...	...	...	...	3 sp.
Siliquaria squamulifera, Tate, m.s.	x	x	x	...	x
,, sp. nov.	x	...	x	...	...
Eulima danae, T. Woods ...	x	...	...	...	...
,, sp	...	x	...	...	...
Niso psila, T. Woods	x	x	x	..	x
Cerithium apheles, T. Woods ...	x	x	x	...	x
,, sp.	x	...	x	...	...
,, sp.	...	x	...	...	...
Triforis wilkinsoni, T. Woods ...	x	...	...	...	...
,, ...	3 sp.	...	...	...	...
,, ...	...	...	2 sp.	...	...

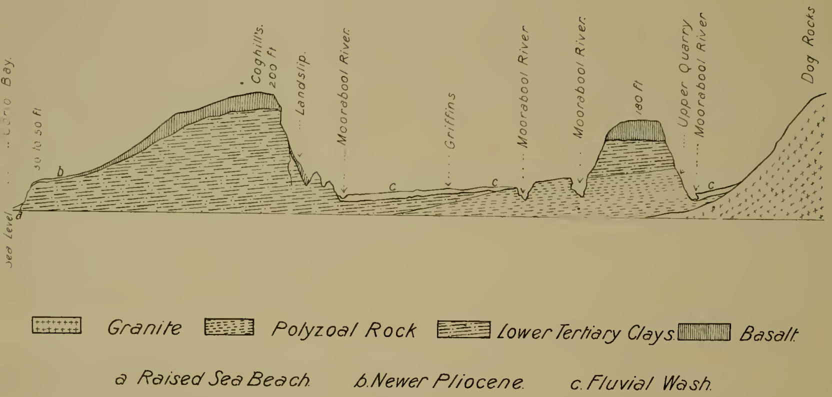
Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Triforis	...	...	..	...	1 sp.
Mathilda sp.	x	...	...	...	...
Liotia sp.	x	...	...	...	...
,, sp.	...	...	x	...	...
,, sp.	x	...	...	...	...
Cyclostrema (?) sp.	...	...	...	...	x
Fissurellidæa malleata, Tate ...	x	x	x	...	...
Hemitoma occlusa, Tate, m.s. ...	...	...	x	...	x
Emarginula candida, Tate, m.s. ...	x	...	...	...	...
,, sp.	x	x	...	...	...
,, sp.	x	...	...	...	...
,, cymbium (?), Tate, m.s.	...	...	...	...	x
,, sp.	...	...	x	...	...
Entalis mantelli, Zittel	x	x	x	x	x
,, annulatum, Tate ...	x	x	x	x	x
Dentalium aratum, Tate ...	x	x	x	x	x
Cylichna exigua, T. Woods ...	x	...	x	...	...
,, sp.	x	...	...	...	...
,, sp.	...	...	...	...	x
,, sp.	...	...	x	...	...
Dolichotoma sp.	x	x	x	...	x
Magilus sp.	...	...	...	...	x
Vermetus (?) sp.	x	...	x	...	x
Scaphander fragilis, Tate, m.s. ...	x	...	...	...	...
Bulla scrobiculata	x	...	...	...	...
,, sp.	...	x	...	...	x
Ringicula australis (?)	x	...	...	...	...
,, sp.	...	...	x	...	...
Pusianella hemiothone	...	x	...	..	...
,, sp.	x	...	...	...	...
,, sp.	...	...	...	...	x
Columbella cainozoica, T. Woods ...	...	x	...	...	x
Clathurella sp.	...	x	...	...	...
Daphnella gracillima, T. Woods ...	...	...	x	...	...
,, sp. (?)	...	x	...	...	...
Delphinula sp.	...	x	...	...	...
Eburnopsis sp.	...	...	x	...	...
Rissoa (?) chrysalida, Tate, m.s. ...	...	...	x	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Trochocochlea (?) sp.	...	...	x	...	...
Cephalopoda.					
Aturia australis, McCoy ...	x	...	...	...	...
Nautilus sp.	x	...	...	...	...
Pisces.					
Shark's teeth (2 species) ...	x	...	...	x	...
Ear bones	...	x	x	3 sp.	x

Section from Corio Bay to the Dog Rocks.

DISTANCE about 6 miles.

Horizontal scale 1¼ inch to 1 mile.



Sketch Map of the District N.W. of Geelong.

Art. IV.—*A New Species of Fresh-water Fish from Lake Nigothoruk, Mount Wellington, Victoria.*

By A. H. S. Lucas, M.A., B.Sc.

[Read June 11, 1891.]

Galaxias nigothoruk, sp. n.

D. 10. A. 11–13. P. 16. V. 7.

Height of body in front of dorsal fin contained between seven and eight times in the length exclusive of the caudal fin. Length of head contained rather more than four times in the same.

Head broad; trunk gradually narrowing to root of caudal; width between eyes equal to maximum height of head; jaws about equal; maxillæ reaching to beneath anterior third of eye; diameter of eye rather less than one-fourth length of head, quite equal to length of snout.

Dorsal commences at last third of trunk; anal a little behind dorsal; pectorals reach rather more than half way to roots of ventrals; ventrals extend over nearly two-thirds of distance between their roots and the vent. Minimum height of tail about two-thirds height of trunk between dorsal and ventral fins.

Coloration.—Ground hue of skin dark-green on back of trunk; lighter green on sides; on belly, silvery blueish-green; Ground hue of head olive-green dorsally, blueish-green ventrally, operculum purplish. Whole skin covered with innumerable tiny brown to black pigment dots. These, when crowded close together, form dark spots, which give the trunk a richly speckled appearance. On the fins, the dots are arranged along the rays. Fins reddish-yellow. Iris a beautiful bronze-yellow.

General length of those caught, somewhat over three inches. None of much greater length were observed, but of this size and smaller, there were thousands.

Locality.—Lake Nigothoruk, above the head of the Wellington River, Gippsland, the only known mountain lake in Victoria.

Food.—Insects, worms, &c.

Art. V.—*Note on the Alkaloids of Strychnos psilosperma.*

By Prof. Rennie, M.A., D.Sc., and G. Goyder, Jun., Esq., F.C.S.

[Read August 13, 1891.]

Some time ago, Baron von Mueller kindly forwarded to one of us, for examination, a small parcel of fruits of Strychnos psilosperma. Baron von Mueller states that this species is not yet cultivated anywhere, and that his correspondent in sub-tropical Eastern Australia had watched the few plants there, in their native haunts, for several years, but that they never bore fruit till last year.

The method used for extraction of the alkaloids was as follows:—The fruits were pounded up as far as possible, and then nearly dried in the water oven. Ten grammes of this material was then mixed with a suitable quantity of lime, some water added, and the mixture dried on a water bath. It was then placed in a Soxhlet's apparatus and extracted for several hours with strong alcohol. The alcoholic extract, having been slightly acidified with sulphuric acid and filtered, was evaporated, again filtered, rendered alkaline with soda, and thoroughly extracted with chloroform. The chloroform extract, after evaporation, was again taken up in acidified water, filtered, again rendered akaline, and extracted with chloroform. The residue, after evaporation, was then dried at 100° C. till constant. The weight of mixed alkaloids so obtained was ·031 gramme, which, allowing for about 4 per cent. of water still remaining in the nearly dried material, gives a yield of 0·32 per cent. Though every care was taken to make the extractions as thorough as possible, this result is doubtless below the truth; but allowing for experimental error, the yield of total alkaloids is not great in comparison with that obtained from some other species. Strychnos Ignatiæ, for example, yields about 1·5 per cent. of strychnine, and 0·5 per cent. of brucine. It is quite possible, however, that under favourable conditions the yield would be much increased. The quantity of total alkaloids was so small, that a quantitative separation was not attempted. A qualitative separation, however, revealed the presence of both strychnine and brucine, the former apparently in considerable excess.

Art. VI.—*On the Oviparity of Peripatus leuckartii.*

By Arthur Dendy, D.Sc., F.L.S.

[Read August 13, 1891.]

Peripatus leuckartii has proved to be by no means uncommon in Victoria, being recorded from a good many distinct localities, and exhibiting a remarkable series of variations in colour and pattern, as I have already described.* Hitherto, however, little has been known of its habits, and nothing of its mode of reproduction. The only observer, so far as I am aware, who has said anything of its life-history, is Mr. Fletcher, who has described† four very young individuals, the progeny of a female kept by him in damp moss and leaves for four months (July to October inclusive). Mr. Fletcher did not observe the birth of the young, but found them in company with the mother when apparently only a few days old. He assumes, naturally enough, that they were born alive, as in all other species whose life-history is known; the viviparous habit being, indeed, one of the most remarkable characters of *Peripatus.*

In May last I obtained several specimens of *Peripatus leuckartii*, chiefly from Macedon, some of which I have since kept alive in a small vivarium specially arranged for the purpose. The vivarium consists of a large glass jar, with a flat glass top supported on two thin slips of glass slightly above the edge of the jar, in order to admit of free ventilation. To guard against drying up, from which cause I had previously lost specimens, I keep a small open jar of water inside the larger one, and the floor of the vivarium is thickly covered with very rotten wood, kept moist by the evaporation of the water.

In this vivarium *Peripatus* flourishes well, and the specimens may be inspected, when desired, by turning over the

* "Proceedings of the Royal Society of Victoria," July 11, 1889.

† "Proceedings of the Linnean Society of New South Wales," October 31, 1888.

rotten wood. On making such an inspection on the 31st of July last, I found that some twelve or fifteen eggs* had been deposited beneath bits of rotten wood, and in crevices of the same. Careful examination showed that these were undoubtedly eggs laid by *Peripatus*. I collected all I could find and removed them, with some of the rotten wood, to a separate receptacle, and then carefully turned out the vivarium, and examined its contents. I found that there were present four specimens of *Peripatus leuckartii*, one male and three females, all apparently in good health,† and that there was nothing else which could possibly have laid the eggs, the largest living thing visible besides the *Peripatus* being a very small ant.

The vivarium was stocked on the 18th of May, and as I have carefully examined it several times since then, I am sure that the eggs must have been recently deposited. The view that they are really eggs of *Peripatus* receives strong support, if required, from anatomical examination of adult females. In these, I have nearly always found eggs in the uterus, but, although I have dissected specimens killed in December, May and July, I have never found embryos.‡ Moreover, the structure of the eggs *in utero* is very characteristic, and argues strongly against any idea of intra-uterine development. They are very large, oval in shape, and consist each of a very tough, thick membrane, enclosing a quantity of thick milky fluid full of yolk granules. I have only examined one egg microscopically after laying, as I wish as far as possible to watch the development; but this one agreed so closely with those found *in utero* that there can, I think, be no reasonable doubt of its identity. It was of just about the same size ($\frac{3}{40}$ by $\frac{3}{50}$ inch), of the same colour (very pale yellow), with a very tough membrane and a milky fluid contents containing very many yolk granules, but with no appearance of an embryo. The only difference concerns the almost chitinous-looking membrane which, instead of being smooth or nearly so, as when *in utero*, is exquisitely sculptured or embossed

* To determine the exact number would have involved breaking up the wood and thus disturbing the eggs more than seemed desirable.

† The male has since died, but the females were all still alive and apparently healthy on August 17th.

‡ The only July specimen dissected contained neither eggs nor embryos. Possibly the eggs had been recently deposited. The specimen was captured quite at the end of the month.

in a beautiful and regular design, consisting of little crumpled papillæ, somewhat resembling worm-casts, arranged at fairly regular intervals over the surface, and with much finer meandering ridges occupying the spaces between them. Such sculpturing is, as is well known, characteristic of many insect eggs, which renders it especially interesting in view of the relationships of *Peripatus*. As it is not present in intra-uterine* eggs, it must be formed as the egg passes through the vagina, which is large and thick-walled.

It thus appears that *Peripatus leuckartii* lays eggs in July, or thereabouts; and it appears also, from Mr. Fletcher's observations, with which it will be seen that my own fit in very well so far, that the young are hatched at the end of October. As, however, I have also found large eggs in a specimen captured and killed in December, I think it not impossible that the animal may be double-brooded.

The mode of reproduction in *Peripatus leuckartii* thus seems to differ widely from that known in any other species of the genus, and to conform rather to the insect type. Probably, considering the immense quantity of food-yolk present, the development also differs widely; this I hope to be able to work out in time, but the presence of so much fluid and granular yolk, and of such a tough membrane, will, I fear, render the task very difficult.

It would be interesting to discover whether *Peripatus insignis*, the only other known Australian species, is also oviparous. The smaller size and much rarer occurrence of this species, however, will render investigation more difficult.

Postscript.—On August 31st one of the female specimens was found dead in the vivarium. I at once dissected it, and found the reproductive organs very well developed; but, although the ovary and oviducts were both large (the former containing a great many ovarian eggs), there was not a single egg in either of the oviducts. Doubtless, all the eggs had been laid. It is worth mentioning in this connection that another female specimen found at Macedon in May last (at the same time as the specimens which were placed in the vivarium) was dissected a few days after being captured, and was then found to contain no less than twelve large eggs in the oviducts.

* I have used the term "uterus" in accordance with the customary nomenclature, it would probably be better to speak only of "oviducts" in *Peripatus leuckartii.*

Up to the present time (September 4th) I have found no more eggs in the vivarium. The total number of eggs found is fourteen. This seems a small number for three females to lay, but probably the number laid varies considerably, as one specimen which I dissected some time ago contained only six eggs in the oviducts.

Art. VII.—*Short Descriptions of New Land Planarians.*

By Arthur Dendy, D.Sc., F.L.S.

[Read August 13, 1891.]

The object of the present communication, is to describe as briefly as possible some new species and varieties of land planarians which have come to hand since I read my last paper on the subject before this Society.* The specimens described were collected by Professor Spencer, Messrs. C. French, F.L.S., H. Grayson, and C. C. Brittlebank, to all of whom I wish to express my indebtedness. The most interesting of the new species is *Rhynchodemus simulans*, collected by Mr. Brittlebank at Myrniong, near Bacchus Marsh, Victoria. With the exception of the single specimen of *Rhynchodemus victoriæ* obtained by Professor Spencer in the Croajingolong district, not very far from the New South Wales border, and described by me in a previous communication,† this is the first time the genus *Rhynchodemus* has been met with in Victoria. I hope on a future occasion to be able to publish figures of all the new species and varieties.

Geoplana ventrolineata, n. sp.

Body, when crawling, almost circular in section, tapering gradually at either extremity; length about 23 mm.; greatest breadth little over 1 mm. Eyes arranged as usual, and continued for a long way down the body in the light lateral line. Peripharyngeal aperture (in spirit) at about the junction of the middle and posterior thirds of the body; genital aperture somewhat nearer to the peripharyngeal aperture than to the posterior end.

Dorsal surface very dark grey, almost black, with two very narrow lines of light greyish, one on either side of a median dark grey line of about equal width. There are two similar narrow lines of pale grey, one on either side of the body, just visible from the dorsal surface.

Ventral surface strongly marked with alternate light and dark longitudinal bands, arranged as follows:—In the middle

* "Transactions of the Royal Society of Victoria," June 11, 1891.

† "Transactions of the Royal Society of Victoria," May 8, 1890.

line a rather narrow band of light yellowish grey; on each side of this, a band of about twice the width of much darker brownish, or almost purplish, grey; outside each of these again, a rather narrow band of light yellowish grey; then a narrow dark band of brownish grey and then the light lateral line already mentioned.

Anterior extremity nearly black.

This beautiful and well marked little planarian was found in abundance by Mr. H. Grayson in Brunning's Nursery Garden, St. Kilda, Victoria, in July and August 1891. Probably it was introduced with plants from some other locality, but it is impossible to say whence. It is an interesting fact that Mr. Grayson also found a number of specimens of the blue-tipped variety of *G. cœrulea* in the same locality; the history of this variety, also probably introduced, is given in my last paper on the subject.

Geoplana dubia, n. sp.

Body shaped as in *G. hoggii* and its allies. Length, when crawling, about 50 mm.; greatest breadth, 3 mm. Eyes arranged as usual, distinct and numerous. Peripharyngeal aperture (in spirit) well behind the middle of the body, but in front of the junction of the middle and posterior thirds; genital aperture doubtful.

The ground colour of the dorsal surface is rather pale yellow, with a tinge of green, especially in the middle line. Only two stripes are present, corresponding in position and appearance to the two inner stripes of *G. hoggii*; they are broad, deep blue-green in colour, and situate one on either side of a somewhat narrower band of ground colour.

The ventral surface is pale yellow, and the anterior extremity brown.

This form closely resembles *Geoplana hoggii* without the dark outer stripes, and may be only a variety of that species (or of *G. sulphurea*). It is readily distinguishable from *G. m'mahoni* by the dark stripes being of a green colour and *much closer together*. One specimen only was obtained by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, in July 1891.

Geoplana alba, var. *roseolineata*, nov.

This very beautiful variety resembles small specimens of the typical *G. alba*, with the addition of two narrow bright red lines running all down the dorsal surface of the body, and dividing it longitudinally into three almost equal parts. Several specimens were obtained, the usual size of which when crawling was about 35 mm. in length, and 1·5 mm. in greatest breadth. The body was more cylindrical than in fully grown typical examples of *G. alba*.

The specimens look as if they were young. One, considerably larger than the remainder, has the red stripes less distinct. On the other hand, I have seen small specimens of *G. alba* from other localities coloured in the typical manner, without any red stripes.

All the specimens of the variety *roseolineata* were obtained along the railway line between Korumburra and Loch, South Gippsland, Victoria, by Professor Spencer, July 1891.

Geoplana howitti, var. *obsoleta*, nov.

Body tapering gradually in front, much more abruptly behind. Ventral surface very flat, dorsal surface very strongly arched. Length, when crawling, about 40 mm.; greatest breadth, about 3 mm. Opening of peripharyngeal chamber (in spirit) somewhat behind the middle of the ventral surface: genital aperture about half-way between the peripharyngeal aperture and the posterior end. Eyes sparingly arranged, almost in a single row, on the sides of the head (? round the front also).

The ground colour of the dorsal surface is rather deep primrose yellow, and there are only two, dark chestnut brown stripes, one on either side of a somewhat wider median band of clear ground colour. Outside the dark stripes the ground colour is flecked with minute specks of a lighter chestnut brown; at each side of the head these specks run together to form an almost continuous but irregular stripe for a short distance.

The ventral surface is nearly white, with no markings, and the anterior extremity is reddish brown.

This variety differs from the type of *Geoplana howitti* in the absence of the outer dark stripes. In one of the two specimens obtained the dark specks also are only faintly indicated.

Both specimens were collected by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, July 1891.

Geoplana adæ, var. *extralineata*, nov.

I propose this name for two small specimens of *G. adæ* with chestnut brown stripes but differing from the typical form in the possession of an additional fine brown stripe on each side, a little outside the broad one. The peripharyngeal aperture (in spirit) is situate at about the middle of the ventral surface, and the genital aperture about half way between it and the posterior end.

Both specimens were collected by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, July 1891.

Rhynchodemus simulans, n. sp.

Body oval in section, a good deal flattened when at rest, more cylindrical when crawling ; tapering gradually in front to the horse-shoe shaped anterior extremity, and more abruptly behind. Eyes two, as usual in the genus, one on either side, a little way behind the anterior extremity. Length, when crawling, about 22 mm. ; greatest breadth, 1·5 mm. Peripharyngeal aperture (in spirit) well behind the middle of the ventral surface, but not quite as far back as the junction of the middle and posterior thirds of the body. Genital aperture slightly nearer to the posterior extremity than to the peripharyngeal aperture.

Dorsal surface dark grey, darker in the middle line ; spotted or mottled all over (in the middle line as elsewhere) with small specks of white, giving it a beautiful and characteristic marbled appearance under a low power of the microscope.

Ventral surface marbled like the dorsal, but with the white predominating instead of the grey. Anterior extremity greyish.

A good many specimens of this beautiful little species were obtained by Mr. C. C. Brittlebank at Myrniong, near Bacchus Marsh, Victoria, in July and August 1891. It is an extremely small species and, owing to the quantity of black pigment present, I had considerable trouble in determining the number of the eyes, so that at one time I considered it as belonging to the genus *Geoplana*. Serial sections, cut by the paraffin method, however, at once decided the question in favour of *Rhynchodemus*.

Art. VIII.—*On the Presence of Ciliated Pits in Australian Land Planarians.*

(With Plate V.)

By Arthur Dendy, D.Sc., F.L.S.

[Read September 10, 1891.]

In his well known memoir, "On the Anatomy and Histology of the Land Planarians of Ceylon,"* Professor Moseley describes the presence of ciliated pits on the anterior margin of the head of *Bipalium*. As his remarks on these pits are short, and at the same time of great interest, I may perhaps be allowed to quote them in full:—"In describing the habits of *Bipalium*, I described the manner in which the animal throws out tentacular-like projections from the anterior margin of its semi-lunar head when in motion, and evidently uses these temporary tentacles as sense organs. In reading M. Humbert's interesting account of *Bipalium*, I found that he had observed this habit of the animal as well as I, and had been led by his observation to seek for sense-organs or tentacular structures on the margin of the head. He was not successful in finding any; but on very careful examination of well-hardened specimens I was more fortunate, and discovered a narrow band extending along the whole anterior margin of the head, entirely free from pigment, and occupied by a row of cylindrical rounded papillæ placed vertically side by side, and with small oval openings between their superior extremities (Plate XIII, Fig. 16). This row of papillæ is in the upper part of the lower fifth of the margin of the head, so that it lies close to the ground when the animal's head is lowered. The papillæ are covered with short cilia, but I could find no special structure in them, except that in their region, and that of the ciliated pits, there

* Philosophical Transactions of the Royal Society, 1874.

is a large quantity of tissue formed of small spindle-cells. The oval apertures between the papillæ lead to ciliated pits, the appearance presented by which is shown in Figs. 11, 12, and 13, Plate XV. In longitudinal and horizontal sections, the appearance presented in Fig. 13 is seen. The light bands, which appear to pass to the bottoms of the ciliated pits, are continuous with the vascular* network of the head. Whether they represent tubes in communication here with the exterior, I cannot say. They may convey nerves to the sacs. From the manner in which the animal uses the front of its head, their can be little doubt that the papillary line discharges some special sense-function ; but it is possible that this function is discharged by the papillæ, whilst the ciliated pits, with their communicating vascular stems act as excretory organs. The papillary line, with its pits, was found in all the species of *Bipalium* examined. The ciliated sacs of Nemertines came at once, of course, into one's mind in conection with these curious structures. Careful examination may perhaps give evidence of the existence of similar ciliated sacs in *Geoplana* and other Planarians. Nothing of the kind was found in *Rhynchodemus*."

Although Professor Moseley subsequently studied and described† species of *Geoplana* from New South Wales and elsewhere, he failed to discover the presence in them of ciliated pits. Von Kennel, also, makes no mention of them in the German land Planarians belonging to the genera *Rhynchodemus* and *Geodesmus*, which were carefully investigated by him,‡ nor have they hitherto been discovered by any of the Australian zoologists who have more recently paid attention to the group. In my memoir on "The Anatomy of an Australian Land Planarian," published in the Transactions of this Society for 1889, no mention is made of any such organs, nor did I at that time suspect their existence, so that, so far, the memoir is incomplete, and I am glad of the present opportunity of making up the deficiency.

The object of the present communication, therefore, is to record the occurrence and describe the structure and arrangement of ciliated pits in Australian land Planarians belonging to the genera *Geoplana* and *Rhynchodemus*. It

* This is now known to be a nervous, and not a vascular, structure.—A. D.

† "Notes on the Structure of Several Forms of Land Planarians, &c." *Quarterly Journal of Microscopical Science*, Vol. XVII (N.S.), p. 273.

‡ "Die in Deutschland gefundenen Landplanarien, &c." Arbeiten des Zool.—Zoot. Institut in Würzburg, Band V, Heft 2.

seems strange that these have not been discovered before, but they are of extremely minute size, invisible with a pocket lens, while even under a low power of the microscope their true nature is difficult to make out; when, however, they are examined under certain favourable conditions, which will be described presently, they are very clearly visible indeed.

The following is a list of the species in which I have found them:—*Geoplana spenceri*, *G. alba*, *G. ventrolineata*, *G. munda*, *G. ventropunctata*. *G. quinquelineata*, *G. hoggii*, *G. adæ*, *G. cœrulea* (blue-tipped variety), *G. dendyi*, *G. quadrangulata* var. *wellingtoni*, *G. sugdeni*, *G. fletcheri*, *G. howitti* var. *obsoleta*, *G. mediolineata*, *G. m'mahoni*, and *Rhynchodemus simulans*.

Of these species I have examined the ciliated pits in the living state only in *Geoplana ventrolineata*, *G. alba* and *G. cœrulea* (blue-tipped variety). In the other species I have clearly recognised them in spirit-preserved specimens. In short, I believe that the ciliated pits occur in all species of *Geoplana* and *Rhynchodemus*.

I first noticed the pits in examining some spirit-preserved specimens of *Geoplana ventrolineata* as opaque objects under a low power of the microscope. I found on the ventral surface, at each side of the anterior extremity, a light longitudinal line, devoid of pigment, slightly curved as shown in Fig. 6, and apparently slightly raised as a ridge, but this raised effect was doubtless exaggerated by the disposition of the pigment, for hardly any ridge is visible in transverse sections (Fig. 7). This line lies beneath the line of eyes, and obviously corresponds to the margin of the horse-shoe-shaped anterior extremity in the living animal. Along the inner margin of the light line on each side was visible a single row of very minute dark specks, which proved on careful examination to be minute punctuations like those made by the point of a very fine needle. These punctuations are arranged with great regularity, and extend throughout the entire length of the light line, disappearing as the latter dies out posteriorly. I could not determine whether or not the punctuations were continued all round the anterior margin; they are only clearly visible in a good light, and it is possible that I may have overlooked them in front.

Having satisfied myself as to the presence of the line of pits in *G. ventrolineata* I went through my collection and examined all the other species I had under similar conditions.

In nearly every species I saw the row of pits clearly; always situate in a light line on each side of the ventral aspect of the head, beneath the line of eyes. Generally the pits have the form of well-defined though minute perforations, as in *G. ventrolineata*. In some of the species, however, and notably in *G. spenceri* (Fig. 8) the light line (= margin of horse-shoe-shaped anterior extremity) tends to become grooved or furrowed transversely; the pits in this case lie in the transverse grooves, very much as figured by Moseley for *Bipalium*. In *G. spenceri* the transverse furrows are well marked in large specimens and may be connected by a longitudinal furrow as shown in Fig. 8. Such furrows might easily be mistaken for artificial wrinkling due to the action of the spirit, and, had it not been for comparison with other specimens, I should not have suspected the presence of ciliated pits in *G. spenceri*.

At this stage in the investigation I received from Mr H. Grayson living specimens of *G. caerulea* (blue-tipped variety), *G. alba* and *G. ventrolineata*, captured in Brunning's Nursery Garden at St. Kilda. Microscopic examination of these soon showed the true nature of the pits seen in spirit-preserved specimens. In making such an examination of living material I find it best to proceed as follows:—Cut off the anterior end of the Planarian with a sharp scalpel, lay it in a drop of water on a glass slip with the ventral surface uppermost; put a cover glass over it and then, with a few sharp raps on the cover glass with a pencil or other blunt instrument, flatten out and crush the specimen until it becomes sufficiently transparent. On examining such a preparation of the blue-tipped variety of *G. caerulea* with a low power of the microscope (Zeiss A, oc. 2), and by transmitted light, I saw the appearance represented in Fig. 1. The eyes (*e*) were arranged in single series all round the anterior extremity. Inside the line of eyes and separated from it by a narrow interval was visible the light line (*l. l.*) corresponding to the margin of the horse-shoe-shaped anterior extremity of the living animal. In this line was visible the single row of ciliated pits (*c. p.*), apparently not continuous round the front, though on this point I am doubtful. Of these pits there seemed to be about thirty on each side. A much higher power, such as Zeiss D or F, is necessary in order to make out the structure of the pits, which measure only about 0·017 mm. in outside transverse diameter.

Under a high power the pits are seen to be oval or circular in optical transverse section, with a very characteristic sharp double outline (Figs. 3 and 5), the thick wall of the pit being composed of almost cubical cells arranged in a circle. These cells in *G. cœrulea* are slightly granular, and richly ciliated, resembling, in fact, the ordinary epidermic cells of the ventral surface as described by me in *Geoplana spenceri*.* In *G. cœrulea* the cilia appear, as far as can be seen by focussing at different levels, to be continuous right to the bottom of the pit, while the pits themselves appear deep and dilated below. The cilia in the pits work in a spiral or vortex. The whole ventral surface of the animal, of course, also appeared ciliated. Occasionally the wall of the pit is seen to contract suddenly and spasmodically, but this only happens rarely and with no regularity.

The observations made upon living specimens of *Geoplana cœrulea* were confirmed in the case of *G. alba* and *G. ventrolineata*. In *G. alba* the pits are very difficult to see in spirit-preserved specimens, but they are plainly enough visible in the living animal. Fig. 5 shows a ciliated pit of *G. alba* seen in optical transverse section at the lowest focus. The cells of the wall seem to be less granular than in *G. cœrulea*, and the cilia do not seem to extend quite to the bottom of the pit, which appears to be occupied by a granular substance. The wall of the pit sometimes twitched spasmodically. In this species the pits are continued right round the anterior margin, and in my preparation the most anterior of them lay right on the edge, so that I was able to study them in optical longitudinal section also. Such a section is represented in Fig. 4. It will be seen that the outer part of the pit is funnel-shaped, that it is narrowest in the middle and dilated at its lower end. The cilia are largest around the external opening, and apparently absent from the dilatation at the bottom of the pit. The cells lining the lower portion of the pit could not be made out, it being necessary to focus through a considerable thickness of granular tissue.

In *G. ventrolineata* the ciliated pits have the same appearance in optical transverse section as in *G. alba*.

I next wished, if possible, to verify the observations recorded above by means of sections. For this purpose I selected a specimen of *G. ventrolineata*, in which the pits

* "Anatomy of an Australian Land Planarian."

were plainly visible after preservation in spirit (Fig. 6), and, after staining with borax carmine, cut a series of thin transverse sections across the anterior extremity by the ordinary paraffin method. I may state that, in order to ensure success, the sections must be cut as thin as possible. One of these sections is represented in Fig. 7 (the muscles, connective tissue, &c., are omitted in the figure; the nervous system, eyes, and epidermis only being shown). The light lines, in which the pits lie, are plainly recognisable in transverse sections by the comparative clearness and freedom from pigment of the epidermis and the tissues immediately below it. The epidermis also seems to be composed of shorter cells, richly ciliated. The exact position of the lines is shown in the figure (Fig. 7, *l. l.*). The pits themselves are more difficult to recognise, but the outer part of the pit is sometimes visible (provided the section be thin enough) as a depression in the epidermis, situate near the inner side of the light area (Fig. 7, *c. p.*); while sometimes the deeper part of the pit is also clearly recognisable, though not nearly so plainly as in the living animal. Sometimes, owing either to obliquity in the section or in the direction of the pit, the inner portion of the latter is cut transversely at a little distance below the epidermis. Special nerves run out from the cerebral ganglion to the light line on each side (Fig. 7, *n.*), and these doubtless supply the ciliated pits. The eyes, on the other hand, lie directly on, in fact partly imbedded in, the nerve sheath, and are apparently innervated therefrom (Fig. 7). The nerves, as usual in land planarians, appear as lighter, more transparent bands, surrounded by the more deeply staining tissues.

So far I have only described the ciliated pits as they appear in species of *Geoplana*. The only species of *Rhynchodemus* in which I have studied them is *R. simulans*, and only in spirit-preserved material. They are arranged exactly as in *Geoplana* around the margin of the horse-shoe-shaped anterior extremity, below the eyes, and a minute study of carefully prepared transverse sections, combined with microscopical examination of the anterior extremity as a whole, has failed to reveal any points of difference between the two genera in this respect.

It is impossible to be certain as to the function performed by the ciliated pits. Their position on the horse-shoe-shaped anterior margin, which, it will be remembered, is uplifted when the animal crawls, and their special innervation, indicate that they are sense organs, and for my own part I am inclined to regard them as olfactory. They probably occur in all land Planarians, and it is not unlikely that they are homologous with the cephalic pits of Nemertines, as suggested by Professor Moseley.

DESCRIPTION OF PLATE V.

(Figures 1 to 5 were drawn from living specimens.)

FIG. 1.—*Geoplana cœrulea* (blue-tipped variety). Anterior extremity crushed flat and examined under Zeiss A, oc. 2, as a transparent object.

e.—Eye.
c. p.—Ciliated pit.
l. l.—Light line in which the ciliated pits lie.

FIG. 2.—*Geoplana cœrulea* (blue-tipped variety). Portion of the above more highly magnified. Lettering as before. The blue specks represent the pigment cells.

FIG. 3.—*Geoplana cœrulea* (blue-tipped variety). Optical transverse section of ciliated pit, surrounded by pigment cells.

FIG. 4.—*Geoplana alba.* Optical longitudinal section of a ciliated pit from the extreme anterior margin (Zeiss F, oc. 2).

ep.—Epidermis.
d.—Dilatation at the bottom of the pit.
ci.—Cilia.

FIG. 5.—*Geoplana alba.* Optical transverse section of a ciliated pit; bottom focus.

FIG. 6.—*Geoplana ventrolineata.* Enlarged view of the ventral surface of the anterior extremity of a spirit-preserved specimen (Zeiss A, oc. 2); showing the light lines and ciliated pits. The eyes are not seen, owing to the opacity of the surrounding tissues.

c. p.—Line of ciliated pits.

Fig. 7.—*Geoplana ventrolineata.* Transverse section of the specimen represented in the last figure. The nervous system is coloured blue (Zeiss A, oc. 4, camera outline).

c. g.—Cerebral ganglion.
n. s.—Nerve sheath.
n.—Nerve to light line and ciliated pits.

Other lettering as in previous figures.

Fig. 8.—*Geoplana spenceri.* Enlarged view of the side of the anterior extremity of a spirit specimen (Zeiss A, oc. 2), showing the eyes and the grooves in which the pits lie.

e.—Eyes.
gr.—Grooves.

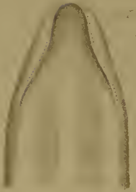


Fig 6

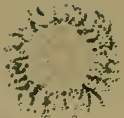


Fig 3.

Fig 5

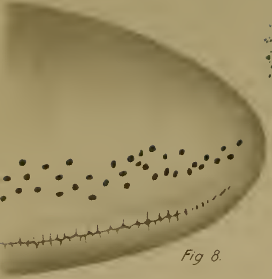


Fig 8.

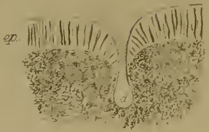


Fig 4

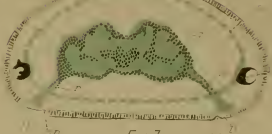


Fig 7

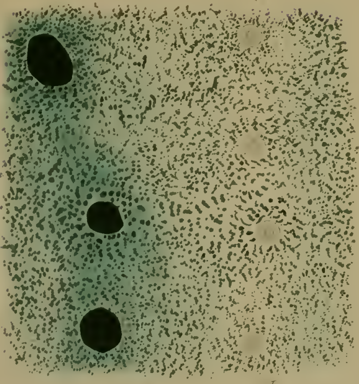


Fig 2

Fig 1

Art. IX.—*Photographic Charting of the Heavens.*

By R. L. J. Ellery, C.M.G., F.R.S., F.R.A.S.

Government Astronomer, Melbourne.

[Read July 9, 1891.]

The immense help to astronomy promised by photography, was fully recognised in the earliest days of the practical application of the art, and no sooner had Arago explained to the French Academy of Sciences Daguerre's discoveries in August 1839, than Dr. J. W. Draper, of New York, applied them to astronomical purposes, and the following year presented to the New York Lyceum of Natural Sciences, the first astronomical photograph ever taken, in the shape of a Daguerreotype picture of the moon, which was one inch in diameter, and required an exposure of twenty minutes duration. Dr. Draper and others followed up this early experiment, but the low sensitiveness of the plates then in use, and other difficulties, confined the results to the category of somewhat unsatisfactory experiment for several years. We find some sun pictures were obtained in Paris in 1845, and in the same year, pictures of the stars Vega and Castor were secured by Bond of Cambridge, U.S., and of the moon by the same astronomer in 1850. These experiments, although far from satisfactory, indicated great possibilities, supposing improvements in the art took place. Warren de la Rue, in 1851, made the first substantial advance, which was rendered possible by the discovery of the collodion process. From this time onwards, astronomical photography made steady progress, and gave most valuable assistance in the total eclipses since 1854, and on the occasions of the transits of Venus in 1874 and 1882. For the purpose of recording the apparition, development, and duration of sun spots, photography has given invaluable help, and since 1858, pictures of the sun have been obtained every fine day, first in England only, but latterly in many parts of the world, Photographs of the moon, of exquisite delicacy, are now common, and almost a commercial commodity.

Photographs of the planets and stars have hitherto been obtained unsatisfactorily, and with considerable difficulty, on account of their small amount of light compared with the sun or the moon. With the sun the light is so intense, that the difficulty is to obtain an exposure sufficiently short to avoid destroying the sensitive surface, and with the moon even a second or two is enough for telescopes of moderate dimensions. The apparent motion of these bodies in that space of time, is also so small as to require no very special contrivances to compensate for it. With stars and planets, however, where the light is but an insignificant fraction of even that of the moon, the time of exposure has to be so much prolonged, that the earth's diurnal motion renders good photographs quite impossible without the most delicate mechanical means for keeping the telescope pointed precisely and without the least deviation, on the star or planet for many minutes, or even hours. For this reason, although many efforts and experiments have been made in this direction, it is only comparatively recently that the great difficulties presented have been so far overcome as to bring this department of astronomical photography within the realms of practical work. The first important step towards this end, was the invention of the gelatine bromide plate, with its wonderfully sensitive film, reducing many times the period of exposure required for the old collodion plates ; and secondly, the devising of driving clocks for equatorial telescopes, with automatic controlling appliances, so accurately constructed that the telescope follows the motion of a star so precisely, that a plate exposed on a group of stars for an hour, will show each star as a distinct and round black spot, of a size proportional to the star's brightness, instead of a *black line*, which would result if the motion of the telescope did not exactly correspond with the motion of the earth; and fainter stars, quite invisible to the naked eye, either in the sky or on the plate, are seen under the microscope as minute and absolutely round black spots, showing unmistakably the accuracy of the movement of the telescope. These two improvements have made it possible to extend the use of photography to one of the most important branches of astronomy, that of cataloguing and charting the stars.

Immediately after the introduction of the gelatine films in 1883, we tried to get some star photographs with our great telescope, with only partial success, owing chiefly, I believe, to the difficulty of getting the necessary smooth and uniform motion of the telescope. Still, some of the photographs, viewed in the light of our present experience, are of high promise and encourage further experiments. Some prints from these photographs are on the table. These were taken with some of the early gelatine plates made by Edwards in London. A photograph print of the group *Kappa Crucis*, will be found interesting to compare with a print obtained from a photograph of the same object taken with the astrographic telescope.

The first photograph of a nebula taken in the Southern Hemisphere, was obtained with the great Melbourne telescope in February 1883.

Star photography reached the stage of practical success in the hands of the brothers Henry, of Paris, in 1885. The Paris Observatory had been for a long time engaged in preparing elaborate charts of the heavens by the ordinary methods of eye observation, but on coming to the regions covered by the milky way, it became evident that by such a method the work would extend over an impracticably long period; they therefore decided to try the photographic method, and after numerous experiments, both with respect to optical and mechanical means, as well as photographic processes, they constructed a special instrument with which they succeeded beyond their most sanguine expectations. The photographs depicted a great number of stars not visible in a telescope of the same dimensions, and it was soon found that the number of stars impressed on the plate for any particular region, increased almost *ad infinitum* with the time of exposure of the plates. Some very important discoveries of celestial objects at once resulted, many interesting physical facts were revealed, and a new and powerful method of astronomical research established, which opens up an immense range of possibilities.

The Henrys' instrument was a double telescope equatorially mounted, one telescope to be used as a guider, and the other as the photographic camera, both rigidly connected and moving together. The whole was made to follow the diurnal motion of the earth by clock work mechanism in the usual manner, the exception being that this part of the instrument was fitted for more accurate and uniform motion than is ordinarily the case. The photographic object glass was 13·4 inches in diameter, and 13 feet focal length, while the guider telescope had an object glass of less diameter, but about equivalent focal length. This latter telescope is used to keep the instrument pointed always exactly on the same point in the sky, by watching a selected star, which is bisected by the spider web cross in the field of the telescope, and by requisite adjusting motion, kept exactly bisected during the whole time of exposure. A photograph of the Pleiades, obtained by the brothers Henry, exhibited 1421 stars, and a small nebula around one of them, which had never before been seen or suspected. A chart of this group, which had occupied an observer three years and four months, contains 671 stars, so that one hour's photography gave the position of 1421 stars, against 671 in three years and four months by eye observation.

So remarkable a success encouraged the Director of the Paris Observatory, Admiral Mouchez, to address a circular to astronomers all over the world, suggesting that a complete charting of the heavens should be undertaken, as an international work, by the various national observatories. The proposal being favourably received, an invitation was issued to all astronomers to attend a conference on the proposal, to meet in Paris in April 1887. Fifty-eight astronomers attended this congress, Australia being represented by my colleague, Mr. Russell, of Sydney Observatory. The congress agreed to the main propositions and passed a series of resolutions on most of the vital points, leaving the further consideration of details to several selected committees. Several meetings of members of the congress have since been held, the last being in March of the present year, when nearly all the minor points left to the committees were settled, and Admiral Mouchez declared the work of the international astrographic charting of the heavens had now commenced.

The earlier resolutions fixed the dimensions and optical characters of the photographic telescopes, the size and kind of photographic plates, times of exposure, and magnitudes of the stars to be secured on the plates. Subsequent decisions allotted particular portions of the heavens to each participating observatory, numbers of plates to be exposed to each two square degrees of the skies, and so on. Questions concerning the after measurements of plates and final formation of charts and catalogues remain still to be disposed of.

The summation of the work of the congress is briefly as follows:—It was agreed to undertake a photo. chart of the heavens of all stars down to the 14th magnitude, as they will be in the year 1900. Each participating observatory is to provide itself with a twin telescope, equatorially mounted, one for photograph camera, having an aperture of 33 centimetres (13·4 inches), and a focal length of 3·5 centimetres (13 feet), the other of about the same focal length, but of less aperture. The photographic object glasses were to be specially constructed with curves calculated for the wave lengths near the Fraunhofer line G. The exact form and dimensions of the twin guide telescope were left to the several observers participating. Gelatine bromide plates, 6¼ (166 millimetres) square to be used (particular make, left also to observers). These plates cover a little over two degrees square at the equator. Two sets of plates to be exposed, one for the catalogue to secure all stars down to the 11th magnitude, the other for the chart to contain all stars down to the 14th magnitude. Each set of plates to consist of two series, one to cover every successive 4 square degrees, and the other to cover the junction of four contiguous plates in such a way that its four corners correspond with the centres of these four contiguous plates. Eighteen observatories take part in the undertaking—eleven in the Northern, and seven in the Southern Hemisphere. For division of the work among these, the sky is partitioned into zones, and certain zones given to each observatory in such a way that no observatory will have to work very far from the zenith. Melbourne has the greatest range in this respect, as the zones from 65 degrees south to the pole are allotted to our Observatory, which gives us a zenith distance of 52 degrees. This was unavoidable, as Melbourne is the most southern of the very few observatories in the Southern Hemisphere. For every plate in each zone, a guide star has to be previously selected, and it was decided by the congress committee that such guide star must be within 22 min. of arc from the centre of the plate to which it belongs. This guide star is used as already described, and its position has to be exactly determined by transit observation to establish a date point to which all stars in the photograph have to be referred in the final measurements. The determination of these guide stars is in itself a great work, for although the position of a considerable number have already been well determined, and are to be found in existing catalogues, especially in the Northern Hemisphere, there are still a very large number of plates for which guide stars have to be found, and positions determined. To cover the whole of the sky with two sets of plates, will require nearly 42,000 plates; the Melbourne zones will require 2298.

It has been found that the gelatine films of the plates sometimes shrink unequally in drying after development. Such a thing would of course vitiate the subsequent measurements of the stars' positions as shown on the plates. To obviate this, the following plan has been adopted:—A glass plate exactly the same size as the photographic plate, $6\frac{1}{2} \times 6\frac{1}{2}$, is silvered on one side. This silvered surface is ruled into squares by extremely fine lines, five millimetres apart; the lines show as clear glass, and allow light to pass through. Each photographic plate before being used is placed in contact with this ruled plate and exposed for a second or two to parallel rays of light, which, passing through the rulings, impress a latent image on the film, and when developed after exposure to the stars in the telescope, exhibits the stars on a plate traversed by a network of extremely fine lines. If, now these lines are exactly five millimetres apart after the film has dried, it shows that there has been no distortion in shrinkage; if not, the amount of shrinkage can be measured. The silvered and ruled plate is called "the reseau," and every plate, before being used for charting, has to be exposed to the reseau as described.

Having explained the general scheme, I propose now to give a brief description of the arrangements made at our Observatory for the Melbourne portion of the work. The congress left it to the several astronomers to get their telescopes constructed on any plan and by any maker they chose, stipulating only that the photograph telescopes should all be of the same optical character and dimensions, viz., thirty-three centimetres aperture, and thirteen feet focal length, and the object glass to be corrected for the wave length about G. Several instruments were made in Paris, some in Germany, and some in America. Those for British and Australian observatories were made by Sir Howard Grubb, of Dublin, and ours is one of these. It consists of a twin telescope on a massive equatorial stand of the German form, with an unusually long declination axis to allow of plenty of room about the eye end when the telescope is pointed to the meridian Both the photograph and guider telescopes are made with strong steel tubes connected one with another in a most rigid manner. The photographic telescope is provided with a metallic plate holder, having all necessary adjustments, and with a shutter to cover the object glass, which can be worked easily from the eye end. The guider telescope has an object glass of ten inches opening, and thirteen feet focal length, and is fitted with a micrometer, with long range slides and an electric lamp apparatus for illuminating the spider webs in the eye piece, and for illuminating the various setting circles, scales, &c. Every means for setting, clamping and moving are found within convenient reach of the hands, when the eye is at the guider telescope. The whole of the moving parts, which amount to nearly two tons, are so balanced and counterpoised as to be operated with the greatest ease, and kept in rotation by the clock work with wonderful smoothness and precision. Nearly everything depends on the precision with which the clock moves the telescope, so as to keep the stars apparently stationary in the field of view. For this purpose, Sir H. Grubb has devised a very beautiful arrangement, which, however, is very difficult to describe without models. The mechanism consists first of a powerful clock gear, driven by a heavy weight and controlled by a peculiar kind of governor. This clock work alone drives the telescope, so as to follow diurnal rotation very closely, and will keep a star for an hour together in the field of view of the telescope, but does not control it so accurately as to keep a star bisected on a single spider line in the eye piece of the guider. To secure this, the maker has made a special electric controlling apparatus, which may be thus described:—The driving clock being adjusted to go as accurately as possible, one of the astronomical clocks in the Observatory is made to send a momentary galvanic current every second to an apparatus attached to the driving clock, called the detector. This is a wheel driven by the clock rotating in forty seconds, having three series of contact teeth on its periphery; pressing on these teeth are three springs electrically connected with another apparatus called a "distributor," which consists of three pairs of electro magnets operating a lever capable of moving right or left and making contact with platinum points, or of being held in a central position by the central electro magnet. The action is this:—The driving clock is set going, and the astronomical clock made to send its momentary currents every second through the detector to one or other of its three springs; if through No. 1, the distributor instantaneously moves to the left platinum point; if through No. 3, to the right, and if through No. 2 to the central electro magnet, keeping the lever neutral. Now, if the driving clock moves the telescope accurately, the astronomical clock current arrives at the moment the detector is making contact with the central spring No. 2, and the distributor remains neutral; if, however, the driving clock goes a little too fast, the current passes through No. 1 spring, and the distributor makes contact with the left platinum point, and if it goes too slow, the current passes through No. 3 spring and moves the distributor to the right platinum point. This works so well, that if the telescope moves $\frac{1}{40}$ of a second too fast, or too slow, it is immediately detected, and works the distributor. Now the "distributor" distributes another battery current to a little mechanism called an *accelerator and retarder*, whose offices are respectively to accelerate or retard the driving clock by very small amounts, according to the operation of the distributor, which is *instructed*, if one may use the word, by the detector. By this means the telescope can be kept following the stars so accurately that any one bisected by the micrometer spider web, will remain there for an hour or more together. The accelerator and retarder apparatus is composed of a pair of accurately constructed epicyclical trains, which cannot be described without models or complicated drawings. Besides these regulators, which are automatically worked as described, there is another pair workable by a hand key with two studs, and battery, so that by pressing one stud it operates the retarder and the other the accelerator.

The following will give a fair idea of the actual work of photographic charting:—The particular parts of the zones to be photographed on a night are arranged beforehand, and the guide stars for each plate selected. The dome being opened up and driving clock set going, the observer sets the instrument on the guide star, and as soon as the telescope is found to be steadily following, an assistant brings the plate holder armed with a photographic plate and inserts it into the plate holder frame of the telescope. The time of exposure being previously settled upon, the observer as soon as all goes quite steadily, opens the exposing shutter, keeping his eye constantly on the guide star, which is now bisected at the cross of the spider webs. The time of opening the shutter is noted, and at the expiration of the fixed time of exposure, as shown by an astronomical clock in the observing room, the assistant warns the observer, who instantly closes the shutter. During the whole time, ten, twenty, forty or sixty minutes' exposure, the observer has to rigorously watch the star and spider webs, and check, by means of the accelerator and retarder hand key, any tendency to leave the intersection, and absolutely to keep the intersection bisecting the star during the whole exposure. Any failure in this respect results in the photographic images of the stars being elongated or oval, instead of round, making them difficult for measurement. One plate being thus exposed it is removed, and the instrument set on the next guide star, and so on. All changing of plates has of course to be done in the dark room, and the observing room itself must be kept moderately dark during the exposure. The development of the plates with us is usually done on the following day.

So far as the Melbourne Observatory is concerned, none of the regular charting has been commenced yet, although for four months past we have been busily engaged in necessary preliminary and experimental work. It was not until the end of March that the Central Congress definitely decided many of the principal questions, and the final instructions have not reached us even yet, nor indeed have the Reseaux, &c., and the appliances for their use. Nevertheless, there are so many preliminary difficulties to be surmounted, and so much to learn regarding the effects of varying atmospheric conditions on the photographic process, and especially as regards time of exposure, that there has been no time actually lost yet. The work will occupy several years—five at least, and probably more. Concerning the more purely photographic part of the work, the relation of magnitudes of the stars to the size of their photographic images on the plates, and the effect of fluctuating conditions of the atmosphere, I hope to be able on some future occasion to contribute some interesting facts.

Art. X.—*On a New Species of Graptolitidæ (Temnograptus magnificus).*

(With Plate VI.)

By G. B. Pritchard.

[Read Sept. 10, 1891.]

This graptolite came from the same locality, namely about five miles to the north-east of Lancefield, as *Dictyonema grande*, a new species described by Mr. T. S. Hall, M.A., at the beginning of this year. It was on the occasion of my second visit to this locality that I had the good fortune to procure an almost perfect specimen. This, however, was not the first collected, as on the previous trip, Mr. T. S. Hall obtained two slabs of slate showing the centre of the stock, and a few bifurcations of the stipes, also numerous smaller fragments apparently referable to the same species.

Genus Temnograptus (Nicholson).

Order—*Hydrozoa*. Sub-order—*Graptolitidæ*. Family—*Dichograptidæ* (Lapworth). Zittel gives the following terse definition of this genus:—"Like *Tetragraptus*, but the four chief branches repeatedly forked in a dichotomous manner—*T. multiplex*, Nicholson."

T. Magnificus, sp. nov.

Polyp-stock multibrachiate, consisting of numerous strong bifurcating stipes which are symmetrically arranged on the two sides of their origin. Funicle very short, length 1·5 mm., breadth 1 mm., sicula not visible. Both extremities of the funicle divide into two non-celluliferous stipes, which diverge at an angle of 90°, and vary in length from about

1·55 cm. to 5·7 cm.; each of these four stipes bifurcates at an angle of about 70°, and then extends for a length varying from 3·8 cm. to 8·85 cm., when a fourth bifurcation (the first being where the funicle is given off from the sicula) takes place at about 45°. The two following bifurcations take place at smaller angles. The intermediate stipes become somewhat curved, probably owing to their flexuous nature, and vary very much in length in the same individual. The stipes after the last bifurcation are very much the longest, nearly all of them in one specimen being upwards of 20 cm. in length, and even then not showing any terminations. In the same specimen, two stipes seem to terminate at 16·4 cm. and 19 cm. respectively, and two others at 23·4 cm., though one of the latter is somewhat indistinct, owing to the jointing of the rock. No hydrothecæ are discernible until after the fifth bifurcation. The breadth of the stock in the specimen as shown in Fig. 1, on a much reduced scale, is 75·75 cm., but as the growth was probably equal on both sides of the centre, we would have the breadth of the entire stock as not less than 100 cm. The stipes are monoprionidian and, where the hydrothecæ are well developed, are 2 mm. broad; the stipes which do not show any hydrothecæ are also about the same width; these measurements may be slightly in excess as they are made from much compressed specimens. The solid axis is plainly visible in the type specimen; and there is no appearance whatever of a central corneous disc. The hydrothecæ are acute, indent the branches for about one-third the width, and are free for a little less than half their length; the upper margin or aperture is slightly concave, and the lower margin is slightly curved, and makes an angle of about 25° with the axis, joining the common canal at a point a little lower than the aperture of the second lower hydrotheca, narrower at the junction with the common canal than at the aperture; hydrothecæ number from 8 to 9 in the centimetre. *Temnograptus magnificus* differs from all other species I have seen described in its enormous size: it is, however, closely related to *T. multiplex*, Nicholson, of the Skiddaw Series, which is characterised by the regularity of its dichotomous branching; but the former differs from the latter in the much greater variation in the length of the stipes between the bifurcations, in the angles at which the corresponding stipes diverge, and in the more crowded hydrothecæ.

The other species to which it is undoubtedly related, are *Graptolithus flexilis*, Hall, *G. rigidus*, Hall, and *G. abnormis*, Hall, of the Quebec Series, but it is easily separable from each of them.

These five species agree in that the hydrothecal-bearing stipes are subdivided, and that there is no central corneous disc present.

I have to acknowledge my indebtedness to Mr. T. S. Hall, M.A., for suggestions on the subject matter of this paper, and to Mr. W. S. Strettle for assistance in quarrying out the specimen.

EXPLANATION OF FIGURES.

Plate VI.

Fig. 1.—*Temnograptus magnificus*, one-seventh the diameter of the original, drawn from a photographic reduction.

Fig. 2.—Portion of the stipe bearing hydrothecæ (enlarged).

Fig. 3.—Central portion of polyp-stock, natural size.

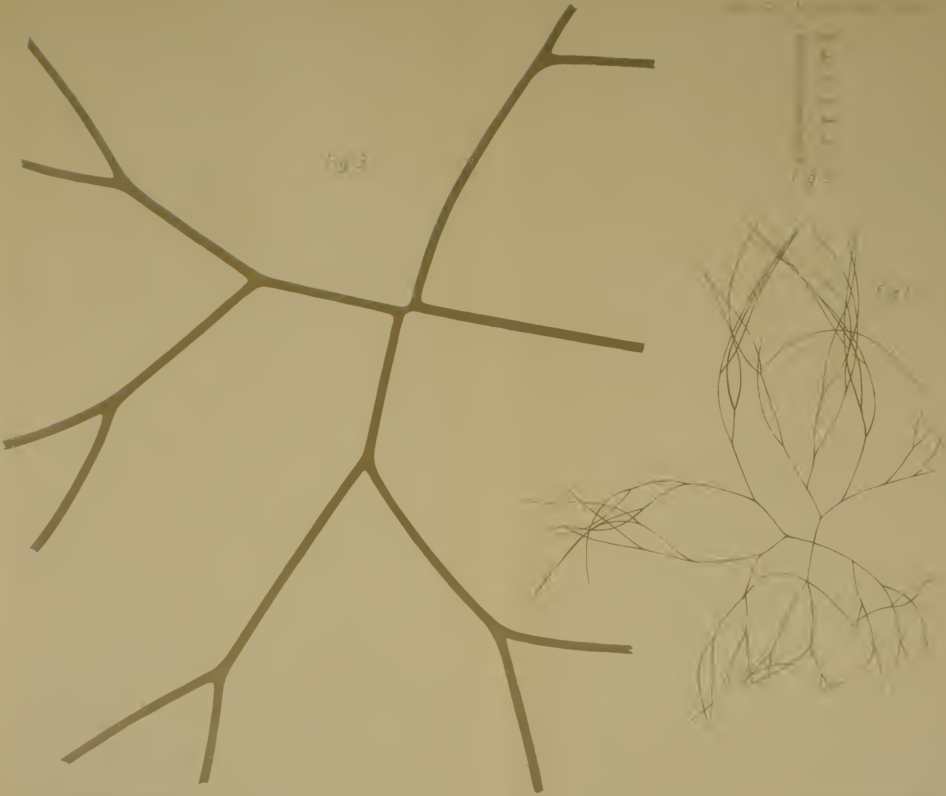


Fig. 3
Fig. 2
Fig. 1

ART. XI.—*Note on the Distribution of Victorian Batrachians, with Descriptions of Two New Species.*

By A. H. S. LUCAS, M.A. Oxon., B. Sc. Lond.

[Read October 8, 1891.]

The Batrachians recorded from Victoria by Mr. G. A. Boulenger, in his British Museum catalogue of the Batrachia Salientia, published in 1882, are six in number, viz.:—

Limnodynastes tasmaniensis, Steindachner. Sandhurst.

Heleioporus pictus, Peters. Sandhurst.

Pseudophryne bibronii, Steind. Sandhurst.

Hyla ewingii, Dum. et Bibr. Melbourne.

H. parvidens, Peters. Port Phillip.

H. aurea, Lesson. Melbourne.

Sir Frederick McCoy, in his "Prodromus of Victorian Zoology," has fully illustrated three species, viz.:—

Limnodynastes tasmaniensis, Steind. Passim.

L. dorsalis, Gray. Sandy tracts about Brighton.

Hyla aurea, Lesson. Passim.

L. dorsalis was first recorded from Victoria by Sir Frederick McCoy.

In 1888, Mr. Boulenger described* a new species of frog sent to him by Mr. J. J. Fletcher, of Sydney. The single

* A.M.N.H., Vol. II (Sixth Series), p. 136.

specimen was from Warragul, and was named by Mr. Boulenger *Crinia victoriana.*

Lastly, about a year ago, Mr. J. J. Fletcher* mentions the occurrence of *Limnodynastes peronii,* Dum. et Bibr., also at Warragul.

In all then, up to the present, nine species of Batrachians are known from Victoria. Mr. Fletcher (*l.c.*), in alluding to this limited number, remarks, "The falling off in the number of species in the southern colonies is possibly, and very probably, in some degree rather apparent than real." This remark, as will be seen, has been fully justified. The researches of Krefft, and later on, those of Fletcher, have swelled the list of known New South Wales Batrachians to thirty-four. While we cannot expect to meet with so large a number in Victoria, it was improbable that there should be so great a difference in the size of the lists of species found in the two colonies.

I am now able to extend the number of Victorian Batrachians to sixteen. During our expedition last summer to the Upper Wellington, Dr. Dendy captured a beautiful specimen, which he handed over to me to determine. It proves to be a new species of Pseudophryne, and is described later on in this paper. This discovery led me to examine all the members of the order to which I could gain access. Professor Sir Frederick McCoy has shown me every consideration, and afforded me all facilities for examining the specimens which are preserved in the National Museum. Besides collections from various parts of Victoria of named and unnamed varieties, I had thus the advantage of handling a series of New South Wales forms received from Sydney. Professor Spencer and Dr. Dendy have placed all their specimens at my disposal. Several correspondents have kindly assisted me by forwarding living specimens from their respective districts. I have especially to thank the Rev. Henry Howard and W. B. Harvey, Esq., of Warragul; D. Clark, Esq., of Bairnsdale; and J. B. Lillie Mackay, Esq., of Sandhurst, for help of this kind. Mr. Charles Frost, in conjunction with whom I hope to prepare a monograph of this group for the Society, has obtained specimens from Gisborne, Macedon, Parwan, &c. I have, of course, also collected specimens myself wherever opportunity has presented.

* P.L.S., N.S.W., Vol. V (Second Series), October 29, 1890.

Our Victorian Batrachians then include:—

CYSTIGNATHIDÆ.

Limnodynastes peronii, D. & B. Melbourne, Warragul, Bairnsdale.

L. tasmaniensis, Steind. Melbourne, Heidelberg, Carrum, Bairnsdale, Western District, Maryborough, Sandhurst.

L. dorsalis, Gray. Sandy tract from Prahran to Mordialloc.

Crinia signifera, Girard. Western District, Grampians, Melbourne, Heidelberg, Carrum, Waterloo in Gippsland.

C. victoriana, Boulenger. Warragul.

C. sp., Gunther. Oakleigh, Macedon, Christmas Hills, Narre Warren and Loch, Gippsland.

Heleioporus albopunctatus, Gray. Parwan, foot of Mount Macedon, Waterloo.

H. pictus, Peters. Sandhurst, Parwan (near Bacchus Marsh).

BUFONIDÆ.

Pseudophryne bibronii, Steind. Grampians, Sandhurst, Macedon, Gisborne.

P. dendyi, n. sp. Upper Wellington River, North Gippsland.

P. semi-marmorata, n. sp Oakleigh, Heidelberg, Ringwood, Narre Warren, Waterloo, Grampians.

HYLIDÆ.

Hyla peronii, Tschudi. Gunbower (near Murray River).

H. ewingii, D. and B. Brighton, Ringwood, Waterloo, Trafalgar, Warragul, Bairnsdale.

H. parvidens, Peters. Port Phillip (B.M. Cat.)

H. aurea, Lesson. All parts of the colony.

H. lesueurii, D. and B. M'Allister and Wellington Rivers.

I have examined specimens of all of these sixteen species, except of *Hyla parvidens* and of *Crinia victoriana*. It seems almost certain that this list will be further supplemented by the addition of species from the Murray, especially from the Gunbower lagoons, from the Western District and Mallee, and from East Croajingolong, while it is by no means improbable that some other kinds will be found nearer to the metropolis. Mr. Frost and I hope to be able to give some account of these in our monograph.

Pseudophryne dendyi, sp. nov.

General shape and characters those of the genus.

Hind limb being carried forwards along the body, the tip of the longest toe reaches beyond the eye; the tibio-tarsal articulation does not reach the shoulder.

Skin slightly granular on the back, smooth below; small lateral folds.

Small inner and outer white metacarpal tubercles, subequal. Inner and outer white metatarsal tubercles; inner elliptical as long as first toe, outer rounded about half size of inner.

No glands present on the loins or thighs.

Dimensions.—From tip of snout to vent, 15 mm.; length of fore-limb from axilla to tip of third finger, 8 mm.; length of hind limb from vent to tip of fourth toe, 12 mm.

Colours of Life—Dorsal.—Head and trunk quite black, with many scattered small white dots, most numerous on the head and sides. The dots are aggregated, to form a superciliary white line over, and small white patches behind and below, each eye. A short median longitudinal yellow streak on the snout, from between the nares nearly to the mouth. On the rump, a yellow median longitudinal band, with a yellow blotch on each side behind (on back of thighs), forming an inverted ┬ above the cloaca. Ventral.—Throat and belly quite black, marbled with irregular white blotches. Both black and white are dense opaque colours, clearly defined. With a lens, tiny black dots can be seen all over the white areas, and lighter dots all over the black ground. Fore limbs.—Black, with small white spots. The dorsal and post-axial surface of the arm (humerus) covered by a canary yellow patch of colour. Dorsal surface of hand white; fingers with white transverse bands, tips black. Hind limbs.—The surfaces of the limb seen from above, and the under side of the foot, are like the back, coloured black with small white dots. The surfaces of the limb, seen from below, and the back of the foot, are like the belly, black, largely marbled with white. Toes with white transverse bands and black tips.

A single male specimen, found by Dr. Dendy on our visit to Wellington River, North Gippsland. It was met with while we were turning over logs in search of Planarian worms, on one of the river flats, which gave evidence of being largely flooded in winter time.

PSEUDOPHRYNE SEMI-MARMORATA, sp. nov.

General form and characters those of genus.

Hind limb being carried forwards along the body, the tip of the longest toe reaches beyond the end of the snout. The tibio-tarsal articulation reaches to the shoulder.

Skin of top of head and back with several more or less distinct longitudinal linear series of rather conspicuous warts. Sides and belly smooth. Under surface of thighs near the symphysis granular.

Two small metacarpal tubercles, the outer rather larger. Two small metatarsal tubercles, subequal.

An oval orange-coloured gland on back of each thigh.

Dimensions of large specimen.—From tip of snout to vent, 31 mm.; length of fore-limb from axilla to tip of third finger, 13 mm.; length of hind-limb from vent to tip of fourth toe, 31 mm.

Colours of Life.—Top of head and back and upper surfaces of limbs olive-green, with darker spots; tips of warts often lighter. Vertebral line usually absent; when present, reduced to faint yellow streak on tip of snout, and another over hinder part of urostyle. Sides, blue black; throat, under sides of limbs, pale greenish yellow, more exactly a light shade of "brown pink," greener near axilla. Palmar surface of hand and plantar surface of inner $3\frac{1}{2}$ toes, flesh-coloured. Belly light olive-green, marbled finely with white.

Met with in all the S.E. parts of the colony, south of the Divide.

Four species of Pseudophryne are recorded in Mr. Boulenger's Catalogue. All are confined to Australia. Mr. Boulenger suggests that two of the species, *P. bibronii* and *P. coriacea*, named by Steindachner and Keferstein respectively, may prove to be only varieties of the original *P. australis* of Gray. But Mr. Fletcher,* who has closely

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* *Vide* Proceedings of the Linnean Society of New South Wales, Vol. IV (Second Series), p. 376.

studied both *P. australis* and *P. bibronii* in their native haunts, is quite convinced that they are good species, distinguished by constant differences in colour and pattern, in temperament, in habits, and in the time of the breeding season. *P. dendyi* is widely removed from all by its conspicuous black and white coloration. That *P. semimarmorata* is also very constant in its colouring and the pattern of the warts on the dorsal surface, I have found after examining dozens of specimens. In its geographical distribution, it is our southern representative of *P. bibronii*, the two forms only overlapping in the Grampians. We have thus another instance of the distinctness of species on the two sides of the Great Dividing Range.

Art. XII.—*The Magnetic Shoal near Bezout Island, off Cossack, N.W. Coast of Australia.*

By R. L. J. Ellery, C.M.G., F.R.S., F.R.A.S.

Government Astronomer, Melbourne.

[Read Oct. 8, 1891.]

In *Nature* of March 19, 1891, p. 471, Commander E. W. Creak, R.N., states that in September 1885, on board H.M. surveying ship "Medea," when passing Bezout Island, near Cossack, N.W. Australia, a steady deflection of the compass of 30° was observed, whilst the ship was running over in a N.N.W. direction, and a depth of 8 fathoms of water.

When the "Penguin" surveying ship was in Hobson's Bay last Autumn, Lieutenant Coombe made magnetic determinations at our Observatory to test his instruments, and he described to me the experience of their vessel, the "Penguin," when at Bezout Island in November last year. The "Penguin" being two miles from the Island N. 79° E., a deflection of 22° was noticed in her compasses. On Bezout Island itself, the dip was normal, viz., 50° 2′ S., but 2·14 miles N., 79½ E. from the island, the needle dipped to 85° with very small deflection of the compass. This was, no doubt, nearly vertically over the disturbing force. The compass deflection increased, first on one side, and then on the other, as the magnetic centre was approached, within a hundred feet or so, or left behind a like distance.

So remarkable a phenomenon has attracted a good deal of attention, and I believe Captain Moore, the Commander, received instructions from the Admiralty to further investigate this abnormal magnetic disturbance. At all events, the "Penguin," on leaving this port, went back to Western

Australia and Bezout Island, and Captain Moore has made a thorough magnetic survey of the locality, and in a letter dated 22nd June this year, has sent me a copy of the official account of his work. As this subject will be interesting to the Society, and of importance to our nautical men going west about to Northern Australia, or the Straits, I now give Captain Moore's account verbatim :—

Magnetic Shoal near Cossack, W.A.

The area of magnetic disturbance near Cossack, exhibits the characteristics of red magnetism, as if there was a congestion or concentration of the magnetic elements, due to the Southern Hemisphere. It seems appropriate, therefore, to call it a "Magnetic Shoal"; and to treat it graphically, as if it was an elevation of the bottom of the sea or area of "shoal" water, the soundings being the "deflections" of the compass needle.

Worked out thus, it was found that the magnetic shoal developed the following features:—(1) An area 4 miles long north-east, and south-west by 2 miles broad; with a depth of 8 to 9 fathoms at low water springtide; bottom, quartz sand, over which the compasses are deflected one degree or more.

Within the above, an area 3 miles long north-east and south-west, by half a mile to $1\frac{1}{2}$ miles broad, over which compasses are disturbed half a point or more.

Within the above:—(1) A line of maximum easterly repulsion, about $2\frac{1}{4}$ miles long, over which the north-seeking end of the needle is violently repelled to the east, in several places over 40°, and in one place 56°. (2) A line of maximum westerly repulsion, about $2\frac{1}{4}$ miles long, over which the north-seeking end of the needle is repelled to the west, to the extent of about one-half the easterly repulsion. (3) Between these two lines, which are from 200 yards to 600 yards apart, a line of no repulsion $2\frac{1}{4}$ miles long, over which the needle points to the true north, and the direction force is very small. This is called the "axis," or "line of vanished repulsion." (4) A point on this line, about one mile from the south-west end of the magnetic shoal, where the intensity is greatest, which is called the "focus." The axis, or line of vanished repulsion, is inclined to the true meridian, at an angle of 56°, in the neighbourhood of the focus. This angle coincides with the angle of maximum easterly repulsion.

A vessel passing in a straight line across the magnetic shoal at the focus, on a north-westerly course, would find the north-seeking end of the needle behave in the following manner:—When about 1 mile from the focus, a slight disturbance would be observed, the north-seeking end of the needle being repelled to the east; but this disturbance would not amount to more than half a point, until she had run to within 500 yards of the focus; the needle would then be more and more repelled, until 300 feet from the focus, when it would be deflected as much as 56° from the true north. It would then quickly resume its correct position, and over the focus—for a hardly appreciable distance, say 8 feet—would point true to the north. After passing the focus, it would be repelled to the west, and at 200 feet from it, would be deflected as much as 26°. It would now begin to return again to its proper position, and at 600 yards from the focus on the north-west side, would not deviate from the normal more than half a point. At one mile from the focus, all signs of disturbance would disappear. Crossing the shoal rectangularly, elsewhere than at the focus, similar, but less powerful repulsion would be observed. The distance between the largest east and largest west repulsion would be greater.

In a wooden ship or composite vessel like the "Penguin," the compasses would act as usual after leaving the shoal. Whether or not induction would take place in an iron vessel, is a matter yet to be ascertained. At present there is no evidence of danger to navigation, except that a vessel steering by compass across the shoal would be set out of her course, more or less, according as to whether she cut across it at the narrowest part, or obliquely.

The focus is in latitude 20° 32′ 35″ S., longitude 117° 13′ 2″ E. from it. Bezout Island summit bears S. 78° 49′ W., distance 2·17 miles. The greatest range in deflection was 82°, after applying the deviation for the apparent position of the ship's head; the actual traverse of the card 86°. The greatest inclination or dip of the needle was 81° 10′. The greatest intensity or total force found was 18·808 (British units), or nearly double the intensity, which, in this locality, is due to the earth considered as a magnet, *i.e.*, the magnetic attraction is such as to draw a weight of 1 grain, 18·808 feet in 1 second, in opposition to the force of gravity.

The statement made by Captain Creak, F.R.S., the Superintendent of Compasses, that the north-seeking end of the needle is repelled from the disturbing cause in the South Magnetic Hemisphere, is fully confirmed by this investigation.

Art. XIII.—*Notes on Victorian Rotifers.*

(With Plates XII and XIII.)

By H. H. Anderson, B.A., and J. Shephard.

[Received December 11, 1891.]

During the last few months we have been working together on the Rotifera, and as one of us is leaving the colony, we have determined to record the results of our observations somewhat earlier than we otherwise should have done. Of one of the new forms, only a single specimen has been seen, and that by only one of us; but we have recorded this and other observations in the belief that they will be of use to other observers. Mr. Anderson has devoted his attention principally to the Rhizota, Mr. Shephard taking the other orders; but in nearly all cases we have been able to show each other, and to examine together, the various species that we have met with. In the case of new forms, seen by only one, we have indicated the fact by the use of brackets and the initials of the observer; we have not considered it necessary to do this in the case of known forms. We have appended to the names of the species the places where we found them, and what other information we thought might be of scientific interest, but have preferred to err on the side of brevity, rather than to insert unnecessary matter. Our authority throughout has been "Hudson and Gosse," which, with its supplement, is a complete record of all observations up to the date of its publication, three years ago.

Order I.—Rhizota.

Flosculariadæ.

Of the Floscularia we have met with :—

(i) *Floscularia coronetta.* In water from the Botanical Gardens, and from a pond near Oakleigh.

(ii) *F. ornata.* Botanical Gardens, Oakleigh, Brighton, &c.

(iii) *F. cornuta.* Botanical Gardens.

(iv) *F. campanulata.* Heidelberg, Brighton.

(v) *F. ambigua.* Oakleigh.

[and a species which I take to be new, and have named

(vi) *F. evansonii*, (n. sp.) It is a small species, much shorter and stouter in proportion to its size than most Floscules. It has five linear, knobbed lobes, in which it resembles *F. coronetta*, but it differs from it in having a broad cylindrical corona with a distinct rim, on which the lobes are inserted at some distance from each other. These lobes are short, less in length than the diameter of the corona, and are very motile, often coming right back till they lie in a plane at right angles with the axis of the body, and they remind one in their movements of the tentacles of the Polyzoa. The corona is broadly barrel-shaped, with a distinct projecting rim, and below it the body again expands somewhat before it tapers to the foot. The breadth of the body is nearly as great as that of the corona, and is one-third of the whole length, while in other species it is usually one-sixth or less. The tube is fluffy and irregular in shape. I found several specimens in water obtained on July 6th, 1891, from a backwater of a stream near Oakleigh. They were $\frac{1}{70}$th to $\frac{1}{80}$th in. in length, and were very bold, expanding freely. —H. H. A.]

[(vii) In water obtained from the Botanical Gardens on November 7th, I came across a single specimen of what is apparently a new species of *Stephanoceros.* It had a three-lobed corona, resembling *Floscularia trilobata,* but the setæ on these lobes were arranged as in Stephanoceros, *i.e.,* diagonally on the lobes in parallel bands. There were several of these bands round the summits of the lobes, and three or four in the centre of the depressions between them. The cilia of these bands were in constant motion, creating a strong current of water, which brought particles from a considerable distance. This habit is, I believe, unique among the Flosculariadæ, though the one known form of Stephanoceros, *S. eichhornii*, is said to lash with its cilia at an escaping captive, and renders this form peculiarly interesting. I was unfortunately unable to make a careful study of the specimen, and have not since succeeded in finding another. It might be worth the while of other observers to search for this species in the place where I found it. The one specimen was $\frac{1}{20}$th in. in length.—H. H. A.]

MELICERTADÆ.

The Melicertadæ are well represented in Victorian waters, and not only have we met with many species, but these species were in almost all cases very numerously represented.

(viii) *Melicerta ringens* is common everywhere, and is sometimes very large. We have seen tubes more than $\frac{1}{15}$th in. in length.

(ix) *Melicerta conifera* is also fairly common, and sometimes most abundant. [I found it in thousands just after the floods in the back waters of Gardiner's Creek at Glenferrie, though a month after I could not find a single specimen there.—H. H. A.]

(x) *Limnias ceratophylli* is common; specimens $\frac{1}{10}$th in. to $\frac{1}{8}$th in. seen.

(xi) *Limnias annulatus* is somewhat rare; we have found it at Oakleigh, at Toorak, in a lagoon by the side of the Yarra, and in the Botanical Gardens.

(xii) *Cephalosiphon limnias.* Botanical Gardens.

(xiii) *Œcistes crystallinus.* Toorak, Brighton, Heidelberg.

(xiv) *Œcistes intermedius.* Oakleigh, Botanical Gardens, Heidelberg.

(xv) *Œcistes longicornis.* Botanical Gardens, Oakleigh, Heidelberg.

(xvi) *Lacinularia socialis.* Heidelberg.

(xvii) *Conochilus volvox.* Heidelberg, Melton.

(xviii) *Lacinularia pedunculata.* We found some colonies of this species at Brighton, and examined it carefully, subsequently mounting specimens. To the somewhat meagre description in Hudson and Gosse, we may add the following particulars:—The corona is circular, but for the indentation on the ventral side, which is shallower than in either *Megalotrocha alboflavicans* or *L. socialis.* The ventral antennæ are merely tubercles placed wide apart. The eyes are visible in the adult as very small red specks; they are seen with difficulty in living specimens, but are plainly visible in some of the mounted ones. One of the colonies was an old one, only a few adults were present, but it was full of eggs, and as we watched it, many of them hatched out. Some of them swam for some time with the foot still recurved on the body, but their motions were so active that we were unable to examine them closely. Attached to the weed close to the base of the large colony, was a small one, having a peduncle of the normal type, though very short, but the animals composing it were widely different from the full grown specimens. They had, however, a certain resemblance to the young ones just hatched from the eggs of the old colony. Unfortunately, we were unable to examine them carefully that evening, and they were all dead the next day. Since writing the above, Mr. Shephard has received from Mr. Whitelegge tracings of his drawings of *L. pedunculata,* and in these, one antenna is shown of the character that we have described above. Specimens have also been found by Messrs. Mann and Shephard at Heidelberg, but apparently the species is not common.

We have also met with some species which we take to be new.

(xix) *Œcistes wilsonii.* We found this form in water collected at Brighton Beach in July. It approaches *Œ. crystallinus,* but differs from it in the form of the body when fully expanded, and in the tube, which is gelatinous, clear and rounded, not fluffy and irregular. The corona is indistinctly two-lobed, nearly three times as broad as the body, dorsal gap minute, and the muscular thickenings of the corona more pointed than in the other *Œcistes* which we have seen. The antennæ are set flush on the body, so that in the retractile state the setæ seem to spring from the body itself; but when the animal expands, that part of the body on which the setæ are situated becomes inflated, so as to form two projecting rounded cones on each side. These cones are placed some distance apart, and in ventral aspect their appearance is very characteristic, the body sloping outwards to their summits till it is half as broad again as it is at their base. When seen somewhat sideways, the anterior slope to the neck is very abrupt, and makes almost a right angle with the axis of the body. When recurved, the sides of the body are drawn back in a deep fold over the wrinkled foot, encircling it, till the bottom of the intestine touches the top of the foot. We observed three vibratile tags in each lobe of the corona, one on each side of the neck, and one in the body near the lower end of the stomach. Two red eyes were clearly seen in young nearly ready for hatching in the eggs. When first seen, the whole body was covered with a layer of gelatinous material, but in a specimen kept alive on a slide for a couple of days, this layer disappeared. Unlike most *Œcistes*, it attaches itself to its tube rather than to the plant on which the tube is fixed, resembling *Floscularia calva* in this respect. It sways itself from side to side, curving right over the edge of its tube.

Sp. ch. Corona indistinctly two-lobed, ventral antennæ placed on the surface of the body wide apart, the body when expanded projecting upwards and outwards to their point of insertion in two rounded cones. Tube gelatinous, rounded; length, $\frac{1}{75}$th in.

(xx) *Lacinularia reticulata.* This species has at first sight a considerable resemblance to *L. socialis*, but a more careful examination brings out points of difference important enough, we think, to prove it a new species. It is found in small colonies, often of only two or three specimens; the largest we have seen was composed of a dozen. In internal structure, it conforms to the usual type of Melicertadæ. Its distinctive features are a heart-shaped corona, as broad as long, and as broad half-way down as it is at its ventral end, giving it a somewhat rectangular appearance. This rectangular appearance is clearly shown in some specimens we mounted. The dorsal gap in the corona is comparatively large, and easily seen. But the most important point of difference between this and the other species of Lacinularia is the presence of antennæ, both dorsal and ventral. The dorsal antenna is small, not to be seen when the creature is fully expanded, nor when fully retracted, but when partially expanded it may often be easily observed. It appears clearly in some of our mounted specimens. The ventral antennæ are peculiar in their position. They are papillæ, situated some distance below the neck on the body of the animalcule. When it is fully retracted, they are situated at its anterior extremity, and they too may be clearly seen in the mounted specimens. At their bases are two large pear-shaped masses of nerve matter (ganglia?) connected with the nerve cord. As *L. socialis* has been most carefully examined by Huxley and others, it is impossible that the antennæ should have been overlooked had they been present in that form, and had they held the same relation to the nervous system that they do in the one we are describing. In the mounted specimens we noticed, too, that the corona appears beautifully reticulated on its under surface, and we subsequently observed it in living specimens. We found this species in large numbers at Brighton Beach.

Sp. ch. Corona broadly heart-shaped; dorsal gap comparatively large; dorsal antenna minute; ventral antennæ papillæ, situated half-way down the body, and wide apart, connected with pear-shaped nerve masses. Length $\frac{1}{25}$th in.

(xxi) *Limnias granulosus* (?). In water taken from the Botanical Gardens on November 8, we found a species which may be this. The tube was yellow, strewed with roundish brown granules, and transversely striated on the inside. But though there were numerous old tubes, there were only two with occupants. In these we observed that the two lobes were not nearly so greatly divided ventrally as in *L. ceratophylli*, and the ventral antennæ were somewhat more prominent. We were unable to see any horny processes, and the foot was certainly not forked, as that of *L. granulosus* is said to be. Hudson and Gosse, however, seem to doubt the forking of the foot, and the description seems generally doubtful. It will be worth while looking for this species somewhat earlier next year, and examining it carefully.

(xxii) *Œcistes intermedius.* We have seen two varieties of this Œcistes—one which we take to be the form mentioned by Hudson and Gosse, the other probably new. The one has the ordinary brown tube of *L. ceratophylli*, with moderately long antennæ; the other has a white tube, which looks a greyish-black by transmitted light. This second form has very short antennæ, and the dorsal gap is somewhat wider, the edges of the corona at the gap curving somewhat outwards. The distinction seems hardly enough to mark a new species.

ORDER II.—BDELLOIDA.

FAMILY PHILODINADÆ.

(xxiii) *Philodina roseola.* Botanical Gardens.

(xxiv) *P. citrina.* Botanical Gardens.

(xxv) *Rotifer vulgaris.* Common.

(xxvi) *R. tardus.* Botanical Gardens.

ORDER III.—PLOIMA (Il-loricata).

FAMILY ASPLANCHNADÆ.

(xxvii) *Asplanchna brightwellii.* This was first noticed at Brighton, in July 1890. It was very plentiful, and numerous males were found. It appears to occur from June to September, as the pool at Brighton constantly visited, did not yield a single specimen for nine months of the year. Heidelberg yielded none, except in September 1891, when they were extremely numerous. Dr. Hudson remarks that his experience is, that the Asplanchnadæ do not occur in the same spot year after year—("The Rotifera," Vol. I, p. 26). But for two years *A. brightwellii* has been found in the same spot at Brighton.

(xxviii) *Asplanchnopus myrmeleo.* Found in all open pools tried, and at all times of the year, though numerous only on one occasion at Brighton.

FAMILY SYNCHÆTADÆ.

(xxix) *Synchæta pectinata.* Brighton and Heidelberg.

(xxx) *S. tremula.* Botanical Gardens.

Family Triarthradæ.

(xxxi) *Polyarthra platyptera.* Brighton.

(xxxii) *Triarthra longiseta.* Brighton.

Family Hydatinadæ.

(xxxiii) *Hydatina senta.* Common. Plentiful on but one occasion, when hundreds were dipped with a small phial from a puddle not two feet in diameter in Hanna Street, South Melbourne. These furnished an interesting instance of rapid multiplication, as a half inch specimen tube set aside with some of the water, and containing a dozen or so of the rotifers, was seen after a few days to be almost as closely packed with the rotifers, as it had previously been with Euglenæ, which had coloured the water a bright green, and formed the food of *H. senta.*

Family Notommatadæ.

(xxxiv) *Notommata aurita.* Botanical Gardens and Oakleigh.

(xxxv) *N. ansata.* Botanical Gardens.

(xxxvi) *N. naïas.* [Brighton yielded a considerable number of what is probably this species. They possessed the two smaller eye specks on the front of the corona, figured by Eckstein, and mentioned by Hudson and Gosse in a foot-note ("The Rotifera," Vol. II, p. 25), but the "tentacular brushes of setæ" were not seen. A reference to Eckstein's figure showed a general agreement between it and the specimens found.—J. S.]

(xxxvii) *Copeus ehrenbergii.* Botanical Gardens. When first found, the specimens were entangled among confervoid filaments, and for some hours did not reveal the "great lateral telegraph-like arms," which only appeared when the animal was in open water, in a watch glass, or deep cell. A good view was obtained of the vibratile tags, which were large, and extended like a fan, the width across the outer edge being equal to the length. The cilia presented a very interesting appearance, rhythmical waves passing longitudinally downwards like the waves across a field of corn.

Sub-Order Loricata.

Family Rattulidæ.

(xxxviii) *Mastigocerca carinata.* Botanical Gardens, Sandringham. The dorsal ridge was less developed in the majority of the specimens taken, but in all other points, the agreement was so close as to negative the idea of a new species.

Family Dinocharidæ.

(xxxix) *Dinocharis tetractis.* Botanical Gardens.

(xl) *Stephanops muticus.* Toorak, Botanical Gardens.

Family Salpinadæ.

(xli) *Diaschiza semiaperta.* Brighton.

(xlii) *Salpina brevispina.* Toorak, Botanical Gardens.

Family Euchlanidæ.

(xliii) *Euchlanis dilatata.* Common.

Family Cathypnadæ.

(xliv) *Cathypna* (n. sp.) Brighton. [This form so much resembled *C. luna*, that it is with some hesitation regarded as new. The points of difference from *C. luna* are—in the lorica being broader anteriorly, and the dorsal occipital edge more deeply excavated; the posterior possessing more of a lobed character, having a decided inward curve on either side, and a rounded termination overhanging the toes, the most marked departure being the setting of the claws which, instead of tapering off from the shoulder to the end, are recessed so as to form a reversed barb ; the surface of the lorica was also stippled. Length about $\frac{1}{130}$th in.—J. S.]

(xlv) *Distyla ichthyoura* (n. sp.) Brighton. [The most distinctive character in this form, is the fish-tailed appendage to the posterior end of the lorica, which extends over half the length of two rod-shaped toes, each toe possessing a one-shouldered tapering claw. Anteriorly, the lorica has a dorsal crescentric excavation, forming two somewhat long lateral points. The lorica is finely stippled. The head is a truncated cone. There is a conspicuous eye. The trophi, as far as observed, resemble those of *C. luna.* Length $\frac{1}{125}$th in., breadth $\frac{1}{280}$th in. *Sp. ch.*—Lorica fish-tailed, stippled, crescentrically excavate in front, with somewhat long lateral points.—J. S.]

(xlvi) *Monostyla quadridentata.* Common.

Family Coluridæ.

(xlvii) *Colurus bicuspidatus* (?). Brighton. [The specimens obtained closely resemble in most points the species doubtfully written, but differ in possessing two eyes very closely set, and two toes. Length $\frac{1}{220}$th in., depth $\frac{1}{450}$th in. Length of foot $\frac{1}{500}$th in.—J. S.]

(xlviii) *Metopidia solidus.* Brighton.

(xlix) *Metopidia ovalis* (n. sp.) Brighton. [The form figured is beautifully transparent, and shows the internal organs well. An egg-shaped lorica, broader posteriorly in its dorsal aspect, possesses a slight excavation at either end, the posterior one being at the summit of a slight projection formed by the lorica curving outwards laterally. The ventral plate has deep anterior and posterior openings of the form of a half ellipse. Two eyes are set wide apart, each at the base of a slight process set at each side of the corona. The toes and foot much resemble those of *M. solidus,* as do the general arrangement of the internal organs. Length $\frac{1}{200}$th in., breadth $\frac{1}{450}$th in.—J. S.]

Family Pterodinadæ.

(l) *Pterodina intermedia.* Brighton. Of this species only one specimen was seen, but the "semi-circular projection" at the anterior was distinctly visible. It is interesting to find here this species, which was first noted by my colleague as occurring among Indian rotifers (*Jour. Asiatic Soc.*, Bengal, Vol. LVII, Part II, No. 4, 1889). —J. S.]

(li) *Pterodina trilobata* (n. sp.) Sandringham. This specimen differs from any described species in the form of the dorsal plate of the lorica, it having the semicircular projection in front, with two broad bulgings on either side, giving it a tri-lobed appearance. The lorica is stippled, and so far as observed, inflexible. The coronal discs are widely separate, and there is a notch at the base of each disc, giving the median portion the form of a short broad lip. The gastric glands, so conspicuous in the genus, escaped observation, probably owing to the stippling of the lorica. Length of lorica $\frac{1}{250}$th in., extended $\frac{1}{140}$th in., breadth $\frac{1}{200}$th in.—J. S.]

Family Brachionadæ.

(lii) *Brachionus rubens.* Common.

(liii) *B. bakeri.* Common.

(liv) *Noteus quadricornis.* Brighton.

Family Anureadæ.

(lv) *Anurea curvicornis.* Botanical Gardens.*

(lvi) *A. aculeata.* Common. Some three or four other species of Anureadæ have been partially worked, but not sufficiently to include them as determined species.

* The habitat Botanical Gardens refers in all instances to the Botanical Gardens, Melbourne.

DESCRIPTION OF PLATES.

Plates XII and XIII.

Fig. 1.—*Floscularia evansonii*, n. sp. × 200.

Fig. 2.—*Lacinularia reticulata*, n. sp. × 120. Left-hand figure partially contracted to show both antennæ.

Fig. 2a.—The same, viewed dorsally, × 200.

Fig. 3.—*Œcistes wilsonii*, n. sp. × 200.

Fig. 3a.—The same, showing fold back of the body over the foot in the contracted state, × 75.

Fig. 3b.—The same, showing appearance of corona and antenna viewed from the side, × 75.

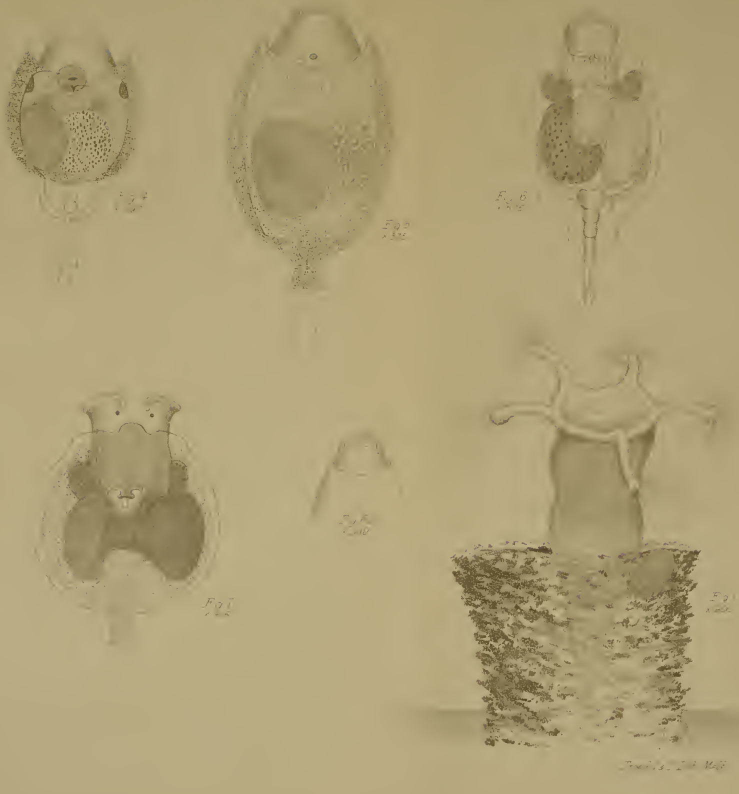
Fig. 4.—*Cathypna*, n. sp. × 290. Viewed dorsally.

Fig. 5.—*Distyla ichthyoura*, n. sp. × 375. Dorsal aspect. Owing to failure of material, the internal structure was not fully made out, but distinctive specific characters are shown.

Fig. 6.—*Metopidia ovalis*, n. sp. × 525. Ventral aspect.

Fig. 6a.—Anterior of same, viewed dorsally, × 500.

Fig. 7.—*Pterodina trilobata*, n. sp. × 315. Dorsal view.



Art. XIV.—*Note on the Habits of Ceratodus forsteri.*

By W. Baldwin Spencer, M.A.

Professor of Biology in the University of Melbourne.

[Read December 10, 1891.]

With the exception of a short account given by Mr. Caldwell before the Royal Society of New South Wales with regard to the spawning and reproduction of Ceratodus I am not aware of there being any note recently published with regard to the habits of this animal. Having lately had the opportunity of visiting the Burnett and Mary River districts, I was enabled to gain a little information with reference to its habits which may prove of interest.

As is well known, the group Dipnoi contains only three forms, of which one (Lepidosiren) is found only in Brazil. another (Protopterus) is confined to West Africa and the third (Ceratodus) at the present time exists only in the Burnett and Mary Rivers in Queensland. My remarks have reference to the Burnett District for though I was for a short time near the Mary River at Gympie I did not there come in contact with the animal.

In the first place, care must be taken with regard to the name; neither of the terms lung-fish or mud-fish, so far as my experience goes, is known to the settlers in the district. Neither at Gympie on the Mary, nor at Gayndah and other places along the Burnett, did those with whom I conversed on the subject recognise Ceratodus under either of these names. It has however two common names, one of which is the "Burnett Salmon," and the other the "Barramunda." Care has, however, to be taken when the latter name is used, since this is properly applied to a very different form, a true teleostean fish (*Osteoglossum leichardti*), which is not found in the Mary or Burnett Rivers, but further north, in the Dawson and Fitzroy. The name of Burnett Salmon is given for the simple reason that the flesh is of a pink colour; beyond this, there is not the slightest resemblance between the two forms. In his recent report of the Queensland fishes, Mr. Saville Kent states that the Ceratodus is much prized as food. This is a mistake, for, as a matter of fact, it is very oily and disagreeable and only eaten by Chinese and those who can afford to get nothing better. From a scientific point of view this is a great advantage and will in no small degree tend to ensure its preservation.

The Burnett River runs in a wide channel, with banks often as much as fifty feet high, through country which is very sandy and undulating with hill ranges, the surface being composed in large part, at all events, of decomposed granitic rocks. For the greater part of the year, during all the warm months, the river channel shows wide sand banks, with only a comparatively narrow and shallow stream of water, broadening out every now and then into wide deep pools, where the river bed and banks are often formed of great granite rocks. Into the river run numerous creeks, the beds of which are usually quite dry and sandy in summer. The Ceratodus always stays in the deep pools, and fishers know well that it is to these they must go if they want to catch the animal. It is possible that on rare occasions it might bury itself in the mud, or to speak more correctly sand, but it by no means normally does this, and speaking generally, I think it is safe to say that Ceratodus always stays in the deep pools which through the heat of summer retain at any rate a fair suply of water. In a season of drought these pools may become isolated, but it is a rare season in which there is not a plentiful trickle from one pool to another, and some of these pools are quite a mile long.

Whilst Protopterus makes cocoons of mud for itself during the season of drought and is enabled to live through the latter by the aid of its lung, its ally, Ceratodus, does no such thing. Quite on the contrary, I believe that its lung is, at all events as useful to it, if not more so, during the rainy as during the hot season; at the same time, it is always of use as a subsidiary organ of respiration.

It may here be mentioned that out of the water Ceratodus is the most helpless and passive creature imaginable. It is perfectly incapable of movement, its weak limbs, which serve well enough as paddles in the water, being quite incapable of sustaining the weight of the body or of assisting in movement. You may put a Ceratodus within a few feet of the water, and there it will lie perfectly passive and making not the least attempt to move. When left in air without being surrounded by damp moss or weeds, its life is limited to a very few hours, eight or ten at most—a length of time exceeded by both the eels and dew fish taken from the same water. If kept damp, however, it will live for a considerable time, and may be carried alive for long distances in this way.

It is most interesting, however, to watch the animal on land. The gill flaps remain closed, and the animal opens and closes its mouth at regular intervals in such a manner as at once conveys the idea of breathing. Not only this, but when in the water it comes at intervals to the surface and expires and inspires air. In the evening, when seated by the edge of a pool, one can hear what the fishermen of the district call a "spouting," and which is due, as in the case of the whale, only on a much smaller scale, to the expiration of air just as the animal reaches the surface. I was not able to actually see the Ceratodus doing this, but was assured by several who were well acquainted with its habits that the noise was made by the Ceratodus.

When the season is very dry and a comparatively small pool is chosen, it is possible, by continuously stirring up the mud and sand, to choke the fish but at the same time, though the latter are killed, the Ceratodus will continue alive.

Now, if we take into consideration the nature of the country through which the Burnett River runs and the fact that the Ceratodus does not require to, and practically never does, leave the water pools, we may gain some idea of what is at all events one chief use, if not the main one, of the lung structure.

In the rainy season the creeks, dry in summer, become converted into roaring torrents; the river rises suddenly, as much sometimes as fifty feet in a very few days, and down from the hills and the country round an enormous amount of sand is swept suddenly into the water. When once the big sand banks of the River have been seen in dry weather it is easy to realize what a vast amount of sand must be swept down into the stream at flood time every year and of what great advantage must be the possession of an organ which will enable Ceratodus under such circumstances to breathe air directly whilst at the same time it remains in its ordinary element.

It is thus probably during the flood season when the waters are muddy that the lung is of great service to the animal. At the same time, in seasons of drought, if the animal be left in a comparatively small pool, the waters of which get almost stagnant and foul from the decomposition of the fast growing weeds, the possession of the lung would again be of the greatest value. On the whole, however, if we consider the nature of the country, the sudden floods to which yearly the river is liable, with the consequent pollution of the water, together with the fact that the animal lives in deep and extensive pools, we shall probably be right in concluding that the lung is of especial advantage during the wet, rather than during the dry season.

It may be noted in conclusion that Ceratodus seems to live principally, if not entirely, on vegetable matter. The alimentary canals of those which I opened in late September and early October, being filled with the fruit of the gum tree *Eucalyptus tereticornis* which overhangs the river banks. The fruit seems to pass entire into the alimentary canal without being crushed by the teeth in the mouth.

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PROCEEDINGS.

Art. XV.—*On an Australian Land Nemertine (Geonemertes australiensis, n. sp.)*

(With Plates VII, VIII, IX, X.)

By Arthur Dendy, D. Sc., F.L.S.

[Read July 9, 1891.]

CONTENTS.

1. Introductory Remarks.

In the *Victorian Naturalist* for December, 1889, I recorded the discovery of three specimens of a terrestrial Nemertine at Walhalla, Gippsland, Victoria, and gave a brief description of the general appearance of the animal.* Being unable, at the time, to obtain access to Professor von Graff's paper on *Geonemertes chalicophora*,† which it was

* "Zoological Notes on a Trip to Walhalla," *loc. cit.* p. 132.

† "*Geonemertes chalicophora*, eine neue Landnemertine," Morphologisches Jahrbuch, Bd. V, 1879, p. 430.

supposed (though without any conclusive evidence) might be an Australian form, I refrained from naming the species. Recently, however, thanks to the kindness of Professor von Graff, Professor Haswell, Professor Spencer and Professor Howes, I have received several copies of the paper in question, and as there can no longer be any doubt that the species is perfectly distinct from any that have been previously described, and as I have since obtained an abundant supply of material from various localities, I have decided to give a detailed description of the new species in this place, under the name *Geonemertes australiensis.*

In addition to the gentlemen whose names are mentioned above, I desire also to record my indebtedness to the following for valuable assistance and material, viz.:—Mr. J. J. Fletcher, M.A., for the loan of two specimens of *Geonemertes* (sp. ?) from Tasmania and New South Wales respectively;* Mr. J. Bracebridge Wilson, M.A., Mr. E. F. J. Love, M.A., Rev. W. Fielder, Mr. C. C. Brittlebank, Mr. Shephard and Mr. Fiddian for specimens from various parts of Victoria; and Mr. T. Whitelegge, of the Australian Museum, Sydney, for most kindly photographing for me the plate illustrative of von Kennel's paper on *Geonemertes palaensis,*† which I have been unable to obtain.

2. Habitat and Distribution.

Geonemertes australiensis is a thoroughly cryptozoic‡ animal. The first specimen which I found was beneath a stone, but since then most of the numerous specimens discovered have been found under rotting logs. As might be expected the animal seems to like a tolerably damp situation, apparently it does not burrow in the earth but simply lies beneath its shelter. Since I first recorded it from Walhalla it has been obtained from the Otway Forest (Mr. Wilson and Mr. Love), Creswick (Mr. Fiddian), the Upper Yarra district (Professor Spencer),§ Narre Warren (Professor Spencer), Myrniong (Mr. Brittlebank) and the Fern Tree Gully district. The most remarkable discovery was that at Fern Tree Gully, on the occasion of an expedition made by the Field Naturalists' Club of Victoria, on March 14, 1891,

* *Vide* Proc. Linn. Soc. N.S.W., April 29, 1891.

† Arbeit. Zool.-Zoot. Inst., Wurzburg, IV., 1877 78.

‡ For explanation of this term *vide Victorian Naturalist, loc. cit.*

§ *Vide Victorian Naturalist*, March-April 1891, p. 179.

when we found dozens of specimens under fallen logs. It is a curious fact that on most carefully searching the same locality only a few weeks later (May 13) I was unable to find a single specimen.

Mr. Fletcher* has lately recorded the occurrence of land Nemertines also in Tasmania and New South Wales, but it is somewhat doubtful whether they belong to the same species as the Victorian specimens, though from the examination of the external characters which I have been kindly permitted to make I am inclined to believe that they do.

3. External Characters, Habits, and Methods of Preparation.

As it lies at rest, with the proboscis retracted, *Geonemertes australiensis* has very much the appearance of a slug or a small Planarian worm, and is very soft and slimy. When it begins to crawl, which it readily does on being disturbed, the body elongates until in large specimens it measures about 40 mm. in length by 2·5 mm. in greatest breadth. The anterior extremity is then seen to be rounded and perhaps slightly swollen into a head, the posterior extremity tapering gradually to a blunt point where the anus is situated. The ventral surface of the body, on which the animal crawls, is somewhat flattened.

The colour of the living animal is chiefly yellow, varying a good deal in shade, and lighter on the ventral than on the dorsal surface. Sometimes it is a translucent, waxy yellow, sometimes orange, and sometimes more brownish. Figure 1 represents a specimen from near the Wood's Point Road, painted from life. In this case the dorsal surface was brownish yellow edged on either side by a narrow band of creamy white continuous with the creamy white ventral surface. Usually there are no stripes but sometimes there is a brown median dorsal band, and in a specimen from Myrniong, which I take to belong to the same species, there were two narrow stripes of a darker brownish tint down each side of the mid dorsal line, the remainder of the dorsal surface being of the usual yellow colour. Sometimes, in large specimens, the sides of the body have a distinctly mottled appearance, due to the large ova showing through the skin. At the extreme anterior end of the body, on the

* *Loc. cit.*

head, is a single aperture, the common opening of the proboscis sheath and alimentary canal, or, to speak more exactly, the opening of the rhynchodæum. A little behind this aperture there is, on each side of the head and somewhat more towards the dorsal than towards the ventral surface, an irregular group of minute black specks, the eyes. The number of the eyes is probably not constant, and the size is certainly very variable; in one specimen examined there were about twenty in each group.

On the ventral surface of the head are situated the two very minute openings of the cephalic pits, one on either side of the middle line, but these are only recognisable in sections, though sometimes there appears to be a transverse groove, visible with a pocket lens, in which they probably lie (Fig. 3.)

The animal crawls normally with an even, gliding motion, much like a Planarian, leaving behind it a slimy track. The motion is probably due in part to muscular and in part to ciliary action, the proboscis being at the time completely withdrawn into the body. If the worm is irritated, however, the proboscis is suddenly shot out from the anterior end with wonderful rapidity. This proboscis is relatively of enormous size, being, even when shot out only to the normal extent, fully as long as the body of the worm, if not longer. After remaining out for an instant it is more slowly withdrawn and this eversion and withdrawal may be repeated several times in rapid succession. Frequently, however (Fig. 12), the proboscis breaks away from its attachment round the mouth of the proboscis sheath and remains attached to the body of the worm only by the retractor muscle, which appears as a long, narrow thread coming out from the opening of the rhynchodæum. When detached in this manner the proboscis is actually larger than the body of the animal. The colour of the everted proboscis is pure white and its surface is quite furry from the presence of innumerable little glandular papillæ, which secrete a sticky fluid. Under normal conditions the proboscis may probably be everted and withdrawn again for an indefinite number of times. When fully extended it adheres slightly to the surface on which it falls and hence, as a necessary consequence, when the proboscis is withdrawn again the body of the animal is pulled forwards over it. In this way the animal may progress, using the proboscis as a means of locomotion. In the case of *Tetrastemma agricola* von

Willemoes-Suhm appears to regard* this as a normal mode of locomotion. From my own observations I am inclined to regard it as accidental, and I think that the proboscis is normally used only as a weapon of offence or defence, probably for catching insects, but this I have not observed. As already stated, when the animal is crawling under ordinary circumstances the proboscis is entirely withdrawn into the body.

So much for the external characters of the living animal. Before passing on to describe the minute anatomy it may be as well to say a few words as to the methods of killing and preserving specimens. Unfortunately the animal is so large and opaque that it is difficult to study the internal anatomy satisfactorily in the living worm, and, owing to the extreme irritability of the proboscis and the delicacy of the whole organism, it is an unusually difficult matter to kill and preserve the animal in a satisfactory condition, for the violent movements of the proboscis are very apt to cause the body to break up.

The following are the results of a number of experiments which I made with a view to finding the best method of killing and preserving specimens :—

(*a.*) By suddenly immersing the living worm in strong methylated spirits. This is sometimes successful, but the proboscis is always more or less everted in the spirit and frequently the body breaks up.

(*b.*) By suddenly immersing in very dilute aqueous osmic acid. Only one specimen was tried ; the proboscis was everted and the body broke up badly.

(*c.*) By suddenly immersing in a cold saturated alcoholic solution of corrosive sublimate. This is fairly successful but the proboscis is always everted and sometimes the body breaks.

(*d.*) By pouring a hot aqueous solution of corrosive sublimate on the living worm. This kills the animal nearly instantaneously, with the body generally intact but the proboscis everted. The heat employed, however, can scarcely fail to injure the histology of so delicate an organism.

(*e.*) By first holding the worm in the vapour of chloroform for about half a minute. Hold the worm on a lifter or glass

* "On a Land-Nemertean found in the Bermudas," *Annals and Magazine of Natural History*, Series 4, Vol. XIII, 1874, p. 409.

slip over an open jar containing a little chloroform, the animal contracts to its normal resting condition and is rapidly stupefied. Then quickly plunge the stupefied worm into strong spirit, taking care not to let the surface of the body adhere to the lifter. The animal is thus killed and hardened while under the influence of chloroform and the proboscis is not everted at all nor does the body break up, but the worm retains when dead the normal resting position. In making use of this method it is important to leave the worm in the chloroform vapour for neither too short nor too long a time; if the former, it regains its activity in the spirit and everts the proboscis; if the latter, it dies and adheres to the lifter or glass slip on which it lies.

This last I find to be by far the most satisfactory way of killing and preserving specimens, and it is the only method known to me by which the proboscis can be retained within the body in its natural position. Of course other hardening fluids besides alcohol may be used after stupefying with chloroform vapour.

Frequently, however, it is very desirable to preserve specimens with the proboscis everted, and for this purpose I recommend methods *a.* and *c.*

My researches on the minute anatomy of *Geonemertes* were conducted chiefly by means of sections taken in three planes (horizontal, sagittal and transverse), stained with borax carmine or Kleinenberg's hæmatoxylin, and cut by the ordinary paraffin method. Both methods of staining should be employed, as the results obtained are very different in the two cases; hæmatoxylin, for example, brings out with wonderful distinctness the network of excretory tubules, which I failed to recognise in the specimens stained with borax carmine.

4. Minute Anatomy.

a. Epidermis and Sub-Epidermic Tissues.

The epidermis and subjacent tissues may be studied very satisfactorily in sections stained with borax carmine; hæmatoxylin I have found very unsatisfactory for this purpose.

The appearance of the epidermis in sections varies a good deal with the state of contraction of the particular part of the body which it covers. Frequently it is thrown into slight folds and sometimes it is so stretched that it becomes very much thinner than in its normal condition, while the component cells are much more difficult to make out.

In favourable preparations, however, the epidermis is seen, very clearly indeed, to consist of very slender, greatly elongated, columnar cells, placed closely side by side. (Fig. 9, *ep.*) Each cell is broadest at its outer end and tapers gradually to a fine point imbedded in the subjacent tissue. About the centre of each is an elongated, deep-staining nucleus. The outer surface of the epidermis is richly ciliated.

Beneath the epidermis is a well-developed layer of unicellular glands (Fig. 9, *gl. c.*) The gland-cells are pear-shaped, with the narrow ends pointing outwards. Each contains a small nucleus and a larger or smaller quantity of finely granular material. These gland-cells are much more numerous and contain much more of the granular contents, on the dorsal than on the ventral aspect of the body. There can, I think, be no doubt that they secrete part of the slime with which the surface of the body is covered.

Scattered between the gland-cells and amongst the tails of the epidermic cells are numerous small, darkly staining nuclei (Fig. 9, *nu.*), whose exact relations I have not been able to make out. Around and beneath the gland-cells we also see a quantity of very finely granular material which scarcely stains at all with borax carmine and which extends inwards to the circular muscle layer. This tissue (Fig. 9, *b. m.*), in which a few scattered nuclei are imbedded, evidently constitutes the basement membrane already frequently described by writers on Nemertean anatomy.

b. Muscular System.

Within the basement membrane there are two well-developed muscular sheaths completely investing the body, viz., an outer sheath of circularly disposed muscle fibres and an inner sheath of longitudinal ones. Between these two principal sheaths there is a very thin and delicate layer of diagonally disposed muscle fibres.

The outer, circular, muscle sheath (Figs. 6, 7, 8, 9, 10, *c. m.*) is well developed and of about equal thickness all round the body, it is not, however, nearly so thick as the longitudinal sheath.

The inner, longitudinal muscle sheath (Figs. 6, 7, 8, 9, 10, *l. m.*) is more strongly developed on the ventral than on the dorsal surface of the body, doubtless in relation to the crawling movements of the animal. In transverse sections it is very clearly seen to be broken up into blocks by small bundles of muscle fibres which run inwards from the circular sheath to the deeper parts of the body (Figs. 8, 24).

The layer of diagonal or oblique muscle fibres (Fig. 10, *o. m.*) is very thin and consists of two series of fibres crossing one another obliquely, just as in *Geoplana*,* only in a different position. This diagonal layer in *Geonemertes australiensis* is very clearly recognisable in tangential sections along the sides of the body, much as is represented in Figure 10, taken from a specimen stained with borax carmine. I should not like to say positively that it extends completely round the body, but it probably does, though I have not been able to detect it with certainty in the mid-dorsal and mid-ventral regions.

In the head-region there is a special and very important development of muscles in relation to the proboscis sheath (*vide* Figs. 2, 3, 4, 5, 6). At about the level of the centre of the cerebral ganglia the longitudinal muscle sheath splits into two layers, an inner and an outer. The outer layer (*l.' m.'*) passes forwards in the old position. The inner layer (*m. d.*), on the other hand, passes forwards and inwards to join the proboscis sheath at the place where the proboscis is attached to it, immediately in front of the cerebral ganglia and behind the mouth. There is thus formed a distinct muscular diaphragm (Figs. 2–6, *m. d.*), convex anteriorly, lying immediately in front of the cerebral ganglia and behind the mouth. The musculature of the proboscis and its sheath, with which this muscular diaphragm is continuous, will be described in dealing with those organs.

I have already mentioned that numerous small bundles of muscle fibres run inwards from the region of the circular muscle sheath through the longitudinal sheath to the deeper parts of the body. Many of these small bands unite together to form a series of strong dorso ventral muscular bands which run in a vertical direction between the lateral diverticula of the alimentary canal.

c. Alimentary Canal.

The alimentary canal agrees very closely indeed with that of *Geonemertes chalicophora*, as described and figured by

* *Vide* Dendy "Anatomy of an Australian Land Planarian," Trans. Royal Soc. Victoria, 1889.

Professor von Graff.* The mouth, as already observed, is situate just in front of the cerebral ganglia, within the rhynchodæum (Fig. 6, *m.*) The alimentary canal, as observed by von Graff, is divisible into two sections, the œsophagus and the gut proper, which differ essentially in the character of their lining epithelium. The œsophagus (Fig. 6, *œs.*) is at first a very narrow and short tube, with thin walls (*œs.* 1), which passes obliquely backwards and downwards beneath the ventral commissure of the cerebral ganglia. Behind the ganglia it suddenly dilates into a large saccular structure with thick and folded walls (*œs.* 2), lying beneath the most anterior portion of the proboscis sheath; then it contracts again to form a straight, short, thin-walled tube (*œs.* 3) springing from the posterior dorsal region of the saccular portion. At its posterior extremity the straight, thin-walled tube joins the gut proper. The relations of the different regions of the œsophagus to one another and to the other organs of the body will be best understood by reference to Figure 6, representing a median longitudinal section through the anterior extremity of the body.

The wall of the œsophagus is made up of more or less elongated, darkly staining, nucleated and richly ciliated columnar cells, and the transition from this epithelium to that of the gut proper is a very sudden one (Fig. 6). Von Graff considers the thick walls of the saccular portion of the œsophagus to be of a glandular nature; this may also be the case in our species, but the columnar cells composing them are certainly very richly ciliated.

The gut proper, or intestine, runs straight from the œsophagus to the anus, which is situated at the posterior extremity of the body (Fig. 12, *a.*) The median portion of the gut lies exactly beneath the proboscis sheath, but it gives rise on either side to a large number of irregular, often branched, saccular or lobate diverticula, which pass outwards and upwards on either side of the proboscis sheath, closely embracing it (Fig. 8).

Just where it joins the œsophagus the gut gives off, as usual, a characteristic diverticulum (Fig. 6, *d. gut*), which runs forward beneath the last portion of the œsophagus and ends blindly.

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* *Loc. cit.*

The digestive epithelium has been admirably described by Professor von Graff in the case of *Geonemertes chalicophora,* and aptly compared to that of the Planarians. His remarks apply equally well to our species. Only in a condition of rest or hunger are the digestive cells clearly recognisable, when they have the form of elongated, columnar cells, apparently not ciliated. When digestion takes place these cells elongate, put out amœboid processes, seize hold of the food particles and run together into a protoplasmic network which may finally completely obliterate the lumen of the alimentary canal, which then appears to be filled with a granular vacuolated mass of protoplasm (syncytium). The digested food material is then, apparently, passed out to the surrounding tissues, after which the digestive cells regain their normal condition, or, as seems to me possible, are replaced by new ones.*

Digestion seems to go on chiefly in the lateral diverticula, which generally appear in sections to be more or less filled with a granular syncytium as shown in Fig. 8. In crushed preparations of the living animal this granular material is very obvious in the lateral diverticula and can be easily squeezed out into the central portion of the gut and thence through the anus.

d. The Proboscis Sheath and Proboscis.

The proboscis and its sheath have essentially the same structure as in other Hoplonemertines and a brief description of these parts will therefore suffice. The sheath (Figs. 6, 7, 8, *p. s.*) is a hollow tube running along in the dorsal region of the body above the alimentary canal, and extending from its opening at the anterior extremity to its blind end very near the posterior extremity. It has well-developed muscular walls lined internally by a layer of epithelium. The thickness of the muscular part of the wall, as also that of the epithelial layer, varies much according to the state of distention of the sheath. When the proboscis is completely retracted the walls of the sheath are necessarily much distended and appear relatively thin, while when the proboscis is everted the lumen of the sheath becomes much narrower and its walls much thicker. The muscular portion

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* Compare my account of the digestive epithelium in *Geoplana spenceri (loc. cit.)* which was written before I had seen von Graff's remarks on the subject.

of the wall of the proboscis sheath consists of longitudinally and circularly disposed fibres irregularly mixed together, and not arranged in definite layers as seems to be the case in other Hoplonemertines.* Just in front of the anterior attachment of the proboscis, and just behind the mouth, the wall of the rhynchodæum† forms a kind of muscular sphincter, which, when the proboscis is completely withdrawn, closes the entrance. This is not seen in any of the sections figured, but it is very distinctly visible in horizontal sections of a specimen killed with the proboscis retracted.

The cavity of the proboscis sheath, or rhynchocœlom, is filled with a liquid in which float numerous elongatedly spindle-shaped corpuscles, each about 0·09 mm. in length and about 0·0036 mm. in greatest transverse diameter. The two ends of the spindle are very gradually and sharply pointed; the substance of which it is composed stains fairly well with hæmatoxylin, and is scarcely at all granular except in the middle of the cell, where there seems to me to be a nucleus. Von Graff describes similar but smaller bodies in *Geonemertes chalicophora*, but states that they have no nucleus. I can offer no suggestion as to the possible use of these remarkable bodies.

On slitting open the proboscis sheath in an animal which has been killed with the proboscis retracted the latter organ is seen packed away in the sheath in a much bent and crumpled condition. The folding of the proboscis within the sheath appears to be very irregular, and is necessitated by its great length, which far exceeds that of the sheath which has to contain it. If we now gently pull the proboscis away from the sheath (Fig. 13) we shall find that it is attached to the latter at two points, (1) at the anterior extremity, where the muscular walls of the sheath and proboscis become continuous all round (Fig. 6, *m. p.*, Fig. 13, *a. a.*, Figs. 12 and 14, *a.' a'*), and (2) at the posterior extremity of the proboscis, which narrows out to form a long retractor muscle (Figs. 13, 14, *r. m.*) whose end is attached to the inner surface of the wall of the sheath a little in front of the blind end of the latter (Fig. 13, *p. a.*)

The proboscis consists of three main divisions—(1) most anteriorly, the eversible portion (Figs. 14, 15, *e. r.*) which is

* *Vide* von Graff, *loc. cit.*

† The rhynchodæum is the cavity into which the proboscis sheath and alimentary canal both open.

much the largest, (2) the stylet-region (Figs. 14, 15, *st. r.*) and (3) posteriorly, the non-eversible portion (Figs. 14, 15, *n. e. r.*)

The eversible portion is a long, cylindrical tube, attached all round at its anterior end to the proboscis sheath and composed, from without inwards, of the following layers (Fig. 16):—(1) a delicate epithelium, (2) a very thin layer of circular muscles (*e. c. m.*), (3) a very thick layer of longitudinal muscles (*e. l. m.* and *i. l. m.*), (4) a thickish layer of circular muscles (*i. c. m.*), (5) a sub-epidermic layer ("basement membrane") of hyaline, faintly staining material containing small, scattered nuclei, (6) a layer of glandular epithelium (*gl. p.*) elevated into numerous elongated papillæ which project into the lumen of the retracted proboscis, and into each of which the basement membrane is continued as a more or less distinct core. The longitudinal muscle layer makes up by far the greater part of the thickness of the proboscis wall and is divided into two portions, an outer thinner (*e. l. m.*) and an inner thicker (*i. l. m.*), by the remarkable nerve sheath of the proboscis (*p. n. s.*), which may be conveniently described in this place.

The appearance of the proboscidean nerve sheath in transverse section is shown in Figure 16 (*p.n.s.*) It is composed of a finely granular, faintly staining material (? with a few scattered nuclei) and appears to form a continuous layer. This layer is thickened at frequent and fairly regular intervals to form a circle of stout longitudinal nerves, continued outwards as thin, radiating, vertical plates to the outer circular muscle layer. On their inner aspect the longitudinal nerves are rounded off but occasionally give off small branches towards the inner circular muscle layer. Similar small branches are given off from the portions of the sheath between the longitudinal nerves.

This complicated proboscidean nervous system thus agrees pretty closely with what von Graff has described and figured for *Geonemertes chalicophora.* Hubrecht* has traced this nervous system into connection with the cerebral ganglia, but I have not succeeded in doing this, though I have no doubt that such a connection exists.

The stylet-region of the proboscis is recognisable externally as a distinct swelling at the junction between the eversible and non-eversible portions (Fig. 14, *st. r.*) This swelling is

* *Vide Encyclopædia Britannica*, Article "Nemertines."

divided by a slight transverse constriction into two portions (Fig. 15), an anterior, which seems, as pointed out by von Graff, to belong more properly to the eversible portion of the proboscis, and a posterior, which seems to belong to the non-eversible portion. For the sake of convenience, however, I follow von Graff in considering these two portions together as a separate region of the proboscis, the stylet-region. In longitudinal sections, however (Fig. 15), the two portions of the stylet-region are seen to be even more sharply marked off from one another than appears from the outside.

The structure of the anterior half of the stylet-region is very complicated. If we take a transverse section across it (Fig. 16) we shall see that it is nearly solid. In the centre is a deeply staining, homogeneous mass (Fig. 16, *h.*), circular in outline; this is the so-called "handle" of the stylet, which appears to be of the nature of a secretion. This handle is surrounded by a rather thin layer of radiating muscle (?) fibres, attached to the "handle" at their inner extremities. Outside this layer of radiating fibres comes a rather thin layer of circular fibres, interrupted at one side of the handle by the "poison-duct" (*p. d.*), which contains a granular material. The boundary between the layer of radial muscles and the circular layer is very sharp and distinct and gives one rather the impression of being the wall of a cavity across which the radial fibres run to their insertion in the handle of the stylet. The layer of circular fibres is not very regular, and is seen in longitudinal section (Fig. 15) to be more or less interrupted by radial bands, it is thicker behind the handle of the stylet than around it. Outside this circular layer is a very thick layer of longitudinal fibres interrupted by occasional radial bands. The proboscidean nerve sheath appears to die out in this region of the proboscis, but if I am not mistaken it may be traced as far back as the level of the handle of the stylet (Fig. 16). Outside the thick layer of longitudinal muscles is a layer of large, irregular, highly granular and deeply staining cells (Figs. 15, 16, *gl. z.*). These evidently correspond to the layer of pigment granules described and figured by von Graff in the case of *Geonemertes chalicophora*, but I do not think that in our species they are actually pigmented although their highly granular character gives them a dark appearance under the microscope even in unstained preparations. Lines of granular material radiate inwards from these cells towards the handle of the stylet, and altogether they appear to be of a glandular nature. Possibly, as Bürger suggests,* they secrete the material which forms the handle of the stylet. This layer of glandular, deeply staining cells is interrupted by the sacs which contain the "reserve" or "accessory" stylets. These sacs (Fig. 16, *s. r. s.*) have the appearance of irregular, clear, rounded spaces ; they are not definitely two in number, as appears to be the case in *G. chalicophora*, but their number varies : I have counted as many as five in a single specimen. Nor do they appear to be constant in position, although in the section represented in Fig. 16 two sacs happen to be cut through in a position which seems to have a definite relation to that of the poison canal. Each sac contains about four accessory stylets, whose structure will be considered later on.

Outside the layer of glandular cells is a very thin, uninterrupted layer of longitudinal muscle fibres, followed immediately by a delicate external epithelium, which is extremely difficult to recognise. I could find no trace of an external circular layer of muscles in the stylet-region of the proboscis.

Certain structures in the anterior half of the stylet-region require further notice. These are the stylets, the stylet-handle and the poison canal. All these parts may best be studied in a longitudinal section of the proboscis taken in the plane of the central stylet and poison canal. Such a section is represented in Fig. 15. It will be seen that the stylet-handle is a somewhat pear-shaped structure whose broader end is posterior, while into the narrower end is inserted the base of a stylet, whose apex projects forwards into the lumen of the eversible portion of the proboscis. At one side of the stylet-handle a narrow "poison canal" (*p. d.*) leads up from the "poison reservoir" (*p. r.*) in the posterior half of the stylet-region. This poison canal leads up to the base of the central stylet The stylets themselves are sharp-pointed, perfectly transparent needles, about 0·12 mm. long and of the shape shown in Fig. 17. Each resembles a nail, with a slightly enlarged head separated from the remainder by a slight constriction. The inner portion appears to be softer than the outer, from which it is pretty sharply marked off, and near the base, or head, is (at any rate in the reserve stylets) a small space, quadrangular in lateral view, which is

* "Untersuchungen über die Anatomie und Histologie der Nemertinen, &c," Zeitsch. für wiss. Zoologie, Vol. 50, p. 1, 1890.

frequently of a black appearance, owing doubtless to the presence of air within it. Sometimes one meets with abnormalities in the development of the stylets. One of these is represented in Fig. 17 (*a. st.*), where several points are attached to one head. Very often small shining globules appear to be attached to the outer surface of the stylet just in the constriction which marks off the head (Fig. 17*a.*)

There can, I think, be little doubt that these calcareous stylets originate, like sponge-spicules, in special mother cells. Occasionally small granular cells (Fig. 17*c.*) may be detected in the sacs containing the reserve stylets, and these sometimes seem to bear already the beginning of a stylet (Fig. 17, *st. m. c.*)

I have not succeeded in finding any communication between the reserve sacs and the lumen of the eversible part of the proboscis, but probably there is some communication as in other species. The structure of the central stylet and the accessory ones appears to be identical, and there can be no doubt that the latter are destined to replace the former when it is broken off or worn away, but the manner in which they come to be inserted into the top of the handle is to me a perfect mystery.

When the proboscis is completely everted the central stylet, of course, must project freely at its free end, and doubtless it forms, with the poison, an efficient weapon of offence or defence.

The posterior half of the stylet-region is less complicated in structure. It is a swollen, bulbous organ, with very thick muscular walls, in which the muscle fibres do not appear to be arranged in definite layers, but circular, longitudinal and oblique or diagonal fibres occur more or less mixed up together in a dense mass. Outside is the usual low epithelium, very difficult to make out, and inside is a large cavity (Fig. 15, *p. r.*), the poison reservoir, which is also lined by a low and apparently non-glandular epithelium, and communicates anteriorly, by means of the poison canal, with the lumen of the eversible portion of the proboscis, and posteriorly, by a short constricted canal, with the lumen of the non-eversible portion. The latter penetrates, with its own muscular coat, for a short distance into the posterior part of the stylet region, as shown in Figure 15.

The non-eversible portion of the proboscis (Figs. 14, 15, *n. e. r.*) is relatively thin-walled, and the muscular elements are not nearly so strongly developed. I have only been able to detect two thin muscular layers, an outer circular and an inner longitudinal. On the outer surface there appears to be as usual a low epithelium, but I have not succeeded in making it out at all clearly. Internally this portion of the proboscis is lined by a highly glandular, very darkly staining epithelium, which I have not been able to clearly differentiate from the darkly staining secretion which fills the lumen. At its posterior extremity the proboscis becomes very narrow and ends blindly. To the blind end is attached a strong bundle of long muscle fibres, the retractor muscle (Figs. 13, 14, *r. m.*), which has its origin on the inner surface of the dorsal wall of the proboscis sheath, a little in front of the blind ending of the latter. When the proboscis is retracted the retractor muscle is short and broad but it is obviously capable of great elongation.

It is, perhaps, hardly necessary to explain the mode of action of the proboscis any further than has been already done. Figure 14, taken from an actual dissection, represents the entire proboscis, with its retractor muscle, separated from the body and in a partially everted condition. It is hoped that reference to this figure will render further description unnecessary. The general view that the protrusion of the proboscis is effected by the powerful contraction of the muscles of the proboscis sheath, acting through the fluid which surrounds the proboscis, while withdrawal is effected by means of the retractor muscle, is doubtless correct. Probably the withdrawal is assisted by the contraction of the muscular diaphragm (Figs. 2–6, *m. d.*), already described, in connection with the anterior attachment of the proboscis to its sheath.

e. Circulatory and Excretory System.

The vascular system is very difficult to make out thoroughly, as, owing to the size and opacity of the body, it must be studied by means of serial sections. There are, as in *Geonemertes chalicophora*, three main longitudinal vessels, one (dorsal or median) lying between the proboscis sheath and alimentary canal, and one (lateral) on either side of the body in the neighbourhood of and ventral to the lateral nerve cords. I have not succeeded in demonstrating any connection between these vessels, unless the network of excretory tubules, to be described presently, be considered as such.

We will first describe the median or dorsal vessel. In the first place it does not keep by any means in the middle line, but is generally found to one side or the other and also curves about considerably. Generally, at any rate in the anterior portion of the body, it appears to keep constantly on one side of the middle line (Figs. 7, 8, *m. v.*)

The diameter of the vessel is by no means uniform. For perhaps the greater part of its length it is a narrow cylindrical tube, but occasionally, and more especially towards the anterior end, it swells out somewhat suddenly into a wide, irregular, lacunar cavity (Fig. 21). The structure of the wall of the vessel is decidedly complex. On the inside, in transverse sections, we see irregularly disposed, deeply staining nuclei (Fig. 22, *nu. v.*), usually projecting more or less into the lumen of the tube. From considerations to be adduced hereafter I doubt whether these are the nuclei of a properly defined epithelium. Outside this nucleated layer there comes a thin layer of very delicate fibres, doubtless muscular, arranged in a circular direction around the vessel (Figs. 22, 23, *c. m. v.*) Outside the muscular layer comes a single layer of large, vesicular-looking, irregularly ovoid, faintly staining cells with small nuclei and slightly granular contents (Figs. 22, 23, *ves. c.*) The wall of the vessel then, in its narrow portions, is made up of three distinct layers. In the swollen, lacunar portions of the vessel (Fig. 21, *l. m. v.*) only the two inner layers can be made out, the outer layer seems to be entirely wanting.

At its extreme anterior end the median vessel becomes narrow again, after swelling out into a series of irregular lacunæ as above described, and passes forward between the œsophagus and proboscis sheath to the level of the ventral commissure (Figs. 6, 18). Here it terminates in a very remarkable manner. A transverse section taken through the region of the ventral commissure will, if taken at exactly the right level, show two curious bodies imbedded in the proboscis sheath, one on each side of the mid-ventral line. These bodies have the form of cellular plugs, containing small, very deeply staining nuclei and frequently projecting very markedly into the cavity of the proboscis sheath. The exact form and position of one of these curious structures will be best understood by reference to Figure 18, representing a small portion of a longitudinal vertical section taken at one side of the median line. It will be seen that in its deeper part, as it passes through the muscular proboscis sheath, the plug (*c. pl.*) forms a relatively narrow stalk, which seems to have a slightly fibrous structure. On reaching the cavity of the proboscis sheath it swells out into a rounded mass of cells, covered, I believe, with a flattened epithelium continuous with the epithelium which lines the proboscis sheath, and projecting into the rhynchocœlom.

The median vessel seems, according to my observations, to be connected with both of these cellular plugs. It appears to be directly continuous with the stalk of the one (Fig. 18) and to send off a branch to the other. Whether there is any constant distinction between the right and the left in this respect I am not able to say.

These cellular plugs appear to me to be probably vestigial structures, and to indicate two things—(1) a former more intimate connection of the median vessel with the proboscis sheath and the rhynchocœlom, such as at the present day exists in many marine Nemertines,* and (2) the former existence of a pair of vessels one on each side of the middle line beneath the proboscis sheath, instead of a single one as at present. Such a pair of vessels exists at the present day in what Oudemans† calls the "Palæo-type." I have been unable to determine whether the right or the left vessel constantly persists in *Geonemertes* or whether it is sometimes one and sometimes the other. Not expecting to meet with any distinction between right and left sides I did not take sufficient care in orientating my section series to justify me in forming a definite conclusion on the point in question. In other words, although the proper sequence of the sections has been rigidly maintained I am not absolutely certain that all the series have been mounted with the same side uppermost. It is some time since many of the sections were cut and I do not like to trust to my memory on such a point.

At its posterior extremity the median vessel is continued into a vessel of smaller diameter, which in histological structure presents a very interesting transition between the main median vessel and the network of excretory tubules to be presently described. A portion of this part of the median vessel is shown in Figure 20. It will be seen that the outer layer of large vesicular cells is absent and that

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* *Vide* Oudemans:—"The Circulatory and Nephridial Apparatus of the Nemertea," *Quarterly Journal of Microscopical Science*, Vol. XXV., Suppl.

† *Loc. cit.*

the whole vessel closely resembles one of the excretory tubules with the addition of a thin layer—apparently discontinuous—of circular fibres around the outside.

The position of the two lateral vessels is shown in Fig. 8 (*l. v*) They are not so distinct and easily recognisable as the median vessel and never seem to attain to such complexity of histological structure. I have not been able to recognise either the circular muscles or the outer coat of vesicular cells in their walls and they seem even more like a specialised portion of the network of tubules to be described presently. Nuclei can be distinguished in their walls and occasionally the vessel dilates into irregular lacunæ (Fig. 23, *l. l. v.*) What happens to the lateral vessels at the anterior and posterior extremities I cannot say, but in the head region there are a number of wide, irregular lacunæ into which they probably open.

In sections which have been stained with Kleinenberg's hæmatoxylin a system of fine, apparently intra-cellular tubules (Figs. 7, 8, *ex. t*) is very distinctly visible, ramifying through all parts of the body between the muscle layers and the proboscis sheath. These tubules run in all directions and branch freely, but they are especially developed in the region of the body above the proboscis sheath and they generally, though by no means always, run in a direction at right angles to the long axis of the body, forming a series of irregular loops curving over the proboscis sheath from side to side. They are also to be found running transversely beneath the alimentary canal. As already stated they branch freely and some of the branches run in the direction of the long axis of the body. These tubules open into the lateral vessels (Fig. 23) and probably also into the median one. I have not been able to demonstrate any opening of the tubules into the latter but they can be traced very close to it and the transitional condition of the median vessel at its posterior end in regard to histological structure is indicative of a close connection between it and the network of tubules. The histological structure of the tubules (Fig. 19) points to an intra-cellular nature. They are very narrow and at fairly regular intervals present very distinct swellings. Each of the swellings is caused by the presence of a nucleus which curves partially round the tubule and which stains very darkly with hæmatoxylin, thus rendering the tubules very conspicuous in sections. Sometimes the tubules appear to be empty and sometimes they appear to be filled with a granular substance. The wall of the tubule between the nuclei is visible as a fine, highly refractive outline.

Although they are such obvious and definite structures in properly stained preparations it is by no means easy to decide upon the true nature of these intra-cellular tubules. The position of the main branches and the connection with the lateral vessels suggests that the former are the homologues of the transverse vessels of other Nemertines. Their histological structure and much branched character suggests that they are excretory in function. The excretory system is so intimately connected with the vascular system in other Nemertines that I am inclined to believe that both these suggestions may be correct.

So far as I am aware no excretory system has yet been described in land Nemertines, and it seems not impossible that in *Geonemertes* the same system of vessels is both excretory and circulatory. Apparently the longitudinal vessels are merely specialised portions of the network of tubules, being similar tubes with the addition in some places of fine circular fibres and an external layer of vesicular cells. Hence I believe the lumen of the longitudinal vessels to be probably intra-cellular.

The great objection to considering the network of tubules as excretory is the apparent absence of any opening whatever to the exterior. In other Nemertines such as *Polia* the excretory pores are easily visible, and in the genus mentioned I have had no difficulty in finding them in transverse sections. Did such distinct openings to the exterior exist in *Geonemertes* I hardly think that I could have overlooked them. It is, however, very possible that smaller openings exist which I have either overlooked entirely or failed to distinguish from the numerous genital apertures to be described presently.

For a long time, also, I could detect nothing of the nature of flame-cells in *Geonemertes*, which one would certainly expect to find in connection with such a system of excretory tubules as I have described. Had I relied solely on my sections I should probably never have found flame-cells at all, but in examining a crushed preparation of the living worm I was fortunate enough to find a beautiful flame-cell in full activity. This is represented in Figure 26, as it appeared in optical section while alive. It will be seen that at one end of the cell there is a triangular projection of denser and clearer looking protoplasm ; the swollen middle portion of the cell is highly granular, and at the other end is a deep pit or excavation, in the bottom of which the flame-like undulating structure (*fl.*) is inserted.

I was able to observe the movements of the "flame" for a considerable time, until they gradually slackened and then ceased. They were extremely beautiful and characteristic, consisting of a series of undulations passing from base to apex in rapid succession and causing the "flame" to exhibit alternate light and dark bands which travelled rapidly along it and at first sight conveyed the impression of successive bubbles of gas escaping from the end of a tube under water.

Probably the flame is made up of a bundle of long cilia, but I could not satisfy myself on this point, although faint indications of longitudinal striations were visible in it.

This cell, I have no doubt, formed the termination of a branch of the system of intra-cellular tubules described above, but I could not trace this system in the living animal owing to the thickness of the specimen and the opacity of the tissues, and it was only by good luck that I found a flame-cell at all in a crushed preparation. As far as I am aware flame-cells have never hitherto been observed in Nemertines except perhaps in the American fresh water species, *Tetrastemma aquarum dulcium*, described by Silliman.* As far as I can gather from that author's description, flame-cells appear to be present, at any rate there are structures which he calls "Flimmer-läppchen" at the ends of narrow branches of the excretory system, but the description of the excretory system is very meagre and unaccompanied by illustrations. As the excretory system of this species appears to agree more closely with that of our *Geonemertes* than that of any other known Nemertine, I may perhaps be allowed to quote it in this place for the sake of comparison :—"Das Wassergefässsystem dieser Art ist sehr leicht zu verfolgen. . . . . . Es scheinen in der Regel zwei selbständige Längsstämme vorhanden zu sein, die sich unter der Leibeswand reichlich verzweigen, besonders im Kopftheile und auf dem Rüssel. Die Ausmündungsporen liegen auf der ventralen Fläche gegen die Mitte der Körperlänge. Die Bewegung der Flüssigkeit wird von den Flimmerläppchen, die in dem erweiterten Ende der kapillaren Zweige sich finden, erhalten." It seems to me very probable that the "Längsstämme" here mentioned may be homologous with

* Zeitschrift für wissenschaftliche Zoologie, Vol. 41, 1885, p. 70.

the lateral vessels of *Geonemertes*, although I have been able to find no external openings in the latter.

There are so many points connected with the circulatory and excretory system of Nemertines still involved in obscurity, that I may well be excused from attempting to give a complete explanation of the structures described above. I would merely suggest as a possible working hypothesis that in *Geonemertes* the excretory and circulatory systems are even more closely related than usual, being in fact represented by one and the same system of vessels, and that *possibly* there are no external excretory openings.

Figures 19 to 23 illustrate the histological structure of various parts of the vascular and excretory systems as seen in sections, and will, it is hoped, sufficiently justify the statements made above as to the form and structure of these parts. For the convenience of comparison all these figures are drawn to the same scale. Figure 26, as already observed, was drawn from life.

It is obvious that the excretory system of *Geonemertes* differs very strikingly from that of marine forms, and it is especially remarkable that it differs even more from that of its marine allies in the group *Enopla* than from that found in the *Anopla*, for, according to Bürger,* the blood-vessels in the marine *Enopla* form no dilatations nor capillaries, and he could find no connection between the blood-vessels and the excretory organs.

f. Nervous System

The nervous system does not, so far as I have been able to make out, present any striking peculiarities, and a brief description of it will therefore suffice. At the anterior end of the body, immediately behind the muscular diaphragm already noticed, is situated the brain, or cerebral ganglionic mass (Figs. 2, 3, 4, 5, 7). This consists of the usual four lobes found in Nemertines, two on each side of the extreme anterior end of the proboscis sheath. One of the two lobes of either side is larger than the other and is also more dorsal and more anterior in position; we may call it the dorsal lobe of the ganglion (Figs. 3, 4, 5, 7, *d. g.*) The other, smaller lobe of each side is more posterior and ventral and may be called the ventral lobe of the ganglion (Figs. 2, 3, 4, 5, 7, *v. g.*) The right and left ventral lobes are connected together by a

* *Loc. cit.*

stout commissure which runs beneath the proboscis sheath and above the œsophagus and which we may call the ventral commissure (Fig. 6, *v. c.*) The right and left dorsal lobes are similarly connected by a slenderer commissure—the dorsal commissure (Fig. 6, *d. c.*)—which runs above the proboscis sheath. In this way a complete ring is formed around the proboscis sheath. The two ventral ganglia are continued posteriorly into the lateral nerve cords (Figs. 2, 8, 24, 25, *n. c.*) These lie one on each side of the ventral aspect of the body, within the layer of longitudinal muscles (Fig. 8); they run straight to the posterior end of the body, where they unite together above the intestine just in front of the anus.

Various nerves are, of course, given off from the central nervous system thus constituted, but these I have not attempted to work out in detail and, indeed, to do so would, owing to the minute size of the animal, be a very difficult matter. The most conspicuous of these nerves are those which come off from the antero-ventral aspects of the dorsal lobes of the cerebral ganglia (Figs. 4, 5, *n.*) It will be seen from Figure 4 that a specially large trunk leaves the brain just above the ganglion of the lateral organ, and divides into a number of branches, some of which run antero-dorsally and probably supply the eyes, while another runs straight to the sac on the lateral organ and yet another runs backwards and somewhat ventralwards and divides into two short branches, whereof one runs to the posterior end of the ganglion of the lateral organ and the other to the curious œsophageal organ marked *x.* in the figures.

The histological structure of the central nervous system bears a marked resemblance to that of the same organs in *Geoplana*,* but the small nerve-cells are more abundantly developed and more definitely arranged. In the brain they occur abundantly in the outer portion of each lobe, leaving the interior free from their presence. In the lateral nerve cords the nerve cells are arranged in a very characteristic manner, as already described by von Graff in the case of *Geonemertes chalicophora.* They are aggregated in two bands, one on the ventral aspect of the nerve cord and one on the dorsal aspect, but above the dorsal band of nerve cells there is a narrow band of fibrous tissue. This characteristic arrangement of the nerve cells in the lateral cords is best shown in Figs. 2 and 25, (*n. c.*)

* *Cf.* Dendy, "Anatomy of an Australian Land Planarian," Trans. Royal Soc., Victoria, 1889.

g. The Lateral Organs.

By way of preface to this portion of our subject, I will take the liberty of quoting part of Professor Hubrecht's concise and excellent account of the lateral organs given in his article on Nemertines in the latest edition of the *Encyclopædia Britannica*:—

"This apparatus is usually known under the name of the "lateral organs. To it belong (*a*) superficial grooves or "deeper slits situated on the integument near the tip of the "head, (*b*) nerve lobes in immediate connection with the "nervous tissue of the brain, and (*c*) ciliated ducts penetrat-"ing into the latter and communicating with the former. "Embryology shews that originally these different parts are "separately started, and only ultimately become united into "one. Two lateral outgrowths of the foremost portion of "the œsophagus, afterwards becoming constricted off, as "well as two ingrowths from the epiblast, contribute "towards its formation, at least as far as both Hoplo- and "Schizonemertines are concerned. . . . These posterior "brain-lobes, which in all Schizonemertines are in direct "continuity of tissue with the upper pair of principal lobes, "cease to have this intimate connexion in the *Hoplonemertea;* "and, although still constituted of (1) a ciliated duct, opening "out externally, (2) nervous tissue surrounding it, and "(3) histological elements derived from the œsophageal "outgrowths, they are nevertheless here no longer constantly "situated behind the upper brain lobes and directly "connected with them, but are found sometimes behind, "sometimes beside, and sometimes before the brain-lobes. "Furthermore, they are here severed from the principal "lobes and connected with them by one or more rather thick "strings of nerve-fibres. In some cases, especially when the "lobes lie before the brain, their distance from it, as well as "the length of these nervous connexions, has considerably "increased. . . . With the significance of these parts we "are still insufficiently acquainted. . . . Whether in the "Hoplonemertines, where the blood fluid is often provided "with hæmoglobiniferous disks, the chief functions of the "side organs may not rather be a sensory one must be "further investigated."

This I take to be a fair summary of our knowledge of the lateral organs* up to the present time, and I will now

* For further details as to the marine forms the reader is referred to Bürger's excellent memoir already referred to.

proceed to describe the condition of the parts concerned in *Geonemertes australiensis.*

In the first place the lateral organ of each side lies almost entirely below the brain, as will readily be seen by reference to Figure 4.

On the ventral surface of the head there is a slight transverse groove (Figs. 5, 6, 12, *gr.*) in which lie, one on either side of the mid-ventral line, the openings of two narrow and deep pits—the ciliated ducts* or cephalic pits. Following one of the ducts (Fig. 4, *c. p.*) inwards from the external opening we find that it passes obliquely upwards and backwards and, at the same time, towards the side of the body, so that in Figure 5 it appears cut transversely. When it reaches the level of the anterior surface of the brain the duct runs into the substance of a dense mass of small-celled tissue (Fig. 4, *l. g.*) This is evidently the epiblastic portion of what Hubrecht calls the posterior brain-lobe, but here no longer posterior and also widely separated from the rest of the brain. From its position and relations I propose to call this part the "ganglion of the lateral organ."

The ganglion of the lateral organ is an elongated mass of densely packed, small cells, lying longitudinally beneath the anterior and dorsal lobe of the brain. It is somewhat bent upon itself and narrows posteriorly. Near its hinder end it receives the nerve from the brain already mentioned, which joins it on its dorsal aspect just as it passes through the muscular diaphragm. At its posterior extremity the ganglion of the lateral organ becomes continuous with the curious body marked *x.* in Figs. 3, 4, 5, 7. This body I take to be the œsophageal portion of the lateral organ mentioned by Hubrecht, and as it is clearly distinguishable from the remainder of the lateral organ, I propose to call it the "œsophageal organ." The œsophageal organ is very different in histological structure from the ganglion of the lateral organ. It is composed of much larger, nucleated, granular, very darkly staining cells, closely packed together into a dense mass which runs beneath and behind the ventral lobe of the brain (Fig. 4). Its appearance suggests that it may possibly be glandular, but for the present I fear it must be regarded as an organ of unknown function. Figure 4 shows that it

* I have not been able to detect the cilia in my sections except just by the external opening.

lies in close proximity to the œsophagus in the adult animal, and this position, taken together with its histological structure, leaves little doubt in my mind as to its homology with the portion of the lateral organ derived from the œsophagus in other Nemertines. It receives at its anterior end, as already stated and as shown in Fig. 4, a special nerve from the dorsal lobe of the brain, or, to speak more accurately, a branch of the same nerve which supplies the ganglion of the lateral organ.

We must return now to the consideration of the ciliated duct, or cephalic pit, which we left just as it was entering the ganglion of the lateral organ. At this point it divides into two branches (Fig. 4). One of these branches penetrates through the middle of the ganglion of the lateral organ and thence enters the substance of the œsophageal organ, where it disappears; its course is represented by the dotted red line in Fig. 4.

The other branch of the duct turns outwards and, passing in front of the ganglion of the lateral organ, dilates into a relatively large, hollow, laterally compressed vesicle (Figs. 2, 3, 4, *sac*). The wall of this sac or vesicle is composed of a single layer of large, columnar, nucleated cells, chiefly remarkable for their bright yellow colour. The inner end of each cell, towards the cavity of the sac, shows indications of being cuticularized and forms a slight, obtuse projection. Such a saccular diverticulum of the ciliated duct appears, according to Bürger, to be very characteristic also of the marine *Enopla*. Possibly, as Bürger suggests, it is sensory in function.

h. The Eyes.

Geonemertes australiensis differs from all previously described land Nemertines in the possession of a large and indefinite number of eyes, all the previously described species having either four or six. These eyes, of which there may be as many as thirty or forty in our species, are arranged in two groups (Fig. 12, *e. g.*), one on either side of the opening of the rhynchodæum at the anterior extremity of the body. Each group, containing about twenty eyes of various sizes, may show indications of a division into an anterior and a posterior portion, the eyes in the anterior portion being on the average larger than those in the posterior. Whether this is a constant arrangement or not I cannot say, but it suggests that the numerous eyes of *G. australiensis* may have been derived by subdivision of four eyes, two larger anterior and two smaller posterior, such as we find in *G. chalicophora.* Sometimes the eyes in our species appear more or less elongated and sometimes even dumb-bell shaped, which seems to indicate that they multiply by division.

In its minute structure each eye agrees in the main with the eye of *Drepanophorus rubrostriatus* as figured by Bürger,* but I have not been able to make out so much histological detail as that observer. Each eye (Figs. 11, 11*a*) has the form of a deep cup whose opening is turned towards the surface of the body. The wall of the cup is made up of a layer of elongated columnar rods, the inner ends of which, next to the cavity of the cup, are perfectly clear and transparent, while their outer ends are filled with pigment granules. In *Drepanophorus*, on the other hand, the pigment is stated to lie not in the rods themselves but in pigment cells situated behind them. There is also a layer of nucleated cells behind (outside of) the pigmented ends of the rods in *Geonemertes* (Fig. 11) but this appears merely to form a kind of capsule whose cells are perhaps also more or less pigmented. The cavity of the optic cup is filled with a non-staining material which in transverse sections appears finely and regularly granular (Fig. 11*a*). In front of the opening of the cup lies the optic ganglion (Fig. 11, *op. g.*), from which extremely delicate fibrils run down into the cavity of the cup, doubtless to become connected with the inner ends of the rods, as in *Drepanophorus*. The nuclei of the ganglion cells are very easy to make out but not so their protoplasmic bodies. I have not succeeded in tracing the optic ganglion into connection with the nerves given off from the dorsal lobes of the cerebral ganglion (Fig. 4, *n.*) but doubtless such a connection exists as in other Nemertines.

The colour of the eye-pigment is black in the living worm and on the addition of dilute hydrochloric acid it turns to a rich reddish brown colour and partially dissolves.

i. Connective Tissue, Glandular Structures, &c.

The connective tissue, which fills all the interspaces between the various internal organs, agrees very closely with what has been described in other Nemertines. It consists of an almost perfectly hyaline, transparent, non-

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* *Loc. cit.* Plate VI. Fig. III.

staining ground substance, resembling closely the ground substance of the mesoderm in Cœlenterata, in which various kinds of cells are imbedded. The most characteristic of the imbedded cells are small, irregularly shaped, finely granular, nucleated masses of protoplasm (Fig. 24, *gr. c.*) which either occur singly or in irregular groups resembling syncytia. These cells are very abundant above and at the sides of the proboscis sheath and also below the alimentary canal. their appearance suggests that they may be amœboid but this of course requires proof.

We also find numerous cells greatly elongated so as to form delicate fibres, but with the nucleus still clearly visible in the middle. These are readily distinguishable in the region between the proboscis sheath and alimentary canal, where the gelatinous-looking ground substance is very strongly developed and contains comparatively few cells. Frequently these cells branch, and I believe they form networks like the stellate mesodermal cells of sponges, which they closely resemble.

Occasionally the gelatinous-looking ground substance appears to be replaced by a close network of very delicate, non-nucleated, transparent fibrils, but this I am inclined to regard as a post-mortem condition due to the method of preparation.

We may mention in this place certain structures which occur imbedded in the ground-substance and which we have not yet had occasion to refer to.

(1) *The Cephalic Gland* (Fig. 7, *c. gl.*).—This consists of a curious mass situated in the head region dorsally and laterally, overlying the proboscis sheath and dorsal lobes of the ganglia, inside the layer of longitudinal muscles. It consists of a number of large, irregular, granular masses, closely packed together. Each mass appears to be made up of a large number of small cells, for each contains numerous small nuclei and sometimes cell divisions can be clearly distinguished. The cephalic gland stains deeply with hæmatoxylin but only slightly (except the small nuclei) with borax carmine and acid alcohol. I have not been able to make out any definite ducts leading to the exterior, but the appearance of my sections leads me to believe that the secretion is passed out through extemporised channels over the back and sides of the head.

Gulliver describes* and figures a "cephalic glandular

* Philosophical Transactions of the Royal Society of London, Vol. 168, 1879, p. 557, *et seq*, Plate LV.

mass" in *Tetrastemma rodericanum,* which apparently closely resembles that of *Geonemertes australiensis*, while a similar gland appears, according to Bürger, to be frequently met with in marine Nemertines.

(2) *Dorsal Glands* (Fig. 6, *d. gl.*)—These consist of very numerous small cells arranged typically in pear-shaped clusters beneath the layer of longitudinal muscles on the dorsal surface, the narrow end of each cluster or bunch of cells pointing outwards. These cells are most abundantly developed in the anterior portion of the body, just behind the head, and are met with only occasionally and in small groups towards the posterior end. The individual cells are characterised by staining very deeply with borax carmine. Each has the form of a somewhat egg-shaped sac with the narrow end pointing outwards. In my preparations the granular cell-contents appear frequently to have shrunk down into the bottom or broad end of the sac, where also the nucleus is situated. In hæmatoxylin preparations the sacs often appear almost empty save for a darkly staining mass lying in the bottom and looking like a local thickening of the sac wall.

(3) *Calcareous Bodies.*—These are clearly visible under the microscope in crushed preparations of the living worm but, curiously enough, I have altogether failed to identify them in my stained sections. They lie beneath the integument and between the lobes of the alimentary canal. They are oval, often irregular, colourless bodies, about 0·028 mm. in diameter and somewhat resembling starch grains in appearance. They do not, however, stain blue with iodine. Under the action of caustic potash they do not swell perceptibly but become very distinct and exhibit a differentiation into an outer wall and a more or less granular contents. Osmic acid does not stain them and alcohol does not dissolve them, at any rate in a short time. They appeared to be unaffected by weak hydrochloric acid so long as I had them under continued observation, but a preparation after prolonged treatment with pretty strong hydrochloric acid (perhaps 15 minutes) no longer shewed them.

From these results I conclude that the bodies in question probably consist of an organic basis more or less impregnated with carbonate of lime.

Von Graff describes somewhat similar bodies in *Geonemertes chalicophora.* They appear to be of about the same size but are flat, and occur in the skin, where they seem to take the place of the rod-like bodies of other forms. Von Graff states that they are mainly composed of carbonate of lime.

I have found no rod-like bodies in *Geonemertes australiensis.*

k. Reproductive Organs.

Bürger* commits himself to the generalisation that terrestrial Nemertines are hermaphrodite, which is somewhat remarkable inasmuch as of the four hitherto described forms two, viz. *Tetrastemma agricola* and *T. rodericanum*, are distinctly stated to have the sexes distinct. In *Geonemertes australiensis* also we find distinct males and females.

Females would appear to be much commoner than males, for I have only found one of the latter amongst the considerable number which I have examined microscopically. The single male observed, although sexually mature, was considerably below the average size; but females of equally small size also occur, so that it is impossible to found any generalisation as to difference in size of the sexes upon this fact. I have detected no other difference between the two sexes except in the reproductive organs themselves.

In the female (Fig. 24) we find ova in various stages of development irregularly and thickly scattered along the sides of the body, above the lateral nerve cords and beneath the muscular layers of the body wall. Their arrangement appears to bear no definite relation to that of the diverticula of the alimentary canal, which is also irregular.

The ova, from a very early stage in their development, are enclosed separately in special capsules (Fig. 24, *c. ov.*), which open to the exterior along the sides of the body by means of narrow ducts (Fig. 24, *sp. d.*) which pierce the different layers of the body wall. The wall of the duct is merely a continuation of the capsule, and around its point of union with the latter there is a large, placenta-like thickening, as shown in the figure. This thickened portion of the capsule is composed of a mass of small, granular, nucleated cells, whose boundaries are extremely difficult to recognise. Probably the cells of the capsule, and especially those of the thickened portion, aid in the nutrition of the growing ovum,

* *Op. cit.*, p. 260.

which attains a very large size before reaching maturity. The most remarkable fact about the capsule is that in life, as seen on examining crushed preparations, it has a very distinct green colour, strongly suggestive of the presence of chlorophyll. The ovum itself is colourless, but is seen to be surrounded by a capsule composed of numerous small, yellowish-green, granular masses. This I carefully observed in two living specimens from different localities. Whether or not chlorophyll is really present I am unable at present to say, but judging from the analogy of *Convoluta* it seems not altogether impossible. A very tempting field for speculation is thus opened, but until we know whether the green colouring matter is really chlorophyll or some other substance it is perhaps best to keep silence.

The ova, as already stated, grow to a very large size, measuring up to about 0·6 mm. in diameter. It seems to me almost impossible that they should be discharged through the narrow, preformed genital ducts. I believe that they escape by rupture of the body wall and that the ducts merely serve to convey spermatozoa to them. That these ducts do so convey the spermatozoa I conclude from the fact that I have found spermatozoa in them. Probably the process of fertilization is effected by the male crawling over the female and passing out the sperm as he crawls.

The reproductive organs of the male (Fig. 25) are found in the same position as those of the female, namely along the sides of the body above the lateral nerve cords. They also bear, at any rate when mature, a striking resemblance to those of the female in structure. In the earlier stages of their development, however, I have only been able to find irregular masses of sperm-mother-cells in various stages of division (Fig. 25, *sp. m. c.*), without, so far as I could see, any distinct capsule or genital duct. Later on, however, we find densely packed, rounded masses of spermatozoa (Fig. 25, *te.*) each enclosed in a very delicate capsule, which opens to the exterior through a slender duct (Fig 25, *v. d.*) exactly as in the female. After the spermatozoa have been discharged the capsule is still recognisable as a shrunken bag (Fig. 25, *te. ca.*) in whose thin wall nuclei are distinctly visible, and this bag appears simply as a large dilatation on the inner end of the genital duct. The testes are, like the ovaries, extremely numerous, and occur thickly scattered along the sides of the body. As to the origin of the ova and spermatozoa I have no definite observations to record, and can only suggest that they are developed from the granular mesodermal cells (Fig. 24, *gr. c.*) which are very abundant in the neighbourhood of the reproductive organs.

5. Summary.

On comparing the foregoing account of the minute anatomy of *Geonemertes australiensis* with Bürger's already often quoted researches on the marine Nemertea, and especially the marine *Enopla*, it will be seen that the marine and terrestrial forms agree very closely in structure. The most striking and important difference concerns the excretory system, which, in *Geonemertes*, consists of a system of intra-cellular tubules terminating in flame-cells. The circulatory system, moreover, appears to be merely a specialised portion of the excretory system.

Only four species of land Nemertines have hitherto been described, viz.:—*Geonemertes palaensis*, Semper; *G. chalicophora*, von Graff; *Tetrastemma agricola*, von Willemoes-Suhm, and *T. rodericanum*, Gulliver. From all these *Geonemertes australiensis* differs widely, the most striking difference being, perhaps, the large and indefinite number of eyes.

The principal characteristic features of *Geonemertes australiensis* are as follows:—

Animal about 40 mm. long and 2·5 mm. broad when crawling. Colour chiefly yellow, sometimes with a darker median dorsal band of brown. Eyes numerous, about forty, arranged in two main groups one on each side of the head. Lateral organs well developed, opening on the ventral surface of the head in front of the brain by small round apertures sometimes (? always) placed in a transverse groove. No rod-like bodies in the skin, but irregularly oval, calcareous bodies in the deeper tissues. Mouth opening into the rhynchodæum. Sexes distinct. Cephalic gland well developed, but with no conspicuous external opening. Excretory system consisting of branching intra-cellular tubules, provided with flame-cells and connected with the circulatory system. The remainder of the anatomy closely resembles that of the marine *Enopla*. Found under logs and stones in Australia.

6. Description of Plates.

Geonemertes australiensis.

Plate VII.

Fig. 1.—Living specimen with the proboscis everted. Dorsal surface. Painted from life. × $2\frac{1}{2}$.

Figs. 2–5.—Selected from a series of vertical longitudinal sections through the anterior end (stained with borax carmine.) All from one and the same side of the middle line, Fig. 2 being nearest to the outside and Fig. 5 nearest to middle line, to show the brain, lateral organs, eyes, &c. In Fig. 4, which passes through about the middle of one-half of the brain, that portion of the cephalic pit which is not actually visible in the section is represented by a red dotted line. The muscular diaphragm is shown in all the figures and sufficient of the longitudinal muscle sheath to show its connection with the latter. All drawn under Zeiss A, oc. 2, camera outline.

al. c. Alimentary canal.
c. p. Cephalic pit.
d. g. Dorsal lobe of cerebral ganglion.
e. Eye.
ep. Epidermis.
gr. Groove in which openings of cephalic pits lie.
l. g. Ganglion of lateral organ.
l. m. Layer of longitudinal muscles.
l.′ m.′ Forward continuation of longitudinal muscle layer in front of the muscular diaphragm. (Portion only shown).
m. d. Muscular diaphragm.
m. v. Median vessel.
n. Nerves coming off from cerebral ganglion.
n. c. Lateral nerve cord.
p. s. Proboscis sheath.
sac. Sac of lateral organ.
v. g. Ventral lobe of cerebral ganglion.
x. Œsophageal organ.

Plate VIII.

Fig. 6.—Median longitudinal vertical section through the anterior end, from the same series and drawn to the same scale as Figures 2–5.

b. m. Basement membrane.
c. gl. Cephalic gland.
c. m. Layer of circular muscles.
c. o. Common opening of mouth and proboscis sheath (=opening of rhynchodæum).
d. c. Dorsal commissure of brain.
d. gl. Dorsal glandular organs.
d. gut. Forward diverticulum of the gut, passing beneath the œsophagus.
ep. p.s. Epithelium lining proboscis sheath.
gut. Gut proper.
m. Mouth.
m. p. Ruptured muscular attachment of the proboscis to the anterior end of the proboscis sheath.
œs. 1. First, narrow portion of œsophagus.
œs. 2. Median, dilated portion of œsophagus.
œs. 3. Last, narrow portion of œsophagus.
v. c. Ventral commissure of brain.

(Other lettering as before).

Fig. 7.—Transverse section of a specimen stained with hæmatoxylin, taken just behind the cerebral commissures, to show especially the cephalic gland. Drawn under Zeiss A, oc. 3, camera outline. The proboscis being everted the non-eversible portion is seen in section inside the proboscis sheath.

ex. t. Excretory tubules.
p. Proboscis.

(Other lettering as before).

Fig. 8.—Transverse section near the middle of the body. From the same series as Fig. 7. The inequality in thickness of the proboscis sheath is due to irregular contraction. The ovaries happen to be very small in this section. Drawn under Zeiss A, oc. 2, camera outline.

l. v. Lateral vessel.
ov. Ovary.

(Other lettering as before).

FIG. 9.—Small portion of a longitudinal vertical section through the skin and muscle-layers in the ventral region of the body (borax carmine). Drawn under Zeiss F, oc. 2.

gl. c. Sub-epidermic gland-cells.

nu. Nuclei scattered about between the inner ends of the epidermic cells.

o. m. Layer of oblique or diagonal muscle fibres.

(Other lettering as before).

FIG. 10.—Small portion of a tangential longitudinal section passing on the left through the layer of longitudinal muscles, in the middle through the layer of oblique (diagonal) muscles, and on the right through the layer of circular muscles. Drawn under Zeiss D, oc. 2.

(Lettering as before).

FIG. 11.—Longitudinal section of an eye and optic ganglion. From a specimen stained with borax carmine. Drawn under Zeiss F, oc. 2.

op. g. Optic ganglion.

FIG. 11A.—Transverse section of an eye, from a specimen stained with borax carmine. Drawn under Zeiss F, oc. 2.

Plate IX.

FIG. 12.—Ventral view of a specimen from Walhalla preserved in spirit, with the proboscis everted and torn away from its anterior attachment. × 3.

a. Anus.

a.′ a.′ Line along which the proboscis has been torn away from its anterior attachment.

e. g. Group of eyes.

(Other lettering as before).

FIG. 13.—Specimen with the proboscis retracted, dissected from the dorsal surface by slitting open the proboscis sheath longitudinally and pulling the contained proboscis to one side. × $3\frac{1}{2}$.

a. a. Anterior attachment of proboscis to proboscis sheath (compare Fig. 6, *m. p.*)

p. a. Posterior attachment of proboscis (by its retractor muscle), to the proboscis sheath.

r. m. Retractor muscle of proboscis.

FIG. 14.—A semi-everted proboscis detached from the proboscis sheath and with the everted portion slit open to show the non-everted portion lying within.

e. r. Eversible region of the proboscis.
st. r. Stylet-region.
n. e. r. Non-eversible region.

(Other lettering as before).

FIG. 15.—Longitudinal section through the stylet-region of the proboscis. Drawn under Zeiss A, oc. 3.

c. st. Central stylet.
gl. p. Glandular papillæ of the eversible region.
gl. z. Zone of glandular cells.
h. "Handle" in which the central stylet is fixed.
p. d. Poison duct, leading up to the base of the central stylet.
p. r. Poison reservoir in the posterior half of the stylet-region.

(Other lettering as before).

FIG. 16.—Transverse section through a partially everted proboscis. The section passes through the "handle" of the stylet, which is seen in the middle, and the outer portion of the section shows the eversible portion of the proboscis turned inside out and surrounding the stylet-region. Drawn under Zeiss A, oc. 3, camera outline.

e. c. m. External circular muscles of the everted portion of the proboscis.
e. l. m. External longitudinal muscles of the same.
i. c. m. Internal circular muscles of same.
i. l. m. Internal longitudinal muscles of same.
p. n. s. Proboscidean nerve sheath.
s. r. s. Sac containing reserve stylets.

(Other lettering as before).

FIG. 17.—A sac containing reserve stylets, from an unstained preparation. Drawn under Zeiss D, oc. 2, camera outline.

a. st. Abnormal stylet.
st. m. c. Stylet mother cell with commencing stylet.

FIG. 17*a*.—A single stylet, drawn under the same conditions.

FIG. 17*b*.—Head of a stylet, seen end on, drawn under the same conditions.

FIG. 17*c*.—Probable mother cell of a stylet, from one of the reserve sacs, drawn under the same conditions.

FIG. 18.—Small portion of a section from the same series as Figs. 2–6, taken a little to one side of the middle line, between the sections represented in Figs. 5 and 6; to shew the curious cellular plug in connection with the median vessel and projecting into the cavity of the proboscis sheath. Drawn under Zeiss D, oc. 2, camera outline.

c. pl. Cellular plug.

(Other lettering as before).

Plate X.

FIG. 19.—Portion of the system of excretory tubules, from above the proboscis sheath in a transverse section stained with hæmatoxylin. Drawn under Zeiss F, oc. 2.

FIG. 20.—Posterior portion of median vessel, as seen in longitudinal section stained with hæmatoxylin. Zeiss F, oc. 2.

cr. Concretion (?) within the vessel.

FIG. 21.—Portion of median vessel seen in a transverse section stained with hæmatoxylin, shewing one of the lacunar dilatations. Zeiss F, oc. 2.

c.m.v. Circular muscle fibres around the vessel.

l.m.v. Lacunar dilatation of the vessel.

nu. v. Nuclei of the inner wall of the vessel.

ves. c. Vesicular cells outside the vessel.

FIG. 22.—Transverse section of the median vessel. Zeiss F, oc. 2.

(Lettering as before).

FIG. 23.—A lacuna on the lateral vessel with an excretory tubule opening into it. From a transverse section stained with hæmatoxylin. Zeiss F, oc. 2.

l. l. v. Lacuna on the lateral vessel.

(Other lettering as before).

FIG. 24.—Portion of a transverse section of a female specimen, stained with borax carmine, to shew the reproductive organs. Zeiss D, oc. 2, camera outline.

c. ov. Capsule of ovum.

f. g. o. Female genital opening.

gr. c. Granular nucleated cells lying in the gelatinous ground substance.

n. ov. Nucleus of ovum.

s ep. Sub-epidermic glandular layer.

sp. d. Duct through which the spermatozoa reach the ovum.

(Other lettering as before).

FIG. 25.—Portion of a transverse section of a male specimen, stained with borax carmine, to show the reproductive organs. Zeiss D, oc. 2, camera.

m. g. o. Male genital opening.

sp. m. c. Mass of developing sperm-mother-cells.

te. Testis full of spermatozoa.

te. ca. Shrunken capsule of a testis from which the spermatozoa have apparently escaped.

v. d. Vas deferens.

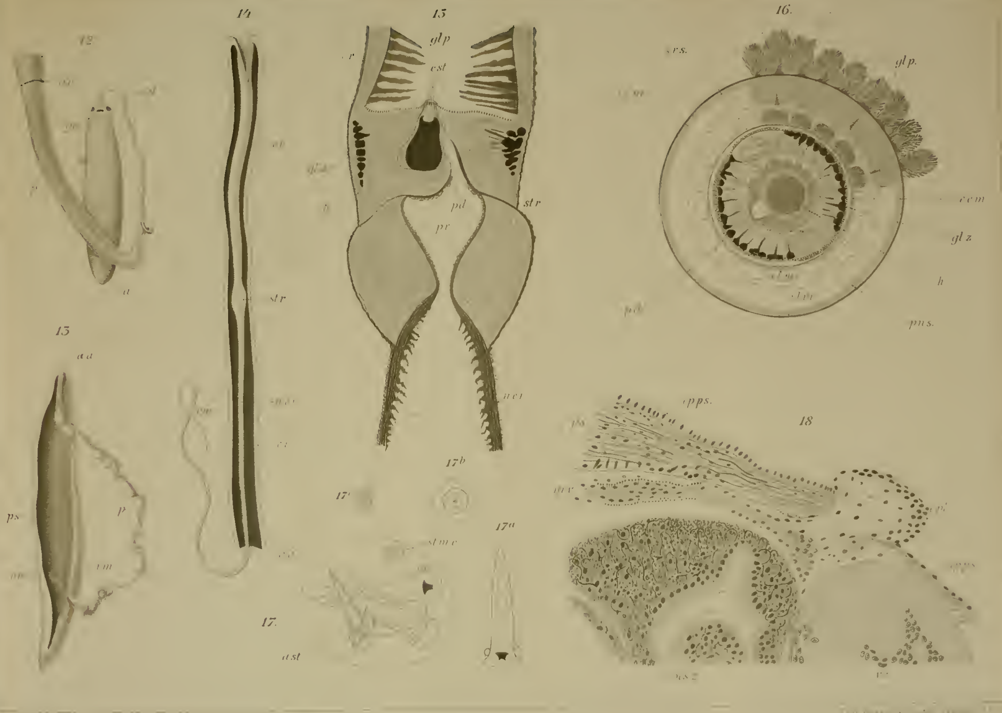
(Other lettering as before).

FIG. 26.—Flame cell. Drawn from crushed preparation of living specimen under Zeiss F, oc. 2.

fl. The flame-like, vibratile bunch of cilia, with alternate light and dark bands caused by its undulatory movement.

GEONEMERTES AUSTRALIENSIS

GEONEMERTES AUSTRALIENSIS.



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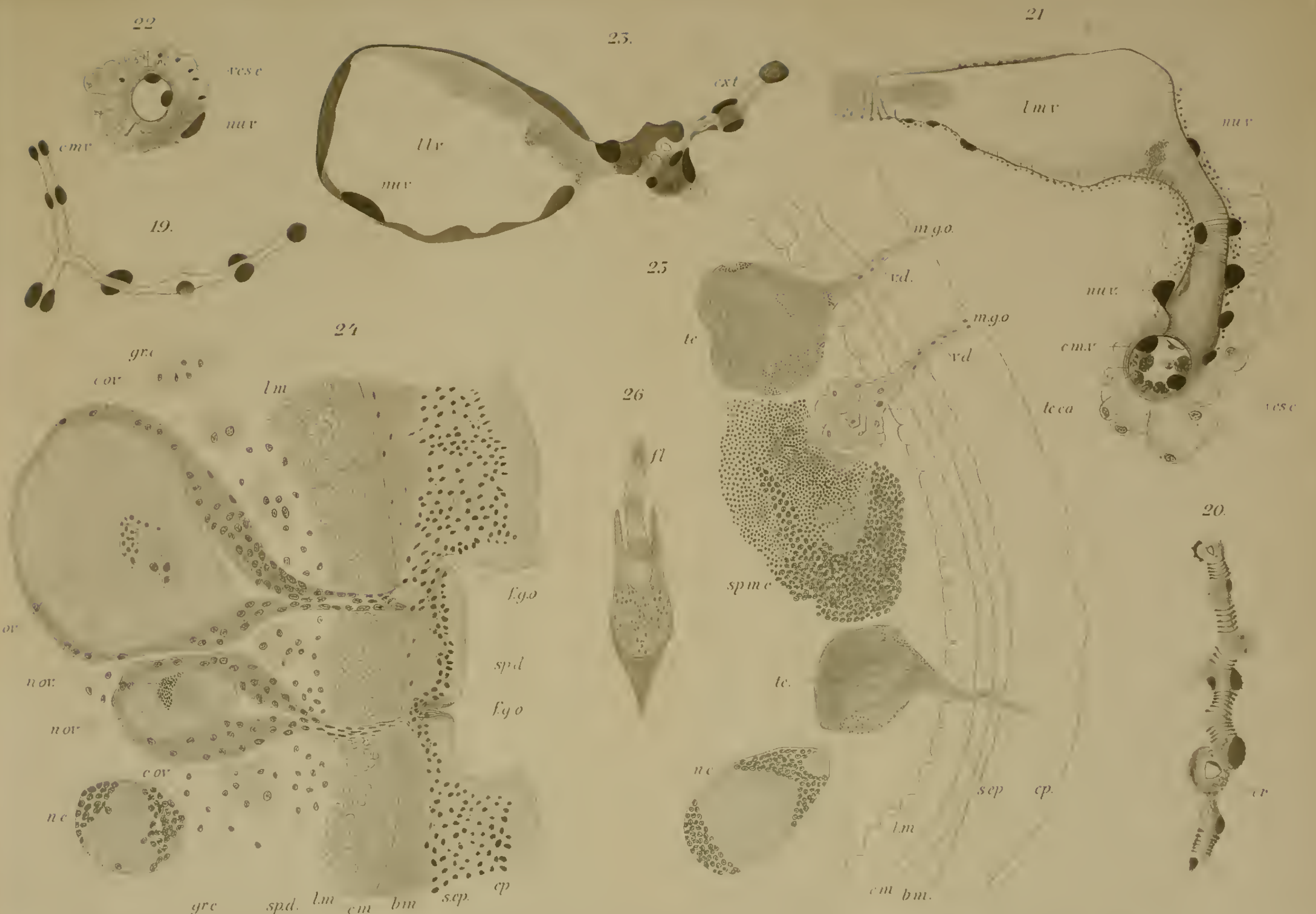


Geonemertes australiensis

Art. XVI.—*Descriptions of some Land Planarians from Queensland.*

(Plate XI.)

By Arthur Dendy, D.Sc.

[Read November 12, 1891.]

The specimens described in the present communication were collected by Professor W. Baldwin Spencer, M.A., on his recent expedition to Southern Queensland in September and October 1891, and kindly placed in my hands in a living condition for purposes of description. There were six species represented in the collection, and these belonged to no less than three genera, viz., *Geoplana* (four species); *Rhynchodemus* (one species); and *Bipalium* (one species, probably introduced). Only two of the species are new to science, but one of these, *Geoplana regina*, is a remarkably handsome worm. The other species are already known from the adjoining colony of New South Wales. As might be expected, the species altogether show a much closer relationship to those of New South Wales than to those of Victoria. Professor Spencer informs me, however, that the Planarian fauna was not nearly so rich in the localities visited by him as it is in many parts of Victoria.

1. *Geoplana cœrulea*, Moseley.*

This well-known species, the first ever described from Australia, was met with in abundance, some of the specimens measuring as much as 110 mm. in length by 2·5 mm. in greatest breadth when crawling. The shape of the body varied considerably in the living animal, the dorsal surface being sometimes flattened, sometimes simply convex, and sometimes strongly ridged, as in the closely allied Victorian

* "Notes on the Structure of several Forms of Land Planarians, &c." *Quarterly Journal of Microscopical Science*, Vol. XVII, N.S., p. 285.

species *G. dendyi*, Spencer. The peripharyngeal aperture (in spirit) is in about the middle of the ventral surface, sometimes a little anterior, and the genital aperture is situate at about one-third of the distance from it to the posterior extremity. The eyes are arranged in a densely crowded irregular patch on each side of the head and continued in single series all round the horse-shoe-shaped anterior margin. The ground colour of the dorsal surface (in life) ranged from pale indigo-blue to dark grey, blue-brown or almost black. The mid-dorsal yellow stripe was sometimes so pale as to be almost white, and frequently there was visible on each side an ill-defined dorso-lateral band of a lighter tint of the ground colour, dividing each half of the dark dorsal surface into a broader (more dorsal) and a narrower (more ventral) band. The anterior extremity was pinkish, although sometimes the pink colour was scarcely recognisable. The ventral surface was bright blue, lighter in the middle line than elsewhere.

Localities.— Gympie (Mary River); Burnett River; Cooran.

2. *Geoplana variegata*, Fletcher and Hamilton.*

(Plate XI, Fig. 2.)

This very handsome species was obtained by Professor Spencer in large numbers and would seem to be the commonest species in the district visited by him. The body is long and narrow, even when lying still and coiled into a knot; tapering a good deal more gradually in front than behind. The shape of the dorsal surface varies from more or less flattened to strongly ridged, according to the position of the animal; it may be said to be characteristically ridged, as shown in the figure. The worm reaches a very large size. The largest specimen, after preservation in spirit, measured 115 mm. in length by 6 mm. in greatest breadth; I could not get it to crawl about actively so as to measure it when crawling. A smaller specimen, however, in which also a portion of the posterior extremity was broken off, measured about 163 mm. in length by 5 mm. in breadth when crawling. The peripharyngeal aperture (in spirit) is in about the middle of the ventral surface and the genital aperture about

* "Notes on Australian Land Planarians, with Descriptions of some New Species, Part I." Proceedings of the Linnean Society of New South Wales, Vol. II (Series 2), 1887, p. 364.

half-way between the peripharyngeal and the posterior extremity. The eyes are not very numerous, in two patches one on each side of the anterior end of the body and continued in close-set single series all round the anterior margin. The predominant tint of the dorsal surface varies from green or violet to rich reddish-brown or brownish-red. Running down the mid-dorsal line is a very narrow stripe of bright yellow. On each side of this is a slightly broader stripe of dark brown, whose outer edge is ill-defined. Then a still slightly broader stripe of bright yellow with a few very minute flecks of brown. Then a very broad, dark band of the predominant tint, most commonly dark greenish-brown or grey, almost black, gradually fading outwards into a narrow band of pale greyish or greenish-blue. Then a narrow stripe of a very dark brownish colour only slightly wider than the narrow blue band, and, lastly, another narrow blue band but wider than the first and extending to the margin of the ventral surface. The anterior extremity is pinkish. In the mid-ventral line there is a rather narrow, almost white band gradually merging on each side into a pale purplish-grey band which, in turn, gradually merges into the pale greenish-blue band at the margin of the dorsal surface.

All things considered, I have little hesitation in identifying this species with Messrs. Fletcher and Hamilton's *G. variegata*, especially as the latter appears to vary somewhat in tint. As this very handsome species has not before been figured of the natural colours, I have thought it desirable to do so now.

Localities.—Gympie (Mary River); Burnett River; Cooran.

3. *Geoplana minor*, n. sp.

Body at rest much flattened; when crawling very long and narrow, nearly cylindrical, tapering very gradually in front and more suddenly behind, and measuring only about 18 mm. in length by 1 mm. in greatest breadth. The peripharyngeal aperture (in spirit) is situate in about the middle of the ventral surface and the genital aperture about half way between it and the posterior end. The eyes are not very numerous, arranged in a single row at the sides of the head-end and all round the anterior margin, and also very sparingly down the sides of the body to the posterior extremity. The colour of the living animal is milk-white all over, sometimes with a yellowish tinge.

This very small Planarian was met with in abundance both at Cooran and on the Burnett River. I at first thought it might be the young of *Geoplana alba* but microscopical examination showed it to be sexually mature and, moreover, no large specimens were met with. It may possibly be a dwarf variety of *G. alba*, but careful anatomical investigation will be required to decide this point. Meanwhile it appears advisable to give it a distinct name.

Localities.—Burnett River ; Cooran.

4. *Geoplana regina*, n. sp.

(Plate XI, Figs. 1, 1*a*, 1*b*.)

The body is remarkably broad and, when at rest, very much flattened on both surfaces. When the animal is crawling, however, the dorsal surface is strongly arched and the body tapers very gradually in front and behind. When crawling the animal measures about 66 mm. in length and 5·5 mm. in greatest breadth. In spirit the body is flat or even concave on the ventral surface, but pretty strongly arched on the dorsal, and the posterior half of the body is, on an average, a good deal broader than the anterior half. The pharyngeal aperture is decidedly behind the middle of the ventral surface but in front of the junction of the middle and posterior thirds. The genital aperture is about half way between the peripharyngeal aperture and the posterior extremity. The eyes are arranged as usual in the genus.

The ground colour of the dorsal surface is rich gamboge-yellow, almost orange, interrupted by eleven longitudinal stripes of varying shades of brown, as follows (Fig. 1*a*) :—In the mid-dorsal line there is a very broad stripe of very dark, rich brown ; on either side of this median stripe is a band of ground colour of only about half the width ; then comes a still narrower and somewhat faint stripe of light brown ; then another band of ground colour similar to the last ; then another brown stripe a good deal darker than the last ; then another band of ground colour as before ; then another still darker stripe of brown ; then another band of ground colour as before ; then another brown stripe, this time light-coloured ; then another band of ground colour as before and then, on the extreme lateral margin, a moderately dark brown stripe. Hence we have, on each side of the broad median stripe, five bands of ground colour alternating with five narrow brown stripes of varying intensity, the middle one of the five being the darkest and broadest. The inner margins of the narrow brown stripes are less well defined than the outer and tend to shade off into the ground colour. The horse-shoe-shaped anterior extremity is dark brown. The ventral surface has also a characteristic pattern (Fig. 1*b*). The ground colour is white. In the middle line there is a moderately broad band of ground colour with no markings, slightly broader around the external apertures (which lie in it) than elsewhere. On either side of this median band, and extending almost to the margin of the ventral surface, is a very broad band of ground colour spotted all over with small flecks of light brown. The brown flecks are pretty evenly distributed except at the outer margin of the spotted band, where they are closer and run together into an irregular, very narrow stripe. Outside this stripe a narrow band of white, with no flecks, extends to the outer margin of the outermost of the narrow brown dorsal stripes.

Only two specimens of this very handsome species were obtained.

Locality.—Gympie (Mary River).

5. *Rhynchodemus obscurus*, Fletcher and Hamilton.*

I have some little hesitation in making this identification. The characters of the species are not at all striking and there were only a few specimens in the collection. When the animal is crawling the body is very long and narrow, strongly convex on the dorsal surface and flattened on the ventral. It scarcely tapers at all to the anterior extremity but tapers gradually posteriorly. One specimen measured 60 mm. in length by 1·7 mm. in greatest breadth when crawling. In spirit the peripharyngeal aperture is situated in about the middle of the ventral surface and the genital aperture about half way between it and the posterior end. The eyes are arranged as usual in the genus, viz., a single pair placed a short way behind the anterior extremity. The

* "Notes on Australian Land Planarians, &c." Proc. Linn. Soc., N.S.W., Vol. II (Series 2), p. 372.

dorsal surface in life was of a uniformly black colour, the anterior extremity rather lighter and the ventral surface brownish-grey.

Localities.—Gympie (Mary River); Cooran.

6. *Bipalium kewense,* Moseley.*

Two specimens of this remarkable Planarian were obtained. When alive the body was very long and narrow, especially when crawling. The head was, as usual, crescentic or "cheese-cutter-shaped." After preservation in spirit the peripharyngeal aperture was situate in about the middle of the ventral surface; the genital aperture I could not distinguish. The ground colour on the dorsal surface of the living animal was olive-brown, interrupted by five dark stripes arranged as follows:—In the middle line a narrow black stripe; on each side of this two dark olive-grey stripes, the outer one being narrower and less well-defined than the inner. The outer and inner paired stripes of each side unite together anteriorly just behind the head. All the stripes stop at the neck and the cheese-cutter-shaped head has a dark purplish-grey colour in front of a lighter transverse band which marks the junction of head and body. The ventral surface was pale grey in the middle line with a darker grey stripe on each side and then, outside this, a pale olive-brown band extending to the outer dark dorsal stripe.

The specimens agreed closely with the figures given by Bell† except for the presence of the outer dark stripes on the dorsal surface, which are not shown in Bell's figures but are described by Moseley in his original paper. I take the present opportunity of stating that I do not at all agree with Professor Bell's remarks as to the uselessness of the head as a generic character. The head, of course, like all other parts of the body of a Planarian, is capable of great changes of shape in the living animal. No one would deny this for a moment, but, at the same time, the head is always there and always has a certain *normal* shape to which it constantly returns and which is eminently characteristic. Nothing could be more striking than the difference between *Geoplana*

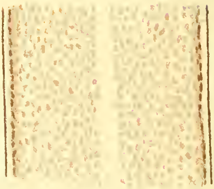
* "Description of a New Species of Land-Planarian from the Hothouses at Kew Gardens." Annals and Magazine of Natural History, S. 5, Vol. I, p. 237.

† "Note on *Bipalium kewense*, and the generic characters of Land-Planarians." Proceedings of the Zoological Society of London, 1886, p. 166, Plate XVIII.

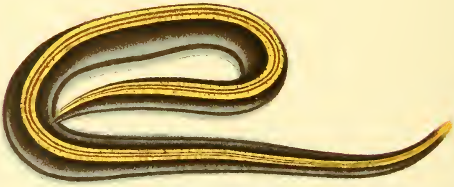
1.

1a

1b



2



AUSTRALIAN LAND PLANARIANS.

or *Rhynchodemus* and *Bipalium* with regard to the form of the anterior extremity, and, having carefully examined specimens of these three genera both alive and in spirits, I have no hesitation in saying that the remarkable development of the head in *Bipalium* is a most marked and important character and of great value for purposes of classification.

Professor Spencer thinks that *Bipalium kewense* was probably introduced by the agency of man to the locality where he found it, as has now been the case in so many places. Possibly the original home of this remarkable worm will ever remain a mystery. Within recent years it has made its appearance in large numbers in the neighbourhood of Sydney, as described in a very interesting paper* by Mr. Fletcher, who has also recorded the species from Victoria and Samoa. I am not aware that it has hitherto been recorded from Queensland.

Locality.—Gympie (Mary River).

DESCRIPTION OF PLATE XI.

FIG. 1.—*Geoplana regina*, n. sp. The animal lying at rest with the head in the centre of the coil × 2.

FIG. 1*a*.—*Geoplana regina*, n. sp. Portion of the dorsal surface, showing the colour and arrangement of the markings × 4.

FIG. 1*b*.—*Geoplana regina*, n. sp. Portion of the ventral surface, showing the colour and arrangement of the markings × 4.

FIG. 2.—*Geoplana variegata*, Fletcher and Hamilton. Specimen from South Queensland × 3.

(All the figures are drawn from living animals.)

* "Remarks on an introduced Species of Land Planarian, apparently *Bipalium kewense*, Moseley." Proceedings of the Linnean Society of New South Wales, Vol. II (Series 2), p. 244.

Art. XVII.—*Preliminary Description of Victorian Earthworms. Part I.—The Genera Cryptodrilus and Megascolides.*

By W. Baldwin Spencer, M.A.

Professor of Biology in the University of Melbourne.

(With Plates XIV, XV, XVI, XVII, XVIII, XIX.)

[Read December 10, 1891.]

For the past four years I have been gradually collecting earth-worms as opportunities offered and the present paper merely contains brief descriptions of forms of the genera Cryptodrilus and Megascolides which have been met with in Victoria.

Mr. J. J. Fletcher, to whom we owe almost entirely our knowledge of Australian earth-worms described up to the present time, has already published brief accounts of, principally, New South Wales forms. I am much indebted to him both for specimens of those which he has described and for valuable advice and information, and it may perhaps be as well to state here that we are at present engaged together upon a somewhat extensive monograph dealing with Australian earth-worms. The completion of this joint work will of necessity occupy considerable time, though we hope to publish very shortly the first part, which will deal with the systematic arrangement of the forms.

Our collection is very extensive, and necessitates a revision of the genera, but meanwhile we have thought it advisable to adhere to existing genera and to give names which will serve at present for identification.

In the preliminary notices of Victorian forms, I have purposely refrained from dealing with any but macroscopic characters, and have not even entered into details with regard to these, other than such as will serve for identification.

A full description, especially as regards the nephridia, genital organs and setæ, which will serve as the basis of a revised classification, is not attempted to be given in this preliminary account. This notice, therefore, contains merely brief descriptions of eleven new species of Cryptodrilus, and of ten new species of Megascolides. In addition to these, two more species have been previously described, viz., *M. australis* (McCoy), and *M. tuberculatus* (Fletcher).

It will be seen that the latter genus is much more strongly represented proportionately in Victoria than in New South Wales. It is one of those series of forms which are more or less characteristic of the south eastern corner of Australia, spreading thence to a slight extent up the eastern coastal district, but dying out to the north. Doubtless it will be found to be strongly developed in Tasmania, since in their faunas, Victoria, south of the Main Dividing Range, and Tasmania are closely allied.

The annual camping out expeditions of the Victorian Field Naturalists' Club have enabled me to collect in very inaccessible parts of the colony, especially in Croajingolong and the mountain ranges around the source of the Yarra, and I am much indebted for valuable assistance, both on these and other occasions, to Messrs. C. French, C. Frost, A. H. S. Lucas, T. Steel, J. Hulme, D. le Souef, W. Mann, J. Shephard, Hugh Copeland, C. Brittlebank, H. R. Hogg, the Rev. W. Fielder, and Dr. Dendy.

As stated above, the present classification can only be regarded as a temporary one with regard to the two genera now dealt with, but the collection which Mr. Fletcher and myself now possess will, we trust, enable us to satisfactorily deal with this question in a short time.

In the descriptions, I have used the terms employed by Dr. Benham in his valuable paper, "An Attempt to Classify Earth-worms"* and may here express the indebtedness of workers in this group of forms to the recent researches of Dr. Benham and Mr. Beddard.†

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* Q.J.M.S., Vol. XXXI, Part 2, p. 201.

† Published principally during the past few years in the *Quarterly Journal of Microscopical Science.*

(*a*) Cryptodrilus (Fletcher).

(1) *C. gippslandicus*, sp. n. (Figs. 1, 2, 3, 63). Spirit specimens 5 inches long, one-third inch broad.

Prostomium completely dovetailed into the peristomium.

Peristomium, with grooves, giving it a ribbed appearance.

Clitellum fairly well developed; red-brown colour dorsally and laterally (in spirit), extending over segments 14–16, together with the posterior part of 13, and the anterior of 17.

Setæ, regularly arranged in couples along the anterior half of the body. Then the two outer rows become irregular, and along the posterior third of the body all the rows are very irregular, giving to this part of the body, at first glance, much the appearance of a perichæte.

Male pores on papillæ on segment 18, at the level of the interval of the two inner setæ of each side.

Oviduct pores on segment 14 ventral of, and slightly anterior to, the innermost setæ on each side.

Spermathecal pores five in number; intersegmental; at the level of the first seta. The first between segments 4 and 5.

Dorsal pores present. The first between segments 3 and 4.

Nephridiopores difficult to distinguish; at the level of and in front of the third seta of each side, commencing on the third segment.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 8–13.

Calciferous glands in segments 14 and 15. Large intestine commencing in segment 17.

Blood vascular system. Dorsal blood-vessel *double* from the sixth segment to within about twenty of the posterior end. That is, there is a very distinct double loop in each segment, the two halves uniting where they pass through the septa. Hearts in segments 6–12, the two first small. A supra-intestinal vessel in the segments containing the hearts.

Excretory system. Meganephric, with a coiled portion ventrally on each side, from which a duct runs upwards to the third seta.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments.

Prostates, coiled, tubular, and in segments 18 and 19.

Sperm sacs finger-shaped, attached to the posterior walls of segments 9 and 10.

Ovaries attached to anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each consists of a long sac, with a simple diverticulum about one-quarter the length of the sac.

Habitat. Croajingolong (East Gippsland). Collected during an expedition of the Field Naturalists' Club of Victoria.

(2) *C. intermedius*, sp. n. (Figs. 4, 5, 6, 64). Spirit specimens 7 inches long, one-quarter inch broad.

Prostomium very slightly dovetailed into the peristomium.

Peristomium, with grooves, giving it a ribbed appearance.

Clitellum well developed, extending over segments 14–17 and may include dorsally when fully developed the anterior part of 18.

The ventral parts of segments 17, 18 and 19, marked by transverse swollen bands.

Setæ in couples, regularly arranged, except at the very posterior end of the body, where the two outer rows are irregular. The outer couple placed laterally and slightly further apart from one another than the inner.

Male pore, on segment 18, at the level of the first seta of each side, on a slight papilla.

Oviduct pores on segment 14 slight ventral of, and anterior to, the first setæ.

Spermathecal pores two in number; intersegmental; at the level of the first setæ, between segments 7 and 8, 8 and 9.

Dorsal pores present. The first between segments 5 and 6.

Nephridiopores at the level of, and anterior to, the third seta on each side.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 10–17. Those in segments 15–17 large. No true calciferous glands. Large intestine commencing in segment 19.

Blood vascular system. Single dorsal vessel. Hearts in segments 6–13. Lateral vessel in segments 5–8, sending branches on to the walls of the pharynx. A supra-intestinal vessel in the segments containing the hearts.

Excretory system. Meganephric. One pair of nephridia in each segment.

Reproductive system. Testes, one pair in segment 11. One pair of ciliated rosettes in the same segment. Prostates, coiled, tubular, and in segment 18. Sperm sacs, large, grape-like, attached to the anterior wall in segment 12, with smaller ones on the anterior wall in segment 14.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 8 and 9. Each consists of a long sac with a small rosette-like diverticulum close to the base.

Habitat. S. Warragul, Gippsland. Collected by Mr. W. Mann.

(3) *C. tanjilensis*, sp. n. (Figs. 7, 8, 9, 65). Spirit specimens $5\frac{1}{2}$ inches long, $\frac{1}{2}$ inch broad.

Prostomium completely dovetailed into the peristomium, with a dorsal longitudinal groove continuous along the body. Ventrally, a median groove only at the very posterior end.

Clitellum strongly developed, complete, occupying segments 14–16, together with the posterior part of 13 and anterior of 17.

Setæ regularly arranged along the whole length of the body. The outer couple wider apart than the inner, and the fourth row placed dorso-laterally.

Male pores on papillæ on segment 18, at the level of the interval between the two innermost setæ of each side.

Oviduct pores on segment 14 ventral of, and slightly anterior to, the innermost setæ of each side.

Spermathecal pores five in number; intersegmental; at the level of the first setæ; the first between segments 4 and 5.

Accessory copulatory structures present at the level of the first setæ between segments 18 and 19, and 19 and 20.

Nephridiopores at the level of, and in front of the third seta of each side. Very prominent on the last few segments

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 7–15; large in segment 15. No true calciferous glands. Large intestine commencing in segment 18.

Blood vascular system. Single dorsal vessel. Hearts in segments 7–12. Supra-intestinal vessel in segments containing the hearts and extending back into segment 13.

Excretory system. Meganephric, with a coiled portion ventrally, and a long sac-like part dorsally, which is larger in and before the clitellum than in the segments posterior to this.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments, which are full in mature specimens of sperm.

Prostates, coiled, tubular, and in segment 18.

Sperm sacs attached to the anterior wall of segment 12, saccular in form.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each consists of a long sac, with a simple diverticulum, about one-quarter the length of the sac.

Habitat. Tanjil Track, near the source of the Yarra River. Collected during an expedition of the Field Naturalists' Club of Victoria to the Yarra Falls, near the source of the River Yarra.

(4) *C. frenchi*, sp. n. (Figs. 10, 11, 12, 66). Spirit specimens 3 inches long, $\frac{1}{8}$ inch broad.

Prostomium dovetailed into the peristomium to the extent of $\frac{1}{2}$ or $\frac{3}{4}$.

Clitellum occupying segments 14–16; not very distinctly marked ventrally.

Setæ in four couples, regularly arranged, except at the posterior end of the body. Prominent. The inner couple nearer together than the outer, the fourth row being dorso-lateral. For the posterior one-sixth of the body the two outer rows are irregular and on the last few segments all are except the innermost on each side.

Male pores on papillæ on segment 18, at the level of the interval between the inner couple of setæ on each side.

Oviduct pores on segment 14, close to the anterior margin and slightly ventral of the inner setæ.

Spermathecal pores, five in number, just on the very anterior boundaries of segments 5–9, at the level of the interval between the inner couple of setæ.

Accessory copulatory structures as follows:—Small oval patches anteriorly on segments 10 and 11 at the level of the spermathecal ducts. Patches on each side of the body at the level of the interval between the inner couple of setæ from segments 16–21. Each patch is composed of a small part of two contiguous segments and the pairs are united across the mid-ventral line by glandular ridges.

Dorsal pores present. The first between segments 4 and 5.

Nephridiopores at the level of the third seta in each segment, commencing on the third.

Alimentary canal. Gizzard small and in segment 6. Vascular swellings on the œsophagus in segments 9–15, but no true calciferous glands.

Blood vascular system. Dorsal blood-vessel single. Hearts in segments 7–12, the first two small. Supra-intestinal vessel in segments 8–12, and continued back into the anterior part of segment 13.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments. Sperm sacs attached to the anterior wall of segment 12 and the posterior of segment 9, the latter finger-shaped.

Prostates long, tubular, and coiled, occupying segments 18–21.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each with a long sac and short diverticulum about one-third the length of the main sac.

Habitat. Croajingolong (E. Gippsland). Collected during an expedition of the Field Naturalists' Club of Victoria.

(5) *C. dubius*, sp. n. (Figs. 13, 14, 15, 67). Spirit specimens $3\frac{1}{2}$ inches long, less than one-quarter inch broad.

Prostomium completely dovetailed into the peristomium, which is ribbed.

Clitellum distinct and complete, occupying segments 14–17.

Setæ in four couples, regularly arranged; interval between the inner and outer couples, and between the two rows of the outer couple double that between the two rows of the inner couple. The fourth row, dorsally placed.

Male pores on distinct papillæ in segment 18, slightly ventral of the level of the second row of setæ.

Oviduct pores on segment 14, slightly anterior to, and ventral of, the innermost setæ.

Spermathecal pores, two in number, on the very anterior margin of segments 8 and 9, at the level of the innermost setæ.

Accessory copulatory structures. Two small glandular patches on segment 17, at the level of the intervals between the inner rows of setæ, and a median ventral patch on the anterior margin of segment 18.

Dorsal pores present, the first between segments 5 and 6.

Nephridiopores conspicuous, commencing on the second segment, and placed on each side anteriorly to, and at the level of, setæ 1, 3 and 4.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 12, 13 and 14. True calciferous glands well developed in segments 15 and 16. Large intestine commencing in segment 18.

Excretory system. Meganephric (?) with three coiled tubes on each side in each segment, corresponding to the nephridiopores. (The nephridia of this form are very interesting and probably indicate an aggregation of plectonephric tubules into three groups).

Reproductive system. Testes doubtful. One pair present, but small, in segment 10, attached to the anterior wall; probably a pair in segment 11. Ciliated rosettes distinct in segments 10 and 11.

Prostates double. A smaller anterior coiled tubular mass in segments 17 and 18; a posterior larger mass in segments 18–21. Separate duct from each, the two uniting together and having a single opening in segment 18.

Sperm sacs in segments 11 and 12. Each has the form of a saccular dilatation attached to the anterior wall of the segment. The anterior one probably encloses a testis.

Ovaries in segment 13. Oviducts opening into the same segment.

Spermathecæ, two pairs. Each consists of a long sac, with two short club-shaped diverticula arising from the duct.

Habitat. Victoria. This probably comes from Croajingolong but the distinct locality other than Victoria is not noted.

It is evidently closely allied to *C. fastigatus*, Fl., but is distinct from this (1) in the possession of well developed calciferous glands in segments 15 and 16, and (2) in the sperm sacs not being racemose. The curious double nature of the prostates, and the identical arrangement of the nephridia shows the two forms to be closely allied, but at present, pending the publication of our full report, they are placed as distinct species in the genus Cryptodrilus.

(6) *C. macedonensis*, sp. n. (Figs. 16, 17, 18, 68). Spirit specimen 3 inches long, one-eighth inch broad.

Prostomium not dovetailed into the peristomium, which is ribbed.

Clitellum distinct, complete and brown coloured in spirit specimens, the rest of the body being bleached.

Setæ, four couples, regular along the whole length. The intervals between the two couples of each side, and between the two rows of the outer couple very nearly equal and each more than twice as great as that between the rows of the inner couple. The fourth seta nearly dorsally placed.

Male pores on papillæ on segment 18, at the level of the interval between the two inner rows of setæ.

Oviduct pores on segment 14 slightly anterior to and ventral of, the innermost setæ.

Spermathecal pores, four in number, on the anterior margins of segments 6–9, slightly ventral to the level of the innermost setæ, each on a distinct little papilla.

Accessory copulatory structures very well marked. A large tumid patch occupying the median ventral part of segment 11, the anterior edge of segment 12 and the posterior of segment 11; or this may be divided into two parts, one occupying the anterior ventral part of segment 11 and the posterior part of segment 10; the other, the corresponding parts of segments 11 and 12.

Behind the clitellum, tumid ridges are present, the first of which occupies the posterior ventral part of segment 17, and anterior of segment 18, and others occupying corresponding positions on segments 18 and 19, 19 and 20, 20 and 21, 21 and 22. Each has a median linnear groove, corresponding in position to the intersegmental groove.

Dorsal pores present, the first between segments 4 and 5. Nephridial pores not easily seen, but are placed at the level of the third seta on each side.

Alimentary canal. Gizzard in segment 5, but not occupying the whole of the segment. Vascular swellings on the œsophagus, but no true calciferous glands. Large intestine commencing in segment 18.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11. Ciliated rosettes in the same segments.

Prostates in segment 18, coiled, tubular, with distinct coiled duct.

Sperm sacs small, and slightly racemose, in segment 12.

Ovaries in segment 13, and oviducts opening into the same segment.

Spermathecæ, four pairs in segments 6–9, each one markedly large in comparison to the size of the body and consisting of a distinct stalk, with swollen sac, and at the base of the stalk, a small diverticulum.

Habitat. Mt. Macedon, Victoria. Collected by Mr. H. R. Hogg and myself.

(7) *C. victoriæ*, sp. n. (Figs. 19, 20, 21, 69). Spirit specimen 4 inches long, three-eighths inch broad.

The prostomium completely dovetailed into the peristomium. There is a very distinct median, dorsal and ventral groove running the whole length of the body (in spirit specimen).

Clitellum fairly distinct and complete, occupying segments 14–16.

Setæ prominent, and in four couples regularly arranged, except at the posterior end of the body, where the last few segments are distinct from and smaller than the others. Male pores on papillæ on segment 18, each slightly dorsal to the level of the innermost setæ.

Oviduct pores on segment 14, slightly anterior to, and ventral of, the position of the innermost setæ.

Spermathecal pores, five in number; intersegmental; the first between segments 4 and 5.

Accessory copulatory structures feebly developed. A median, ventral, glandular patch on the anterior halves of segments 9 and 10, together with faintly marked intersegmental patches immediately in front of and behind the male openings.

Dorsal pores present, the first probably between segments 2 and 3, one certainly present between segments 3 and 4.

Nephridiopores at the level of the third setæ, commencing at the second segment.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings present in segments 9–15. Large intestine commencing in segment 17.

Circulatory system. Single dorsal vessel with the last pair of hearts in segment 12.

Excretory system. Meganephric, with a coiled tube in each segment ventrally, from which a long duct leads up to the level of the third setæ.

Reproductive system. Two pairs testes, in segments 10 and 11, with funnels opening into the same segments which are filled with sperm.

Prostates, long coiled tubes, extending through segments 18–26.

Sperm sacs. Saccular structures, attached to the anterior wall of segment 12 and the posterior of segment 9.

Ovaries, one pair in segment 13, with oviducts opening into the same.

Spermathecæ. Five pairs in segments 5–9. Each consists of a large sac with a tubular diverticulum arising from the stalk, and about one-third the length of the sac.

Habitat. Collected at Warburton, Yarra Valley, by Dr. Dendy.

(*Var. a*) Length of spirit specimen $2\frac{3}{4}$ inches, one-quarter inch broad.

The general anatomy closely similar to the typical form, from which it differs (1) in the irregularity of the setæ extending slightly further along the body; (2) in the presence of a curious elongate white smooth surface, extending ventrally from segment 17 to segment 23; (3) in the openings of the spermathecæ being slightly dorsal of the level of the innermost setæ, and (4) in the diverticulum of the spermathecæ being relatively longer than in the typical form.

Habitat. Thompson Valley. Tanjil Track.

(*Var. b*) Length of spirit specimen 3 inches, one-quarter inch broad. The body more robust and lighter colour than in *var. a*.

The irregularity of the setæ extends further forwards along the body than in *var. a*. A white smooth surface of skin extends ventrally in the region of the male pores, as in *var. a*, and there is present in addition a similar surface ventrally on segments 4–9.

No testes can be seen, though the rosettes are well developed in segments 10 and 11. Prostates long and coiled, exactly as in the typical form. The spermathecæ have very small knob-like diverticula.

Habitat. Victoria (exact locality not known).

(8) *Cryptodrilus willsiensis*, sp. n. (Figs. 22, 23, 24, 70).

Spirit specimen $7\frac{1}{2}$ inches long, half inch broad.

Prostomium very slightly dovetailed into the peristomium, which is ribbed. Median ventral furrow on prostomium.

Clitellum not strongly glandular, but clearly indicated by its reddish colour in spirit, extending over segments 14–17.

Setæ prominent. Four couples of which, the outer on each side, is dorso-lateral in position. As far back as the clitellum they are regularly arranged, the rows of the outer couple being nearly three times as far away from one another as those of the inner couple. The fourth row is slightly irregular in the clitellar region but is fairly regular for about two-thirds the length of the body, then it becomes exceedingly irregular. The third row is noticeably regular till quite the posterior end of the body, when it becomes slightly irregular. The second and first rows are regular till within 20 segments of the posterior extremity, when they become irregular. At the posterior end there may be 5 setæ present on each side of the body.

Male pores placed on papillæ, in segment 18, at a level corresponding to the interval between the two rows of the inner couple of setæ.

Oviduct pores on segment 14.

Spermathecal pores intersegmental in position, between segments 4 and 5, 5 and 6, 6 and 7, 7 and 8, 8 and 9.

Accessory copulatory structures scarcely indicated.

Nephridiopores on the anterior margin of each segment at the level of the third seta.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings. Large intestine commencing in segment 18.

Circulatory system. Dorsal vessel double in each segment, as far forward as the fifth segment. In the latter, the two halves unite on the top of the gizzard and run forward as a single vessel. Hearts in segments 5–12.

Excretory system. Meganephric.

Reproductive system. Testes in segments 10 and 11, into which also the rosettes open.

Prostates coiled, tubular, in segment 18.

Sperm sacs. Saccular in nature and attached to the anterior wall of segment 12, and the posterior of segment 9.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, 5 pairs in segments 5–9. Each consists of a sac, with a double diverticulum.

Habitat. Mt. Wills. Collected by Mr. T. Lidgey.

(9) *Cryptodrilus narrensis*, sp. n. (Figs. 25, 26, 27, 71).

Length in spirit $1\frac{3}{4}$ inches long, one-eighth inch broad.

Prostomium incompletely dovetailed into the peristomium (about one-half).

Clitellum well marked, occupying segments 14–17, whilst the posterior part of 13, and the anterior of 18, may be modified dorsally. The posterior half of segment 17 ventrally, may be sharply marked off, and not glandular in appearance.

Setæ regularly arranged in four rows. At the anterior end, the outer couple is lateral in position, the rows of setæ being slightly further apart than those of the inner couple. Posteriorly, the rows gradually separate from one another, until the fourth becomes dorsal in position.

Male pores on papillæ in segment 18, at the level of the interval between the rows of the inner couples of setæ.

Oviduct pores on segment 14, on a slight glandular space in front of, and ventral of the level of the innermost setæ.

Spermatheeal pores intersegmental in position, between segments 7 and 8, and 8 and 9. Slightly dorsal to the level of the innermost setæ.

Accessory copulatory structures. Two circular patches, one immediately in front of and one immediately behind the male openings; each small and in the mid-ventral space, between the innermost rows of setæ of each side.

Nephridiopores at the level of the third setæ (?)

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings in segments 15 and 16. Large intestine commences in segment 20.

Circulatory system. Single dorsal blood-vessel. Last heart in segment 12.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, into which the rosettes also open.

Prostates, coiled, tubular, and in segments 18 and 19.

Sperm sacs, grape-like, attached to the anterior walls of segments 14 and 12, and the posterior wall of segment 9.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a long saccular part, with a diverticulum about one-third its length.

Habitat. Narre Warren, Gippsland. Collected by Mr. C. French and myself. Very abundant under logs in wet weather.

(10) *Cryptodrilus lucasi*, sp. n. (Figs. 28, 29, 30, 72). Length in spirit $4\frac{1}{2}$ inches, slightly more than one-eighth inch broad.

Prostomium only slightly dovetailed into peristomium (about $\frac{1}{3}$).

Clitellum well marked, occupying segments 14–17, together with the anterior part of segment 18, and posterior of segment 13. The middle of segment 17 is not included ventrally, but together with the same part of segments 18 and 19, is white and swollen in spirit specimens.

Setæ in four couples, all of which, for the greater part of the length of the body, are placed close to the ventral surface. For the posterior third of the body, the two outer rows are irregular.

Male pores on small papillæ on segment 18, slightly dorsal of the level of the innermost row.

Oviduct pores on segment 14, slightly anterior to, and ventral of the level of the innermost setæ.

Spermathecal pores, two pairs, intersegmental, between segments 7 and 8, 8 and 9, and at the level of the innermost setæ.

Dorsal pores present, the first between segments 4 and 5.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but the œsophagus is markedly swollen and vascular in segments 9–13. Large intestine commences in segment 15.

Circulatory system. Single dorsal vessel, hearts in segments 6–12, those in segments 9–12 large.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, rosettes opening in the same segments.

Prostates, tubular and coiled, in segments 16–18.

Sperm sacs, grape-like, in the anterior wall of segment 12, and posterior of segment 9.

Ovaries in segment 13, the oviducts opening into the same segment. An extra pair of ovaries may be present in segment 14.

Spermathecæ. Two pairs in segments 8 and 9. Each consists of a large sac with a diverticulum, having the form of a rosette.

Habitat. Tallarook, Goulburn River. Collected by Mr. A. H. S. Lucas, M.A.

(11) *Cryptodrilus minor*, sp. n. (Figs. 31, 32, 33, 73). Length in spirit 2–5 inches. Very narrow.

Setæ, for the greater part of the length of the body, arranged in four couples, of which the two rows in each are close together, the outer couple being dorso-lateral in position. The ventral row is straight throughout, the second row becomes irregular at the very posterior end, and about $\frac{9}{10}$ of the way down the body, the two upper rows suddenly become very irregular.

Prostomium very slightly dovetailed into the peristomium.

Clitellum well developed, occupying segments 14–17 very slightly, the anterior part of 18 dorsally.

Male pores on segment 18, at the level of the interval between the two innermost setæ of each side.

Oviduct pores in a linnear depression on segment 14, anterior to, and ventral of, the innermost setæ.

Accessory copulatory structures. Two depressed elliptical patches, one on segment 17 ventrally, and another on segment 19.

Dorsal pores not visible in front of the clitellum.

Nephridiopores at the level of the third setæ (?)

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but large swollen portions of the œsophagus in segments 13–18. Large intestine commencing in segment 20.

Circulatory system. Single dorsal vessel, with the last heart in segment 12.

Excretory system. Meganephric.

Reproductive system. Testes, one pair in segment 11, into which open the rosettes.

Prostates, small, tubular, and coiled, in segment 18.

Sperm sacs, grape-like, in segment 12 on the anterior wall.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each one consisting of a large sac with a triple diverticulum.

Habitat. South Warragul, Gippsland. Collected by Mr. W. Mann.

(*b*) Megascolides, McCoy (= Notoscolex, Fletcher).

(1) *M. cameroni*, sp. n. (Figs. 34, 35, 36, 74). Length of spirit specimen $8\frac{1}{2}$ inches, half inch broad.

Prostomium incompletely dovetailed into the peristomium (about $\frac{1}{2}$). Peristomium ribbed.

Clitellum well marked, but incomplete ventrally, especially at the anterior end.

Setæ somewhat difficult to see. In four couples, the outer couple being placed laterally, and having its two rows slightly farther apart than those of the inner couple. The setæ become irregular in the upper two rows in the clitellar region, the innermost row of each side being regular along the whole length.

Male pores on two papillæ on segment 18, at the level of the innermost setæ.

Oviduct pores on segment 14.

Spermathecal pores, five in number; intersegmental; the first between segments 4 and 5.

Dorsal pores present, the first between segments 3 and 4.

Alimentary canal. Gizzard occupying half of segments 5 and 6. No true calciferous glands, but vascular swellings present in segments 8–14. Large intestine commences in segment 19.

Circulatory system. Dorsal vessel double in each segment as far forward as the fifth segment. The last heart is in segment 13, and a lateral vessel is present on each side in segments 5–11, and a supra-intestinal in segments 8–14.

Excretory system. Plectonephric. The little nephridial tufts are very minute, but for the posterior third of the body, large paired nephridia are present ventrally, with internal funnels.

Reproductive system. Testes, two pairs in segments 10 and 11, with rosettes opening into the same segments.

Prostates flattened with the surface mammillated in segment 18. Sperm sacs, a pair of grape-like structures on the anterior wall of segment 14, and of sac-like structures on the posterior wall of segment 9.

Ovaries in segment 13, into which the oviducts also open.

Spermathecæ. Five pairs in segments 5–9. Each consisting of a sac with a diverticulum about half the length of the sac. The spermathecæ are small in relation to the size of the body.

Habitat. Croajingolong. Collected during an expedition of the Field Naturalists' Club of Victoria.

(2) *Megascolides insignis*, sp. n. (Figs. 37, 38, 39, 75). Length of spirit specimen 6 inches, slightly more than one-quarter inch broad.

Prostomium feebly developed, and not at all dovetailed into the peristomium.

Clitellum distinct and light coloured in spirit specimens, extending over segments 13–18. Well and sharply marked dorsally; saddle shaped with ridges on the mid-ventral surface, though it tends to extend over the ventral surface and include the ridges.

Setæ in four couples, the outer couple being lateral in position and having its two rows twice as far apart as those of the inner couple. Posteriorly, the intervals between the rows composing each couple increases considerably.

Male pores on slight papillæ, in a depression on segment 18, at the level of the interval between the two rows of the inner couples of setæ.

Oviduct pores on segment 14, slightly ventral of, and anterior to the innermost setæ.

Spermathecal pores intersegmental, between segments 7 and 8, 8 and 9; at the level of the interval between the rows of the inner couples of setæ.

Accessory copulatory structures very strongly developed, white swollen ridges ventrally on segments 15–21, the setæ of the inner couples being placed on the ridges.

Dorsal pores present, the most anterior one being between segments 9 and 10.

Alimentary canal. Gizzard in segment 6. Vascular swellings on the œsophagus in segments 10 and 11, small white diverticula (calciferous glands ?) in segments 12, 13, 14, and large prominent calciferous glands in segments 15, 16, 17. Large intestine commences in segment 19.

Circulatory system. Dorsal vessel single; hearts in segments 7–13, those in segments 6–9 small.

Excretory system. Plectonephric, with larger paired nephridia at the posterior end of the body, with internal openings.

Reproductive system. Testes, a single pair in segment 11, with rosettes opening into the same. Prostates somewhat small and flattened. Sperm sacs grape-like on the anterior wall of segment 12. A small pair on the anterior wall of segment 14.

Ovaries in segment 13, with oviducts opening into the same.

Spermathecæ, 2 pairs in segments 8 and 9, each consisting of a long sac, with very short blunt diverticulum.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

(3) *Megascolides hulmei* sp. n. (Figs. 40, 41, 42, 76).

Of several specimens, none are perfect, some wanting the anterior, others the posterior end. These worms are remarkably long and attenuated. One specimen, which is incomplete posteriorly, measures 3 ft. 5 in. in length. Another measures the same length, but lacks the anterior end. A perfect spirit specimen will probably measure 4 feet; width $\frac{1}{3}$–$\frac{1}{4}$ inch.

Prostomium feebly developed and not at all dovetailed into the peristomium.

Clitellum remarkably developed, extending over segments 13–20, and measuring 2 inches in length. Complete and very sharply marked off at either end. The indications of the segments are completely obliterated.

Setæ, in four couples, regularly arranged; the rows of the outer couples which are lateral in position, being slightly further apart than those of the inner couple.

Male pores on segment 18 inconspicuous. Difficult to determine their position with regard to the setæ, but they are probably at the level of the innermost setæ.

Oviduct pores on segment 14.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9.

Accessory copulatory structures. A circular patch in front of the oviduct pores, partly on segments 13 and 14. Two circular patches, one on each of the segments 16 and 17. Three elliptical patches, the first half on segment 19, and half on 20; the second and third with the same relationship to segments 20 and 21, 21 and 22.

Dorsal pores present, the first between segments 8 and 9.

Alimentary canal. Gizzard in segment 5. No true calciferous glands. Large intestine commencing in segment 17.

Circulatory system. Dorsal vessel single. Hearts in segments 6–13. Supra-intestinal in segments 8–13.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Single pair of testes in segment 11; two pairs of rosettes, one in each of segments 10 and 11.

Prostates, flatted bodies with mammillated surface in segment 18.

Sperm sacs, grape-like, attached to the anterior wall of segment 12.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a moderately long sac, with a small blunt diverticulum.

Habitat. Dandenong Ranges. Collected by Mr. Joseph Hulme.

I have much pleasure in associating the name of Mr. Joseph Hulme with this interesting form. I am indebted to that gentleman for a valuable collection of earth-worms, including no fewer than four new species of the genus *Megascolides*, as at present described. This form ranks next in length to the giant Gippsland earth-worm.

(4) *Megascolides obscurus*, sp. n. (Figs. 43, 44, 45, 77). Length of spirit specimens 16 inches, one-half inch broad. One incomplete specimen measures 17 inches, so that probably the above is a minimum length, though the specimen is mature.

Prostomium feebly developed, and not at all dovetailed into the peristomium.

Clitellum purple in spirit specimens. Lines of the segments not obliterated, and the position of the setæ marked by minute papillæ. Extends over segments 14–18, and includes also the posterior part of segment 13, and the anterior of segment 19.

Setæ in four couples, difficult to see, except the inner two pairs. Regularly arranged (?)

Male pores on papillæ on segment 18, at the level of the interval between the rows of the inner couples.

Oviduct pores on segment 14.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9, at the level of the innermost setæ.

Accessory copulatory structures in the form of prominent ridges, the first half on segments 13 and 14, the second in segment 18, and the third and fourth half on segments 19 and 20, 20 and 21.

Dorsal pores present, the first between segments 5 and 6.

Alimentary canal. Gizzard in segment 6. No true calciferous glands. Vascular swellings on the œsophagus in segments 13, 14, and 15. Large intestine commences in segment 18.

Circulatory system. Dorsal blood-vessel single. Hearts in segments 6–13. Supra-intestinal vessel in segments 9–15.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Testes in segment 11. Rosettes in segments 10 and 11, those in the former small.

Prostates comparatively small, flattened, with mammillated surface, in segment 18.

Sperm sacs large in segment 12; a small pair on the anterior wall of segment 14.

Ovaries in segment 13, with oviducts opening into the same segment.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a sac, with two small rounded diverticula at the base.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

(5) *Megascolides manni*, sp. n. (Figs. 46, 47, 48, 78). Length of spirit specimen 10 inches, one-quarter inch broad.

Prostomium not completely dovetailed into the peristomium (about half), which is ribbed.

Clitellum well marked, and slightly darker than the rest of the body in spirit specimens. Extending over segments 14–18. Complete.

Setæ in four couples, regularly arranged, the distance between the rows of the outer couple, which are laterally placed, being slightly greater than that between the inner couple.

Male pores on segment 18, slightly ventral of the level of the innermost setæ.

Oviduct pores on segment 14, on a small whitish elliptical patch on the anterior part of segment 14, the pores ventral of the level of the innermost setæ.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9, ventral of the level of the innermost setæ.

Accessory copulatory structures. Two club-shaped tumid patches, the first half on each of segments 17 and 18, the second half on each of segments 18 and 19; a depression in each half of the patches at the level of the interval between the rows of the inner couple of setæ.

Dorsal pores present, but not visible in front of the clitellum.

Alimentary canal. Gizzard occupying half of segment 5 and the whole of segment 6. No true calciferous glands present, but vascular swellings in segments 15 and 16. Large intestine commencing in segment 18.

Circulatory system. Dorsal vessel single. Hearts in segments 6–12. Supra-intestinal vessel in segments 9–13. Strong development of blood-vessels on the walls of the gizzard.

Excretory system. Meganephric. Remarkable paired tufts of nephridiæ tubules in segments 5, 6, and 7.

Reproductive system. Testes, two pairs in segments 10 and 11, into which open the rosettes. Prostates coiled in segment 18. Sperm sacs grape-like, attached to the anterior walls of segments 11, 12, and 14.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs, one in segment 7, the other in segment 9. Each consist of a large sac and small rounded diverticulum.

Habitat. South Warragul, Gippsland. Collected by my assistant, Mr. W. Mann, to whom I am indebted for many interesting specimens of Victorian earth-worms.

Megascolides manni, var. *variabilis*.

This form, collected by Mr. Mann, in the same locality, is evidently very closely allied to the above form. It may be clearly distinguished from it, however, by the fact that the accessory copulatory structures, instead of being club-shaped, are circular in form, each one having a single median depression. The internal anatomy is closely similar to that of the typical form. In one specimen there is a pair of spermathecæ in segment 7, a single one on the left side in segment 8, and a single one on the right side in segment 9. Another specimen dissected, had two pairs as in the typical form, one in segment 7, and another in segment 9. This probably indicates that one pair present in segment 8 has in some way become suppressed.

Habitat. South Warragul, Gippsland. Collected by Mr. W. Mann.

(6) *Megascolides victoriensis* (Figs. 49, 50, 51, 79). Length of spirit specimen 3 feet, one-quarter to one-half inch broad.

Prostomium not dovetailed into the peristomium.

Clitellum well marked, and coloured purple in spirit specimens, with small white papillæ indicating the position of the setæ.

Setæ, four couples, the rows of the outer ones being four times as far apart as those of the inner ones. Setæ irregular at the posterior end of the body, where they are very difficult to see.

Male pores on papillæ on segment 18, at the level of the intervals between the setæ of the inner couple.

Oviduct pores on segment 14.

Spermathecal pores intersegmental, between segments 7 and 8, 8 and 9.

Accessory copulatory structures. White elliptical patches, the first half on segment 13, and half on segment 14. The second, third and fourth occupying the same relative positions on segments 19 and 20, 20 and 21, 21 and 22.

Dorsal pores present, the first between segments 11 and 12.

Alimentary canal. Gizzard in segment 5. No true calciferous glands. Large intestine commences in segment 17.

Circulatory system. Dorsal vessel single, the last heart in segment 13.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Two pairs of testes in segments 10 and 11, into which open the rosettes.

Prostates flattened, with mammillated surfaces in segment 18.

Sperm sacs, grape-like, on the anterior wall of segment 12, with a small pair on the anterior wall of segment 14.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9. Each consisting of a large sac, with a pair of small rosette-like diverticula.

Habitat. Victoria (exact locality unknown).

(7) *M. incertus*, sp. n. (Figs. 52, 53, 54, 80). Length of spirit specimens 10 inches, one-quarter inch broad.

Prostomium completely dovetailed into the peristomium.

Clitellum, when fully mature, includes segments 13–18, but when not fully developed, only includes the posterior part of 13, and the anterior of 18.

Setæ arranged regularly in four couples, the rows of the outer couple, which is lateral in position, being about twice as far from one another as those of the inner couple.

Male pores on papillæ on segment 18, at the level of the interval between the setæ of the inner couples.

Oviduct pores on small papillæ on segment 14, anterior to, and ventral of, the level of the innermost setæ.

Spermathecal pores, two pairs on slight papillæ in the anterior part of segments 8 and 9, at the level of the interval between the setæ of the inner couples.

Accessory copulatory structures. A round tumid patch between the male pores. Elliptical elevations, with median depressions, situated at the level of the intervals between the setæ of the inner couples, and placed half on each of the segments 16 and 17, 19 and 20, 20 and 21, 21 and 22, 22 and 23.

Alimentary canal. Gizzard in segment 6. No true calciferous glands and no well marked vascular swellings. Large intestine commences in segment 18.

Circulatory system. Dorsal vessel single. Hearts in segments 6–12, those in segments 6–8 small.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, rosettes opening into the same segments. Prostates, coiled, tubular, and in segment 18. Sperm sacs, grape-like, attached to the anterior wall of segment 12, and the posterior wall of segment 9.

Ovaries in segment 13, the oviducts opening into the same segment.

Spermathecæ, two pairs in segments 8 and 9, each consisting of a large sac with a very small diverticulum scarcely noticeable.

Habitat. Victoria (exact locality unknown).

(8) *Megascolides sinuosus,* sp. n. (Figs. 55, 56, 57). Length of spirit specimen 20 inches, slightly more than one-quarter inch broad.

Prostomium not at all dovetailed into the peristomium.

Clitellum only indicated by a slight colouration (in spirit) in the region about the genital openings, where also ridges are present.

Setæ, in four couples, the rows of the inner couple being close together, those of the outer far apart; the third row is lateral, and the fourth dorsal in position. The two outer rows are sinuously arranged in the middle and posterior parts of the body.

Male pores on slight elevations on segment 18.

Oviduct pores on segment 14, ventral of, and anterior to, the innermost setæ.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9.

Accessory copulatory structures. Two ridges, one half on segments 19 and 20, the other half on segments 20 and 21 ventrally.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but slightly vascular swellings in segments 13–17. Large intestine commences in segment 18.

Circulatory system. Dorsal blood-vessel single. Hearts in segments 7–13. Supra-intestinal and lateral blood-vessel in the region of the hearts.

Excretory system. Plectonephric. No large paired nephridia present.

Reproductive system. Testes, two pairs in segments 10 and 11, with rosettes in the same segments.

Prostates, coiled, tubular. in segment 18.

Sperm sacs, grape-like, attached to the anterior walls of segments 12 and 14, the former large.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each consisting of a long sac, with a short diverticulum at the base.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

This is evidently very closely allied to *M. obscurus*, from which, however, it differs amongst other points, in the fact that the spermatheca has only one small diverticulum, whilst two are present in *M. obscurus*.

(9) *M. roseus*, sp. n. (Figs. 58, 59, 60, 81). Length of spirit specimen 7 inches (length when alive 10–12 inches), one-quarter inch broad.

Prostomium completely dovetailed into the peristomium. The latter ribbed.

Clitellum strongly marked, including segments 13–18, only the posterior dorsal part of the former, and the anterior two annuli of the latter. Complete in segments 14, 15, and the posterior part of 13, and anterior of 16; saddle-shaped in segment 17, and the posterior part of 16, and anterior of 18. Bright pink colour when alive, the body being flesh-coloured.

Setæ, four couples, regularly arranged. The rows of setæ of each couples in the anterior median part of the body being very close together, and the outer ones latero-ventral in position. The rows gradually become wider apart posteriorly.

Male pores on papillæ on segment 18, at the level of the interval between the rows of setæ of the inner couples.

Oviduct pores on segment 14, ventral of, and anterior to, the level of the innermost setæ.

Spermathecal pores, two pairs, between segments 7 and 8, 8 and 9.

Accessory copulatory structures. Swollen, round, tumid patch between the male pores. In front of these, on segment 17, are two round elevations, each at the level of the interval between the rows of the inner couples of setæ. Elliptical elevations, with median depressions, placed half on each of the segments 19 and 20, 20 and 21, 21 and 22, 22 and 23.

Dorsal pores present, but not visible in front of the clitellum, and may be obliterated in this.

Nephridiopores at the level of the third row of setæ.

Alimentary canal. Gizzard in segment 5. Two large pairs of calciferous glands in segments 15 and 16. The large intestine commences in segment 18.

Circulatory system. Dorsal vessel single. The last heart in segment 12 A supra-intestinal vessel present in the region of the hearts.

Excretory system. Meganephric.

Reproductive system. Two pairs of testes in segments 10 and 11, with rosettes in the same segments. Prostates, coiled, tubular, and in segments 17, 18, and 19. White elevated patches are seen in segments 18, 19, 20, 21, and 22, corresponding in position to the accessory copulatory structures seen externally. Sperm sacs, grape-like, attached to the anterior wall of segment 12.

Ovaries in segment 13, into which also open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each with a large sac and small rosette-like diverticulum.

Habitat. Warragul, about one foot under ground.

(10) *M. attenuatus*, sp. n. (Figs. 61, 62, 82). Length of spirit specimen 6–8 inches. Only one-eighth inch broad at most, and often only half of this. Very thin and attenuate; more than one foot long when alive. Dull greyish colour when alive.

Prostomium not at all dovetailed into the peristomium.

Clitellum purple in spirit specimens, and well marked, occupying segments 13–18, but not complete on the ventral surface of the latter.

Setæ in four couples, the interval between the rows of the outer couple, which are lateral in position, being slightly greater than that between the rows of the inner couple. The fourth row slightly irregular in the last ten segments, and coming to lie dorsally.

Male pores, inconspicuous, on segment 18.

Oviduct pores on segment 14, ventral of, and anterior to, the level of the innermost setæ.

Spermathecal pores, two pairs, between segments 7 and 8, 8 and 9.

Dorsal pores present, the first between segments 5 and 6; obliterated in the clitellar region.

Alimentary canal. Gizzard in segment 5. No true calciferous glands.

Circulatory system. Dorsal vessel single, the last heart in segment 12.

Excretory system. Meganephric.

Testes difficult to determine exactly, but almost certainly two pairs in segments 10 and 11, into which open two distinct pairs of rosettes.

Prostates, coiled, tubular, in segment 18. Around each prostatic duct lies a curious structure, consisting of minute grape-like processes.

Sperm sacs, grape-like, attached to the anterior wall of segment 12, and the posterior of segment 9.

Ovaries in segment 13, with oviducts opening into the same segment.

Spermathecæ, two pairs, in segments 8 and 9, each with a long sac and small diverticulum.

Habitat. Warragul, Gippsland. Obtained by digging in gullies, and found along with *Megascolides australis, tuberculatus, manni, roseus, &c.* Always some distance under ground.

(11) *M. australis* (McCoy).

The first description of this was published by Professor Sir F. McCoy in the Prodromus of the Zoology of Victoria.* It was subsequently re-described by Mr. Fletcher† under the name of *Notoscolex gippslandicus*, and its anatomy described by myself in the Transactions of the Royal Society of Victoria.‡

(12) *M. tuberculatus* (Fletcher).

This has been described by Mr. Fletcher§, who obtained it from Warragul. I have since obtained it from Camperdown, Victoria.

DESCRIPTION OF PLATES 14, 15, 16, 17, 18, 19.

The Plates contain diagrammatic drawings representing the arrangement of the various organs and parts mentioned in the foregoing account in each different species. In the case of each species one drawing represents the external anatomy, a second the alimentary canal, circulatory system and the disposition of the nephridia, and a third the reproductive organs. On Plate 19, the spermathecæ are drawn in outline (under the camera lucida, × 4).

REFERENCE LETTERS.

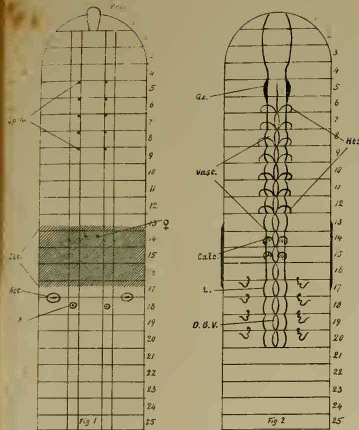
Acc.	Accessory copulatory structures.	*Ovd.*	Oviduct.
Calc.	Calciferous glands.	*Pr.*	Prostate gland.
Clt	Clitellum.	*R.*	Sperm rosette.
D.Br.	Dorsal blood-vessel.	*Spth.*	Spermathecæ.
Gz.	Gizzard.	*T.*	Testis.
Hts.	Hearts.	*Vasc.*	Vascular swellings on œsophagus.
I.	Intestine.	*V.S.*	Sperm sacs.
Ov.	Ovary.		

* Decade I.

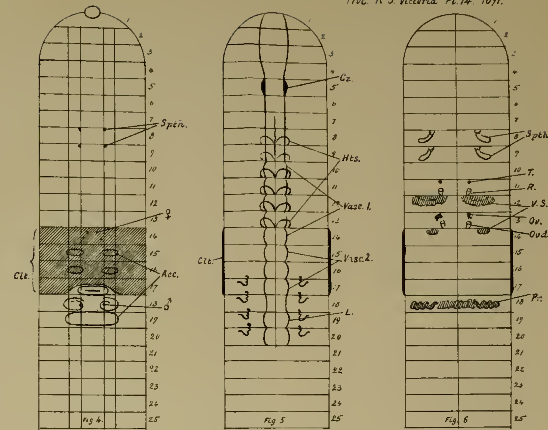
† Notes on Aust. Earth-worms. Proc. Linn. Soc. N.S.W., Vol. II (Series 2nd), 1887, p. 603.

‡ Trans. R. S. Victoria, Part I, 1888.

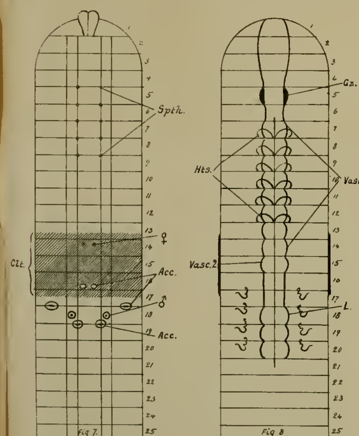
§ *Loc. cit.*, p. 611.



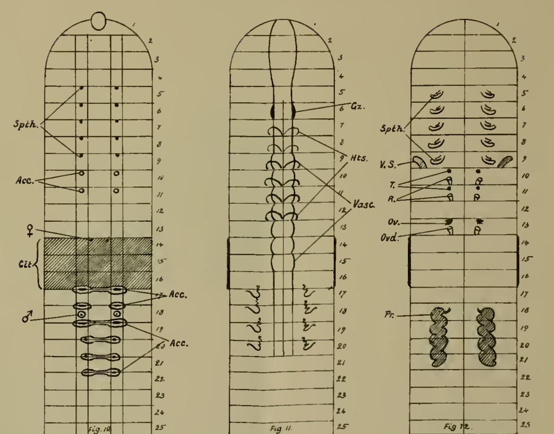
CRYPTODRILUS GIPPSLANDICUS.



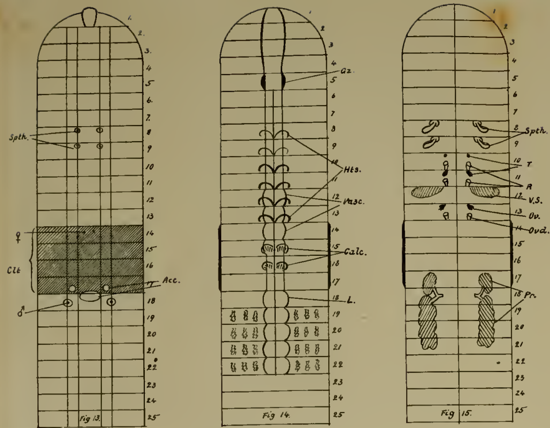
CRYPTODRILUS INTERMEDIUS



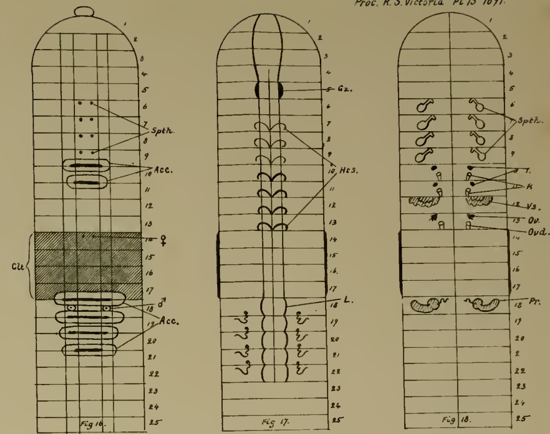
CRYPTODRILUS TANJILENSIS.



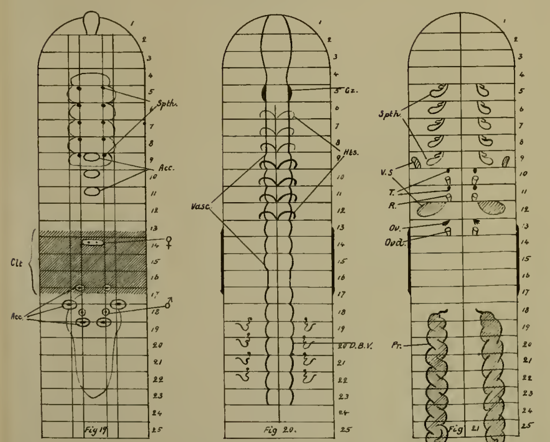
CRYPTODRILUS FRENCHII.



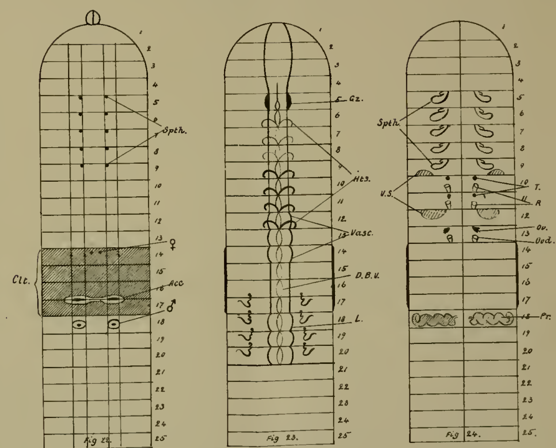
CRYPTODRILUS DUBIUS.



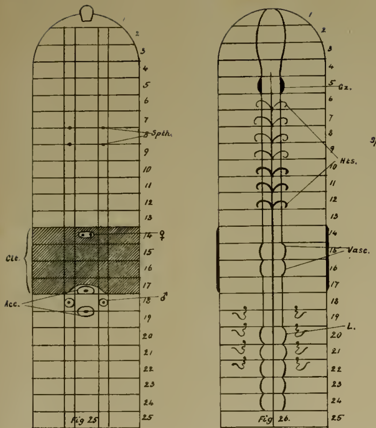
CRYPTODRILUS MACEDONENSIS.



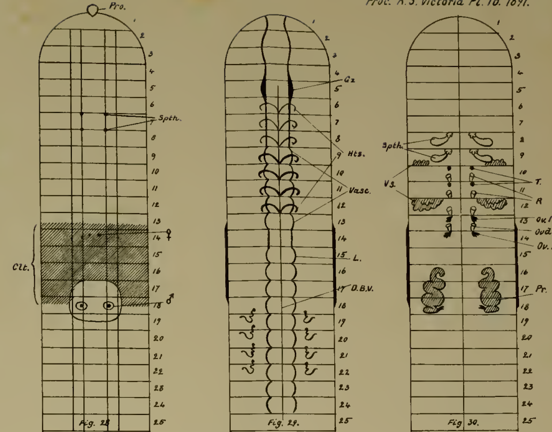
CRYPTODRILUS VICTORIÆ.



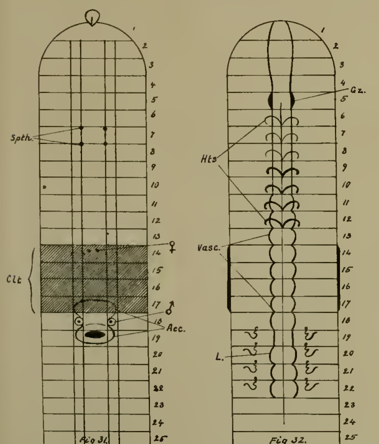
CRYPTODRILUS WILLSIENSIS.



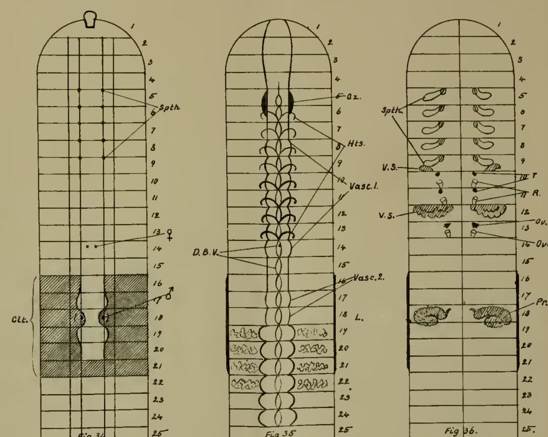
CRYPTODRILUS NARRENSIS.



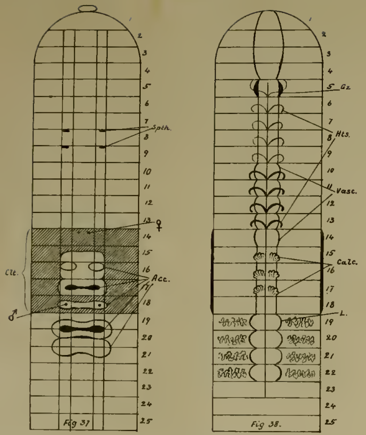
CRYPTODRILUS LUCASI.



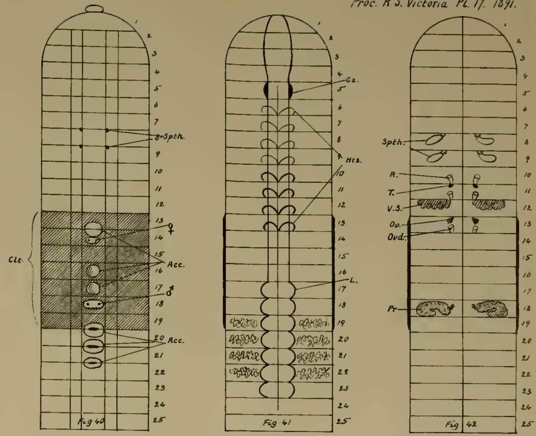
CRYPTODRILUS MINOR.



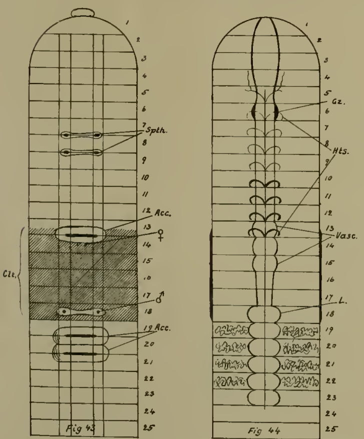
MEGASCOLIDES. CAMERONI.



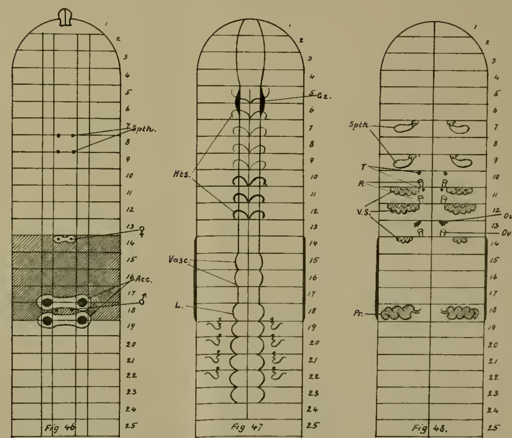
MEGASCOLIDES INSIGNIS.



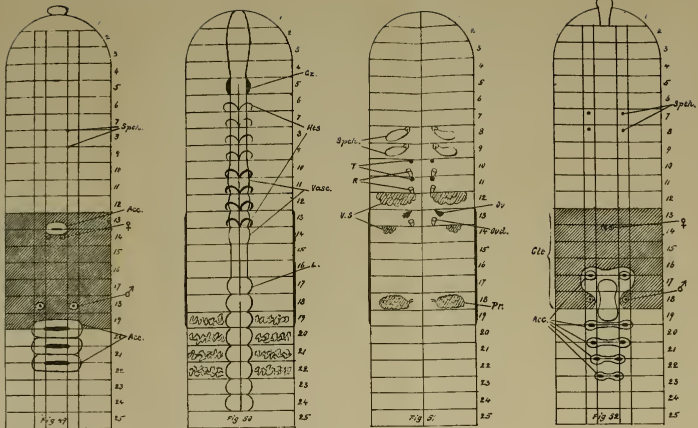
MEGASCOLIDES HULMEI.



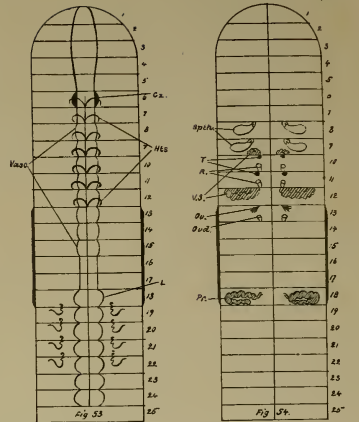
MEGASCOLIDES OBSCURUS.



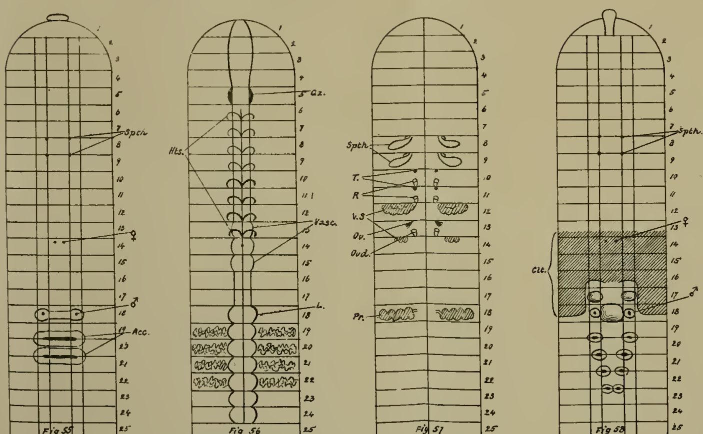
MEGASCOLIDES MANNI.



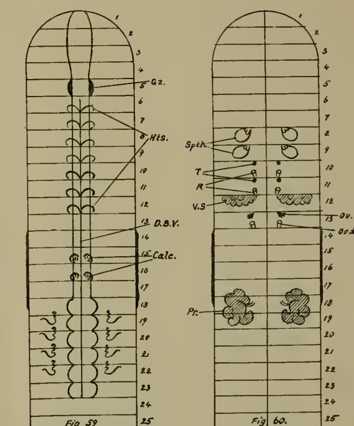
MEGASCOLIDES VICTORIENSIS.



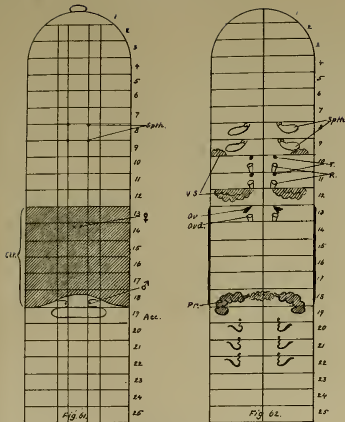
MEGASCOLIDES INCERTUS.



MEGASCOLIDES SINUOSUS.



MEGASCOLIDES ROSEUS.



MEGASCOLIDES ATTENUATUS.

Fig. 63.

Fig. 64.

Fig 65

Fig. 66.

Fig. 67.

Fig. 68.

Fig. 69.

Fig. 70.

Fig. 71.

Fig. 72.

Fig. 73.

Fig. 74.

Fig. 75.

Fig. 76.

Fig. 77

Fig. 78.

Fig. 79.

Fig. 80.

Fig. 81.

Fig. 82.

Art. XVIII.—*Catalogue of Algæ collected at or near Port Phillip Heads and Western Port.*

By J. Bracebridge Wilson, M.A., F.L.S.

LIST OF ABBREVIATIONS USED.

Kütz., Sp. Alg. ..	..	Species Algarum, by F. T. Kützing.
J. Ag., S. G. et O. Alg.	..	Species, Genera, et ordines Algarum, by J. G. Agardh.
Harv.. Phyc. Aus...	..	Phycologia Australica, by W. H. Harvey.
J. Ag., Alg. Syst. ..	..	Till Algernes Systematik, by J. G. Agardh.
J. Ag., Sp. Sarg. ..	..	Species Sargassorum, by J. G. Agardh.
J. Ag., Flor. Morph.	..	Florideernes Morphologi, by J. G. Agardh.

* An Asterisk prefixed, indicates that the genus or species was previously unknown.

MELANOSPERMEÆ (FUCOIDEÆ.)

Ordo I. FUCACEÆ.

SARGASSUM.

S. biforme, Sond. Kütz., Sp. Alg., 625.
J. Ag., S. G. et O. Alg., I, 301.
J. Ag., Alg. Syst., Part I, 67.
J. Ag., Sp. Sarg., 75.
S. cristatum, J. Ag. J. Ag., Sp. Sarg., 84.
S. fallax, Sond. Kütz., Sp. Alg., 301.
J. Ag., S. G. et O. Alg., I, 297.
J. Ag., Sp. Sarg., 68.

S. gunnianum, J. Ag. J. Ag., Sp. Sarg., 71.
S. lævigatum, J. Ag. J. Ag., Sp. Sarg., 67.
S. sonderi, J. Ag. J. Ag., Sp. Sarg., 44.
Harv., Phyc. Aus., V, pl. 243. Sub nomine Cystophora Sonderi.
S. teretifolium, J. Ag. J. Ag., S. G. et O. Alg., I, 331. J. Ag., Sp. Sarg., 101.
S. verruculosum, J. Ag. J. Ag., Sp. Sarg., 53.

SEIROCOCCUS.

S. axillaris, Grev. Kütz., Sp. Alg., 593.
J. Ag., S. G. et O. Alg., I, 260. Harv., Phyc. Aus., I, pl. 4.

PHYLLOSPORA.

P. comosa, J. Ag. Kütz., Sp. Alg., 592.
J. Ag., S. G. et O. Alg., I, 253. Harv., Phyc. Aus., III, pl. 153.

SCABERIA.

S. agardhii, Grev. Kütz., Sp. Alg., 636. Sub nomine Castraltia salicornoides. J. Ag., S. G. et O. Alg., 252.
Harv., Phyc. Aus., III, pl. 164.

CYSTOPHORA.

C. cephalornithos, J. Ag. J. Ag., S. G. et O. Alg. I, 246.
Harv., Phyc. Aus., II, pl. 116.
C. paniculata, J. Ag. J. Ag., S. G. et O. Alg., I, 248.
Harv., Phyc. Aus., V, pl. 247.
C. platylobium, J. Ag. J. Ag.. S. G. et O. Alg., I, 245.
C. sonderi, J. Ag. J. Ag., S. G. et O. Alg., I, 247.
Harv., Phyc. Aus., V, pl. 243.
C. spartioides, J. Ag. J. Ag.. S. G. et O. Alg., I, 244.
Harv., Phyc. Aus., II, pl. 76.
C. subfarcinata, Mert. Kütz., Sp. Alg., 628. Sub nomine Blossevillea subfarcinata. J. Ag., S. G. et O. Alg., I, 240.
C. torulosa, Br. Kütz., Sp. Alg., 628. Sub nomine Blossevillea.
J. Ag., S. G. et O. Alg., I, 243.

CYSTOPHYLLUM.

C. muricatum, J. Ag. Kütz., Sp. Alg. Sub nomine Sirophysalis muricata. J. Ag., S. G. et O. Alg., I, 231.
Harv., Phyc. Aus., III, pl. 139.

CAULOCYSTIS.

C. uvifera, Areschong. Kütz., Sp. Alg. Sub nomine Blossevillea uvifera. J. Ag., S. G. et O. Alg., I, 246. Sub nomine Cystophora.
Harv., Phyc. Aus., III, pl. 175.

FUCODIUM.

F. chondrophyllum, J. Ag. J. Ag., S. G. et O., Alg., I, 203.

HORMOSIRA.

H. banksii, Decaisne. Kütz., Sp. Alg., 586. J. Ag., S. G. et O. Alg., I, 198.
Harv., Phyc. Aus., III, pl. 135.

CARPOGLOSSUM.

C. confluens, J. Ag. Kütz., Sp. Alg., 591.
J. Ag., S. G. et O. Alg., I, 195.
Harv., Phyc. Aus., III, pl. 159.

MYRIODESMA.

* M. calophyllum, J. Ag. Ms., spec. nov., 1887.
M. integrifolium, Harv. J. Ag., Alg. Syst., VI, p. 6.
M. pinnatifidum, J. Ag. Hodie forma M. integrifolii potius videtur laciniis in rachide costata magis conspicue in folium pinnatifidum conjunctis.
M. quercifolium, J. Ag. Kütz., Sp. Alg., 588.
J. Ag., S. G. et O. Alg., I, 192. J. Ag., Alg. Syst., VI, p. 7.

SARCOPHYCUS.

S. potatorum, Labill. Kütz., Sp. Alg., 588.
J. Ag., S. G. et O. Alg., I, 190.
Harv., Phyc. Aus. Sub nomine d'Urvillea potatorum, V, pl. 300.

SPLACHNIDIUM.

S. rugosum, Grev. Kütz., Sp. Alg., 585.
J. Ag., S. G. et O. Alg., I, 186.
Harv., Phyc. Aus., I, pl. 14.

NOTHEIA.

N. anomala, Harv. Harv., Phyc. Aus., IV, pl. 213.

Ordo II. SPOROCHNOIDEÆ.

CARPOMITRA.

C. cabreræ, Kütz. Kütz., Sp. Alg., 569.
J. Ag., S. G. et O. Alg., I, 177.

BELLOTIA.

B. eriophorum, Harv. Harv., Phyc. Aus., II, pl. 69.

PERITHALIA.

P. inermis, J. Ag. Kütz., Sp. Alg., 570.
J. Ag., S. G. et O. Alg., I, 178. Harv., Phyc. Aus., IV, pl. 238.

NEREIA.

N. australis, Harv. Harv., Flor. Tasm., II, pl. 188.
N. filiformis, Zan. Kütz., Sp. Alg. Sub nomine Clatothele filiformis. J. Ag., S. G. et O. Alg., I, 175. Sub nom. Sporochnus.
* N. lophocladia, J. Ag. Ms., spec. nov., 1889.

SPOROCHNUS.

S. apodus, Harv. Flor. Tasm., II, pl. 287.
S. comosus, Ag. J. Ag., S. G. et O. Alg., I, 174.
Harv., Phyc. Aus., II, pl. 104.
S. moorei, Harv. Harv., Phyc. Aus., 1, pl. 19.
S. pedunculatus, Harv. J. Ag., S. G. et O. Alg., I, 174.
S. radiciformis, Ag. J. Ag., S. G. et O. Alg., I, 175.
Harv., Phyc. Aus., IV, pl. 225.

DESMARESTIA.

* D. obtusa, J. Ag. Ms., sp. nov., 1885 (Western Port).

Ordo III. LAMINARIEÆ.

MACROCYSTIS.

M. pyrifera, Ag. Kütz., Sp. Alg., 582.
J. Ag., S. G. et O. Alg., I, 156. Harv., Phyc. Aus., IV, pl. 202.

ECKLONIA.

E. radiata, J. Ag. J. Ag., S. G. et O. Alg., I, 146.

CHORDA.

C. lomentaria, Lyngb. Kütz., Sp. Alg., 548.
J. Ag., S. G. et O. Alg., I, 126. Sub. nomine Scytosiphon lomentarium.

Ordo IV. DICTYOTEÆ.

HALYSERIS.

H. acrostichoides, J. Ag. J. Ag., Alg. Syst., II, p. 133.
H. muelleri, Sond. J. Ag., Alg. Syst., II, p. 132.
Harv., Phyc. Aus., III, pl. 189.

PADINA.

P. commersoni, J. Ag. Kütz., Sp. Alg., 565.
J. Ag., S. G. et O. Alg., I, 113,
P. pavonia, Gaillon. Kütz., Sp. Alg., 565.
J. Ag., S. G. et O. Alg., I, 113.

ZONARIA.

Z. crenata, J. Ag. J. Ag., Alg. Syst., I, p. 48.
Z. flava, Harv. Kütz., Sp. Alg., 563. Sub nomine Stypopodium flavum.
J. Ag., S. G. et O. Alg., I, 110. J. Ag., Alg. Syst., I, p. 49.
Z. microphylla, Harv. J. Ag., Alg. Syst., I, p. 49.
Harv., Phyc. Aus., IV., pl. 195.
Z. nigrescens, Sond. Kütz., Sp. Alg., 561. J. Ag., S. G. et O. Alg., I, 108. J. Ag., Alg. Syst., I, p. 46.
Z. stuposa, J. Ag. Kütz., Sp. Alg., 564. J. Ag., S. G. et O. Alg., I, 110. J. Ag., Alg. Syst., I, p. 50.
Z. turneriana, J. Ag. J. Ag., Alg. Syst., I, p. 48.

LOBOSPIRA.

L. bicuspidata, Aresch. Harv., Phyc. Aus., I, pl. 34.

CUTLERIA.

C. multifida, Grev. Kütz., Sp. Alg., 558.
J. Ag., S. G. et O. Alg., I, 104.

TAONIA.

T. atomaria, J. Ag. Kütz., Sp. Alg., 563. Sub genere Stypopodium. J. Ag., S. G. et O. Alg., I, 101.

SPATOGLOSSUM.

S. australasicum, J. Ag. J. Ag., Alg. Syst., II, p. 113.
* S. cuneatum, J. Ag. Ms., Species nova, 1886.

DILOPHUS.

D. fastigiatus, Kütz. J. Ag., Alg. Syst., II, p. 107.
Harv., Phyc. Aus., II, pl. 82.
D. foliosus, J. Ag. Ms.
D. gunnianus, J. Ag. J. Ag., Alg. Syst., II, p. 106.
D. opacus, J. Ag. J. Ag., Alg. Syst., II, p. 107.
D. tener, J. Ag. Ms., nondum descripta.
* D. wilsoni, J. Ag. Ms., species nova, 1884.

DICTYOTA.

D. abyssinica, Kütz. Tab. Phyc., Vol. IX, tab. 21.
D. apiculata, J. Ag. Ms., nondum descripta.
D. dichotoma, J. Ag. J. Ag., S. G. et O. Alg., I, 92.
J. Ag., Alg. Syst., II, p. 92.
D. diemensis, Sond. J. Ag., Alg. Syst., II, p. 97.
D. foliolosa, J. Ag. Ms., nondum descripta.
D. furcellata, J. Ag. J. Ag., S. G. et O. Alg., I, 90.
J. Ag., Alg. Syst., II, p. 102.
Harv., Phyc. Aus., I, pl. 38.
D. nigricans, J. Ag. J. Ag., Alg. Syst., II, p. 94.
D. paniculata, J. Ag. J. Ag., S. G. et O. Alg. 91.
J. Ag., Alg. Syst., II, p. 105.
D. pellucida, J. Ag. Ms., nondum descripta.
D. pinnatifida, J. Ag. J. Ag., Alg. Syst., II, p. 100.
D. radicans, Harv. J. Ag., Alg. Syst., II, p. 92.
Harv., Phyc. Aus., II, pl. 119.

STILOPHORA.

S. lyngbyei, J. Ag. Kütz., Sp. Alg., 549. Sub nomine Spermatochnus paradoxus.
J. Ag., S. G. et O. Alg., I, 84.

ASPEROCOCCUS.

A. sinuosus, Bory. Kütz., Sp. Alg., 552. Sub nomine Encœlium sinuosum. J. Ag., S. G. et O. Alg., I, p. 75.
A. turneri, Harv. Kütz., Sp. Alg., 552. J. Ag., S. G. et O. Alg., I, 77. Sub nomine A. bullosus.

Ordo V. CHORDARIEÆ.

POLYCEREA.

P. ramulosa, J. Ag. J. Ag., Alg. Syst., II, p. 48.

BACTROPHORA.

B. nigrescens, J. Ag. J. Ag., Alg. Syst., II, p. 26.

Ordo VI. SPHACELARIEÆ.

CLADOSTEPHUS.

C. spongiosus, Harv. J. Ag., S. G. et O. Alg., I, 43.
C. verticillatus, Ag. Kütz., Sp. Alg., 469.
J. Ag., S. G. et O. Alg., I, 43.

SPHACELARIA.

S. paniculata, Lb. Kütz., Sp. Alg., 467.
J. Ag., S. G. et O. Alg., I, 36.

Ordo VII. ECTOCARPEÆ.

ECTOCARPUS.

E. fasciculatus, Harv. Kütz., Sp. Alg., 452.
J. Ag., S. G. et O. Alg., I, 22.
E. giraudiæ, J. Ag. Ms.
E. siliculosus, Harv. Kütz., Sp. Alg., 453. Sub nomine E. gracillimus. J. Ag., S. G. et O. Alg., I, 22.
E. sordidus, Harv. Flor. Tasm, II, p. 294.

RHODOSPERMEÆ (FLORIDEÆ.)

Ordo I. RHODOMELEÆ.

CLAUDEA.

C. elegans, Lamour. Kütz., Sp. Alg., 888.
J. Ag., S. G. et O. Alg., II, 1275.
J. Ag., Flor. Morph., XXXII, 30–33.
Harv., Phyc. Aus., I, pl. 1.

SARCOMENIA.

S. dasyoides, Harv. J. Ag., S. G. et O. Alg., II, 1263.
S. delesserioides, Sond. Kütz., Sp. Alg., 880.
J. Ag., S. G. et O. Alg., II, 1266.
Harv., Phyc. Aus., III, pl. 121.
S. tenera, J. Ag. Harv., Phyc. Aus., V, pl. 257.
S. victoriæ, J. Ag. J. Ag., S. G. et O. Alg., II, 1262.

HANOVIA.

H. arachnoidea, Harv. J. Ag., S. G. et O. Alg., II, 1254.
Harv., Phyc. Aus., I, pl. 37. Sub nom. Halodictyon.
H. robusta, Harv. J. Ag., S. G. et O. Alg., II, 1254.
Harv., Phyc. Aus., I, pl. 37.

TRIGENEA.

T. umbellata, J. Ag. J. Ag., Alg. Syst., VI, 116.

DICTYURUS.

D. quercifolius, Decaisne. Kütz., Sp. Alg., 673. Sub nom. Thuretia. J. Ag., S. G. et O. Alg., II, 1245. Harv., Phyc. Aus., I, pl. 40.
D. teres, J. Ag. J. Ag., S. G. et O. Alg., II, 1244.
Harv., Phyc. Aus., IV, pl. 191.

DASYA.

* D. atactica, J. Ag. J. Ag., Alg. Syst., VI, p. 107. Species nova, 1886.
D. ceramioides, J. Ag. Kütz., Sp. Alg., 801. Sub nom. Trichothamnion ceramioides. J. Ag., S. G. et O. Alg., II, 1187. J. Ag., Alg. Syst., VI, p. 106.

* D. dictyuroides, J. Ag. Species nova, 1886. Olim dictyurus gymnopus.
J. Ag., Alg. Syst., VI, p. 111.
D. gunniana, Harv. Kütz., Sp. Alg., 798. Sub nomine Eupogonium gunnianum.
J. Ag., Alg. Syst., VI, p. 85. J. Ag., S. G. et O. Alg., II, 1200.
D. gunniana v. laurenciana, Harv. Kütz., Sp. Alg., 832.
J. Ag., S. G. et O. Alg., II, 1201.
D. haffiæ, Harv. J. Ag., S. G. et O. Alg., II, 1237.
J. Ag., Alg. Syst., VI, p. 97. Harv., Phyc. Aus., III, pl. 143.
D. hapalathrix, Harv. J. Ag., S. G. et O. Alg., 1211.
J. Ag., Alg. Syst., VI, p. 96. Harv., Phyc. Aus., II, pl 88.
* D. microcladioides, J. Ag. Species ad D. pellucidam olim relata. J. Ag., Alg. Syst., VI, p. 82.
D. muelleri, Sond. J. Ag., S. G. et O. Alg., II. 1196.
J. Ag., Alg. Syst., VI, p. 84. Harv., Phyc. Aus., I, pl. 31.
D. naccarioides, Harv. J. Ag., S. G. et O. Alg., II, 1217.
J. Ag., Alg. Syst., VI, p. 100.
D. villosa, Harv. J. Ag., S. G. et O. Alg., II, 1215.
J. Ag., Alg. Syst., VI, p. 103.
D. villosa v. macroura, Harv. Sub D. villosâ species duo confusas potius crederem.
* D. wilsonis, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., VI, p. 88.
D. wrangelioides, Harv. J. Ag., S. G. et O. Alg., 1192.
J. Ag., Alg. Syst., VI, p. 86. Harv., Phyc. Aus., III, pl. 174.

LOPHOTHALIA.

L. australis, J. Ag. Olim Polysiphonia australis, aut P. cladostephus. J. Ag., S. G. et O. Alg., II, 1044. J. Ag., Alg. Syst., VI, p. 59.
Harv., Phyc. Aus., III, pl. 154.
L. bolbochæte, J. Ag. Olim Dasya bolbochæte.
J. Ag., S. G. et O. Alg., II, 1233. J. Ag., Alg. Syst., VI, p. 63.
L. feredayæ, J. Ag. Olim dasya. f. J. Ag., S. G. et O. Alg. II, 1235. J. Ag., Alg. Syst., VI, p. 62.
Harv., Phyc. Aus., III, pl. 173.

L. hormoclados, J. Ag. = Dasya. h. J. Ag., S. G. et O. Alg., II, 1188. J. Ag., Alg. Syst., VI, p. 59.
L. verticillata, J. Ag. = Dasya. v. J. Ag., S. G. et O. Alg., II, 1234. J. Ag., Alg. Syst., VI, p. 61.

POLYZONIA.

P. flaccida, Harv. J. Ag., S. G. et O. Alg., II, 1165.
J. Ag., Flor. Morph., XXXII, 24. Harv., Phyc. Aus., I, pl. 42.
P. incisa, J. Ag. Kütz., Sp. Alg., 882.
J. Ag., S. G. et O. Alg., II, 1165.
Harv., Phyc. Aus., I, pl. 42.

CLIFTONÆA.

C. pectinata, Harv. J. Ag., S. G. et O. Alg., II, 1160.
J. Ag., Flor. Morph., XXXII, 22.
Harv. Phyc. Aus., II, pl. 100.

POLYPHACUM.

P. smithiæ, Harv. Kütz., Sp. Alg., 878. Sub nomine Epiglossum smithii.
J. Ag., S. G. et O. Alg., II, 1132.

LENORMANDIA.

L. chauvinii, Harv. J. Ag., S. G. et O. Alg., II, 1104.
L. marginata, Harv. J. Ag., S. G. et O. Alg., II, 1107.
Harv., Phyc. Aus., IV, pl. 235.
L. muelleri, Harv. J. Ag., S. G. et O. Alg., II, 1105.
Harv., Phyc. Aus., I, pl. 45.
L. prolifera, J. Ag. J. Ag., S. G. et O. Alg., II, 1103.
Harv., Phyc. Aus., V, pl. 246.

RYTIPHLÆA.

R. australasica, Kütz., Sp. Alg., 841. Sub nomine Halopithys a. J. Ag., S. G. et O. Alg., II, 1192.
Harv., Phyc. Aus., I, pl. 27.
R. elata, Sond. J. Ag., S. G. et O Alg., II, 1088.
J. Ag., Alg. Syst., IV, p. 106.
Harv., Phyc. Aus., IV, pl. 236.
R. umbellata, J. Ag. Ms., hanc speciem nusquam invenio descriptam.

DICTYMENIA.

D. harveyana, Sond. J. Ag., S. G. et O. Alg., II, 1079.
J. Ag., Alg. Syst., IV, p. 104.
D. tridens, Kütz., Sp. Alg., 848. J. Ag., S. G. et O. Alg., II, 1081.
J. Ag., Alg. Syst., IV, p. 105.

POLYSIPHONIA.

P. blandi, Harv. J. Ag., S. G. et O. Alg., II, 976.
Harv., Phyc. Aus., IV, pl. 184.
P. cancellata, Harv. Kütz., Sp. Alg., 815.
J. Ag., S. G. et O. Alg., 1049. J. Ag., Flor. morph., XXXIII, 7–8.
P. frutex, Harv. Kütz., Sp. Alg., 815.
J. Ag., S. G. et O. Alg., 1047.
P. hookeri, Harv. Kütz., Sp. Alg., 832. J. Ag., S. G. O. Alg., II, 1019.
P. hystrix, Harv. Kütz., Sp. Alg., 832. J. Ag., S. G. et O. Alg., II, 1017.
P. laxa, Harv. Kütz., Sp. Alg., 827. J. Ag., S. G. et O. Alg., II, 1071.
P. lyallii, Harv. Kütz., Sp. Alg., 837. J. Ag., S. G. et O. Alg., II, 1021.
P. mallardiæ, Harv. Kütz., Sp. Alg., 834. J. Ag., S. G. et O. Alg., II, 1020.
P. mollis, Harv. Kütz., Sp. Alg., 823. J. Ag., S. G. et O. Alg., II, 968.
P. pectinella, Harv. J. Ag., S. G. et O. Alg., II, 918.
P. pennata, Harv. Kütz., Sp. Alg., 803.
J. Ag., S. G. et O. Alg., II, 928.
P. rostrata, Harv. Kütz., Sp. Alg., 809.
J. Ag., S. G. et O. Alg., II, 926.
P. rufolanosa, Harv. J. Ag., S. G. et O. Alg., II, 939.
* P. sphacelarioides, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., IV, p. 100.
P. spinosissima, Harv. J. Ag., S. G. et O. Alg., II, 1045.
Harv., Phyc. Aus., III, pl. 155.
P. succulenta, Harv. Kütz., Sp. Alg., 824. Sub nomine P. subtilis. J. Ag., S. G. et O. Alg., II, 968.
P. versicolor, Hook. et Harv. Kütz., Sp. Alg., 805.
J. Ag., S. G. et O. Alg., II, 922.

N 2

RHODOMELA.

R. periclada, Sond. J. Ag., S. G. et O. Alg., II, 878.
Harv., Phyc. Aus., I, pl. 28.

ALSIDIUM.

A. comosum, Harv. Harv., Phyc. Aus., V, pl. 270.
J. Ag., Alg. Syst., VI, p. 52.

JEANNERETTIA.

J. lobata, Hook. et Harv. Kütz., Sp. Alg., 881. Sub nomine Botryoglossum lobatum.
J. Ag., S. G. et O. Alg., II, 837. J. Ag., Flor. Morph., XXXIII, 20–23. Harv., Phyc. Aus., I, pl. 33.

MELANOSERIS.

M. crispata, Zanard. Phyceæ australicæ novæ, Z.

POLLEXFENIA.

* P. crenata, J. Ag. Ms., species nova, 1891.
* P. nana, J. Ag. Ms., species nova, 1891.
P. pedicellata, Harv. Kütz., Sp. Alg., 875.
J. Ag., S. G. et O. Alg., II, 834.

MARTENSIA.

M. australis, Harv. J. Ag., S. G. et O. Alg., II, 827.
Harv., Phyc. Aus., I, pl. 8.
M. elegans, Harv. Kütz., Sp. Alg., 888.
J. Ag., S. G. et O. Alg., II, 828.

ACANTHOPHORA.

A. arborea, Harv. J. Ag., S. G. et O. Alg., II, 822.
Harv., Phyc. Aus., III, pl. 132.

CHONDRIOPSIS.

* C. arborescens, J. Ag. Ms., species nova, 1891.
C. debilis, J. Ag. = Chondria debilis, Harv.
Harv., Syn. Cat., 206.
* C. foliifera, J. Ag. Species nova, 1882.
J. Ag., Alg. Syst., IV, p. 90.
C. fusifolia, J. Ag. = Chondria fusifolia, Harv.
Harv., Syn. Cat., 207.
C. harveyana, J. Ag. J. Ag., S. G. et O. Alg., 808.
* C. ovalifolia, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI, p. 48.
* C. succulenta, J. Ag. Ms., species nova, 1883.

Ordo II. CHONDRIEÆ.

* HALITÆNIA.

* H. wilsonis, J. Ag. Species nova, 1890. Ms.

LEPTOPHYLLIS.

L. conferta, J. Ag. J. Ag., S. G. et O. Alg., III, 676.
Harv., Phyc. Aus., III, pl. 144. Sub nomine Cladhymenia conferta.

PTILONIA.

P. australasica, Harv. J. Ag., S. G. et O. Alg., III, 674.
* P. subulifera, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., VI, p. 46.

DELISEA.

D. elegans, J. Ag. Kütz., Sp. Alg., 670. Sub nomine Rhodocallis elegans. J. Ag., S. G. et O. Alg., III, 670.
D. hypneoides, Harv. J. Ag., S. G. et O. Alg., III, 670.
Harv., Phyc. Aus., III, pl. 134.
D. pulchra, Grev. Kütz., Sp. Alg., 770.
J. Ag., S. G. et O. Alg., III, 671.
Harv., Phyc. Aus., I, pl. 16.

BONNEMAISONIA.

B. asparagoides, J. Ag. Kütz., Sp. Alg., 842.
J. Ag., S. G. et O. Alg., III, 669.

ASPARAGOPSIS.

A. armata, Harv. J. Ag., S. G. et O. Alg., III, 666.
Harv., Phyc. Aus., IV, pl. 192.
A. delilei, Harv. Kütz., Sp. Alg., 802.
J. Ag., S. G. et O. Alg., III, 666.

LAURENCIA.

L. dendroidea, J. Ag. J. Ag., S. G. et O. Alg., III, 650.
L. elata, Harv. J. Ag., S. G. et O. Alg., III, 659.
L. forsteri, Grev. J. Ag., S. G. et O. Alg., III, 645.
L. grevilleana, Harv. J. Ag., S. G. et O. Alg., III, 661.
Harv., Phyc. Aus., I, pl. 15.
L. obtusa, Grev. J. Ag., S. G. et O. Alg., III, 653.

CORYNECLADIA.

C. umbellata, J. Ag. J. Ag., S. G. et O. Alg., III, 643.

CŒLOCLONIUM.

C. opuntioides, Harv. J. Ag., S. G. et O. Alg., III, 640.
C. verticillatum, Harv. J. Ag., S. G. et O. Alg., III, 640.
Harv., Phyc. Aus., II, pl. 102. Sub nomine Chondria verticillata.

Ordo III. WRANGELIEÆ.

WRANGELIA.

W. ballioides, J. Ag. J. Ag., S. G. et O. Alg., III, 621.
W. clavigera, Harv. J. Ag., S. G. et O. Alg., III, 621.
Harv., Phyc. Aus., V, pl. 287.
W. crassa, Hook. et Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 620.
W. halurus, Harv. J. Ag., S. G. et O. Alg., 619.
Harv., Phyc. Aus., II, pl. 70.
* W. incurva, J. Ag. Ms., species nova, 1886.
W. mucronata, Harv. J. Ag., S. G. et O. Alg., III, 616.
W. nitella, Harv. J. Ag., S. G. et O. Alg., III, 616.
Harv., Phyc. Aus., II, pl. 105.
W. nobilis, Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 622.
W. plumosa, Harv. Kütz., Sp. Alg., 664.
J. Ag., S. G. et O. Alg., III, 624.
W. princeps, Harv. J. Ag., S. G. et O. Alg., III, 624.
Harv., Phyc. Aus., IV, pl. 234.
W. protensa, Harv. J. Ag., S. G. et O. Alg., III, 619.
W. setigera, Harv. J. Ag., S. G. et O. Alg., III, 622.
J. Ag., Flor. Morph., XXXII, 3.
W. velutina, Harv. J. Ag., S. G. et O. Alg., III, 617.
J. Ag., Flor. Morph., XXXII, 1–2.
Harv., Phyc. Aus., I, pl. 46.
W. verticillata, Harv. Kütz., Sp. Alg., 664.
J. Ag., S. G. et O. Alg., III, 619.

BORNETIA.

B. meredithiana, J. Ag. J. Ag., S. G. et O. Alg., III, 614

MONOSPORA.

M. australis, Harv. J. Ag., S. G. et O. Alg., III, 610.
Harv., Phyc. Aus., V, pl. 253. Sub nomine Corynospora australis.

Ordo IV. SOLIERIEÆ.

RHABDONIA.

R. charoides, Harv. J. Ag., S. G. et O. Alg., III, 594.
Harv., Phyc. Aus., IV, pl. 196.
R. clavigera, J. Ag. J. Ag., S. G. et O. Alg., III, 594.
R. coccinea, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 591. Harv., Phyc. Aus., I, pl. 54.
R. dendroides, Harv. J. Ag., S. G. et O. Alg., III, 591.
Harv., Phyc. Aus., III, pl. 152.
R. mollis, Harv. J. Ag., S. G. et O. Alg., III, 593.
R. nigrescens, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 590.
R. robusta, Grev. J. Ag., S. G. et O. Alg., III, 592.
Harv., Phyc. Aus., III, pl. 149. Sub nomine Solieria australis.
R. verticillata, Harv. J. Ag., S. G. et O. Alg., III, 594.
Harv., Phyc. Aus., V, pl. 299.

Ordo V. HYPNEACEÆ.

ECTOCLINIUM.

E. dentatum, J. Ag. J. Ag., S. G. et O. Alg., III, 575.
J. Ag., Flor. Morph., XXX, 1–8.

MYCHODEA.

M. carnosa, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 571. Harv., Phyc. Aus., III, pl. 142.
* M. decipiens, J. Ag. Ms., species nova, 1887.
M. foliosa, Harv. J. Ag., S. G. et O. Alg., III, 573.
Harv., Phyc. Aus., IV, pl. 194. Sub nomine Gymnogongrus foliosus.
M. hamata, J. Ag. J. Ag., S. G. et O. Alg., 572.
Harv., Phyc. Aus., III, pl. 141. Sub nomine Acanthococcus ewingii.
M. terminalis, Harv. J. Ag., S. G. et O. Alg., III, 570.
Harv., Phyc. Aus., IV, pl. 200.

MERRIFIELDIA.

M. ramentacea, J. Ag. J. Ag., Alg. Syst., IV, p. 56.

HYPNEA.

H. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 563.
Sub nomine H. divaricata.
H. episcopalis, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 561.
Harv., Phyc. Aus., I, pl. 23.
H. musciformis, J. Ag. J. Ag., S. G. et O. Alg., III, 561.
H. ramentacea, J. Ag. J. Ag., S. G. et O. Alg.. III, 561.
H. seticulosa, J. Ag. J. Ag., S. G. et O. Alg., III, 562.
J. Ag., Flor. Morph., XXIX, 13–16.

GATTYA.

G. pinnella, Harv. J. Ag., S. G. et O. Alg., III, 560.
Harv., Phyc. Aus., II, pl. 93.

Ordo VI. GELIDIEÆ.

GELIDIUM.

G. asperum, Harv. J. Ag., S. G. et O. Alg., III, 551.
G. australe, J. Ag. J. Ag., S. G. et O. Alg., III, 550.
G. corneum, Auch. J. Ag., S. G. et O. Alg., III, 549.
J. Ag., Flor. Morph., XXIX, 7–8.
G. glandulæfolium, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 551.
Harv., Phyc. Aus., I, pl. 18.

PTEROCLADIA.

P. lucida, J. Ag. J. Ag., S. G. et O. Alg., III, 545.
Harv., Phyc. Aus., V, pl. 248.

Ordo VII. CHÆTANGIEÆ.

ACROTYLUS.

A. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 541.
J. Ag., Flor. Morph., XXIX, 2–6.
Harv., Phyc. Aus., II, pl. 99.

BINDERA.

B. splachnoides, Harv. J. Ag., S. G. et O. Alg., III, 536.
Harv., Phyc. Aus., II, pl. 111.
J. Ag., Alg. Syst., IV, p. 46.

Ordo VIII. HELMINTHOCLADIACEÆ.

GALAXAURA.

G. marginata, Lamour. J. Ag., S. G. et O. Alg., III, 534.
Sub nom. Zanardinia marginata.
Harv., Phyc. Aus., III, pl. 136.

LIAGORA.

L. australasica, Sond. Kütz., Sp. Alg., 538.
L. viscida, Ag. Kütz., Sp. Alg., 538.
J. Ag., S. G. et O. Alg., III, 518.

SCINAIA.

S. furcellata, Biv. J. Ag., S. G. et O. Alg., III, 512.
* S. moniliformis, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV., p. 72.

GLOIOPHLÆA.

G. scinaioides, J. Ag. J. Ag., S. G. et O. Alg., III, 510.
J. Ag., Flor. Morph., XXVIII, 1–5.

NEMALION.

N. insigne, Harv. J. Ag., S. G. et O. Alg., III, 508.
Harv., Phyc. Aus., V, pl. 284.

* TIAROPHORA.

* T. australis, J. Ag. J. Ag., Genus novum et species nova, 1887.
J. Ag., Alg. Syst., VI, p. 45.

HELMINTHORA.

H. divaricata, J. Ag. Kütz., Sp. Alg., 713. Sub nomine Nemalion divaricatum.
J. Ag., S. G. et O. Alg., III, 507.
J. Ag., Flor. Morph., XXVIII, 6–11.

HELMINTHOCLADIA.

H. australis, Harv. J. Ag., S. G. et O. Alg., III, 506.
J. Ag., Alg. Syst., VI, p. 39.
Harv., Phyc. Aus., V, pl. 272.

Ordo IX. DELESSERIEÆ.

DELESSERIA.

D. frondosa, Harv. Kütz., Sp. Alg., 876. Sub nomine Hypoglossum frondosum. J. Ag., S. G. et O. Alg., III, 485.
J. Ag., Flor. Morph., XXVI, 18–19.
Harv., Phyc. Aus., III, pl. 179.

* D. heterocystidea, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., IV, p. 71.

D. imbricata, Aresch. J. Ag., S. G. et O. Alg., III, 494.
Harv., Phyc. Aus., IV, pl. 240. Sub nomine Chauvinia imbricata.

* D. marginifera, J. Ag. Species nova? A me lecta et ad J. G. Agardh, missa anno 1890. Sub numero 55. Descriptionem hucusque invenire nequeo.

D. revoluta, Harv. J. Ag., S. G. et O. Alg., III, 490.
Harv., Phyc. Aus., III, pl. 170.

D. simulans, J. Ag. Kütz., Sp. Alg., 876. Sub nomine Hypoglossum lyallii.
J. Ag., S. G. et O. Alg., III, 488.

NITOPHYLLUM.

N. affine, Harv. Kütz., Sp. Alg., 869. Sub nomine Aglaophyllum affine. J. Ag., S. G. et O. Alg., III, 456.

N. crispum, Kütz. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 448.

N. endiviæ-folium, Hook. et Harv. Alg. Tasm., p. 6.
J. Ag., S. G. et O. Alg., III, p. 461.

N. erosum, Harv. J. Ag., S. G. et O. Alg., III, 460.
Harv., Phyc. Aus., II, pl. 94.

* N. fallax, J. Ag. Ms., species nova, 1887.

N. gattyanum, J. Ag. J. Ag., S. G. et O. Alg., III, 454.

N. gunnianum, Harv. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 456.
J. Ag., Flor. Morph., XXVII, 13.
Harv., Phyc. Aus., V, pl. 241.

N. multipartitum, Hook. et Harv. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 457.

N. obscurum, J. Ag. J. Ag., S. G. et O. Alg., III, 452.

N. parvifolium, Ag. J. Ag., S. G. et O. Alg., III, 457.

N. polyanthum, J. Ag. J. Ag., S. G. et O. Alg., III, 461.
N. pristoideum, Harv. J. Ag., S. G. et O. Alg., III, 460. Harv., Phyc. Aus., IV, pl. 229.
N. pulchellum, Harv. J. Ag., S. G. et O. Alg., III, 447.
* N. subfulvum, J. Ag. Ms., species nova, 1889.
N. uncinatum, J. Ag. Kütz., Sp. Alg., 870. Sub nomine Cryptopleura lacerata. J. Ag., S. G. et O. Alg., III, 465.

Ordo X. SPHÆROCOCCOIDEÆ.

STENOCLADIA.

S. furcata, J. Ag. J. Ag., S. G. et O. Alg., III, 439. Harv., Phyc. Aus., IV, pl. 215.

HERINGIA.

* H. ceramioides, J. Ag. Ms., species nova, 1888.

DICRANEMA.

D. filiforme, Sond. Kütz., Sp. Alg., 757. Sub nomine Cystoclonium filiforme. J. Ag., S. G. et O. Alg., III, 436.
D. grevillei, Sond. J. Ag., S. G. et O. Alg., III, 435. Harv., Phyc. Aus., II, pl. 120.
J. Ag., Flor. Morph., XXVI, 4–5.
* D. ramulifera, J. Ag. Ms., species nova, 1891.

SARCODIA.

S. montagneana, Kütz. Sp. Alg., 787. Sub nomine Rhodophyllis montagneana.
J. Ag., S. G. et O. Alg., III, 431.
S. novæ-hollandiæ, J. Ag. Ms.? Descriptionem nusquam invenio; planta a me ad J. G. Agardh relata, sub æstate 1887, sic ab illo determinata.
S. palmata, Sond. Alg., Nov. Holl. trop., p. 22.

TYLOTUS.

T. obtusatus, J. Ag. Kütz., Sp. Alg., 784. Sub nomine Sphærococcus obtusatus. J. Ag., S. G. et O. Alg., III, 429. Harv., Phyc. Aus., IV, pl. 210.
J. Ag., Flor. Morph., XXIV, 7–8.

GRACILARIA.

G. confervoides, Grev. Kütz., Sp. Alg., 772. Sub nomine Sphærococcus confervoides.
J. Ag., S. G. et O. Alg., III, 413.

G. fruticosa, Harv. J. Ag., S. G. et O. Alg., III, 416.
Harv., Syn. Cat., 427.

G. furcellata, Harv. J. Ag., S. G. et O. Alg., III, 419.
Harv., Phyc. Aus., IV, pl. 286.

MELANTHALIA.

M. obtusata, Mont. J. Ag., S. G. et O. Alg., III, 404.
Harv., Phyc. Aus., I, pl. 25.

CURDIÆA.

C. laciniata, Harv. J. Ag., S. G. et O. Alg., III, 402.
Harv., Phyc. Aus., I, pl. 39.

PHACELOCARPUS.

P. labillardierii, J. Ag. J. Ag., S. G. et O. Alg., III, 399.
Harv., Phyc. Aus., III, pl. 163.

NIZYMENIA.

N. australis, Sond. J. Ag., S. G. et O. Alg., III, 397.
Harv., Phyc. Aus., III, pl. 165.

Ordo XI. CORALLINEÆ.

CORALLINA.

C. officinalis, Lamour. Kütz., Sp. Alg., 708. Sub nomine C. palmata. J. Ag., S. G. et O. Alg., II, 562.

C. cuvieri, Lamour. Kütz., Sp. Alg., 708.
J. Ag., S. G. et O. Alg., II, 572.

C. nana, Zan. Kütz., Sp. Alg., 709. J. Ag., S. G. et O. Alg., II, 564.

C. pilifera, Lamour. Kütz., Sp. Alg., 708. J. Ag., S. G. et O. Alg., II, 571.

JANIA.

J. fastigiata, Harv. J. Ag., S. G. et O. Alg., II, 556.
Harv., Phyc. Aus., V, pl. 251

J. micrarthrodia, Lamour. J. Ag., S. G. et O. Alg., II, 555.

ARTHROCARDIA.

A. wardii, Harv. J. Ag., S. G. et O. Alg., II, 551.

AMPHIROA.

A. australis, Sond. Kütz., Sp. Alg., 703.
J. Ag., S. G. et O. Alg., II, 537.
Harv., Phyc. Aus., II, pl. 77.
A. charoides, Lamour. Kütz., Sp. Alg., 702.
J. Ag., S. G. et O. Alg., II, 539.
A. stelligera, Lamour. Kütz., Sp. Alg., 701.
J. Ag., S. G. et O. Alg., II, 540.
Harv., Phyc. Aus., IV, pl. 230.

MASTOPHORA.

M. lamourouxii, Decaisne. J. Ag., S. G. et O. Alg., II, 526.

LITHOTHAMNION.

L. mamillare, Harv. J. Ag., S. G. et O. Alg., II, 521.

MELOBESIA.

M. patena, Hook. et Harv. Kütz., Sp. Alg., 696. Sub nomine Mastophora crassiuscula. J. Ag., S. G. et O. Alg., II, 514.

Ordo XII. SQUAMARIEÆ.

PEYSSONELIA.

P. australis, Sond. Harv., Phyc. Aus., II, pl. 81.

Ordo XIII. RHODYMENIACEÆ.

RHODOPHYLLIS.

R. goodwiniæ, J. Ag. J. Ag., S. G. et O. Alg., III, 367.
J. Ag., Flor. Morph., XXII, 1–7.
R. gunnii, Harv. J. Ag., S. G. et O. Alg., III, 366.
R. pulchella, J. Ag. Ms., speciei diagnosin nusquam video; specimina ad J. G. Agardh missa sub numeris 70, anno 1888, et 98, anno 1884.
R. ramentacea, Ag. J. Ag., S. G. et O. Alg., III, 365.
R. volans, Harv. J. Ag., S. G. et O. Alg., III, 363.
Harv., Phyc. Aus., IV, pl. 216.

PLOCAMIUM.

P. angustum, J. Ag. J. Ag., S. G. et O. Alg., II, 402, III, 343.
P. coccineum, Lamour. Kütz., Sp. Alg., 883.
J. Ag., S. G. et O. Alg., II, 395, III, 339.
P. costatum, J. Ag. Kütz., Sp. Alg., 886.
J. Ag., S. G. et O. Alg., II, 403, III, 344.
P. cystophyllum, J. Ag. J. Ag., S. G. et O. Alg., III, 339. Sub nom. P. coccinium, var. uncinatum.
P. leptophyllum, Kütz. Sp. Alg., 885.
J. Ag., S. G. et O. Alg., III, 338.
P. mertensii, Harv. J. Ag., S. G. et O. Alg., III, 346.
P. nidificum, Harv. J. Ag., S. G. et O. Alg., III, 346.
P. preissianum. Sond. Kütz., Sp. Alg., 885.
J. Ag., S. G. et O. Alg., III, 342.
Harv., Phyc. Aus., II, pl. 63.
P. procerum, J. Ag. Kütz., Sp. Alg., 886.
J. Ag., S. G. et O. Alg., III, 347.
Harv., Phyc. Aus., IV, pl. 223.

EPYMENIA.

E. angustata, Sond. Harv., Syn. Cat., 582.
E. halymenoides, J. Ag. J. Ag., Epicr., p. 694.
E. membranacea, Harv. J. Ag., S. G. et O. Alg., 334.
Harv., Phyc. Aus., II, pl. 89.

RHODYMENIA.

R. corallina, Auch. Kütz., Sp. Alg., 780. Sub nomine Sphærococcus corallinus. J. Ag., S. G. et O. Alg., III, 330.
R. foliifera, Harv. J. Ag., S. G. et O. Alg., III, 331.
Harv., Syn. Cat., 508.
R. leptophylla, J. Ag. Hujus speciei descriptionem non vidi.
R. linearis, J. Ag. J. Ag., S. G. et O. Alg., III, 331.
* R. stenoglossa, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., IV, p. 50.

* AMPHIBRACHIA.

* A. hymenocladioides, J. Ag. Ms., novum genus et species nova, 1891.

CORDYLECLADIA.

C. australis, J. Ag. Diagnosin nusquam invenio.
C. furcellata, J. Ag. J. Ag., S. G. et O. Alg., III, 327.

GLOIOPHYLLIS.

G. barkeriæ, J. Ag. = Rhodophyllis barkeriæ, Harv.
J. Ag., Alg. Syst., VI, p. 29.
Harv., Phyc. Aus., V, pl. 276.
G. barkeriæ, var. palmata, J. Ag.
J. Ag., Alg. Syst., VI, p. 30.

CHRYSYMENIA.

* C. gelatinosa, J. Ag. Species nova, 1889.
J. Ag., Alg. Syst., VI, p. 24.
C. obovata, Sond. Kütz., Sp. Alg., 865. Sub nomine Gastroclonium obovatum.
J. Ag., S. G. et O. Alg., III, 324.
Harv., Phyc. Aus., I, pl. 10.
* C. polyglotta, J. Ag. Ms., species nova, 1886.

GLOIOSACCION.

G. brownii, Harv. Kütz., Sp. Alg., 719. Sub nomine Dumontia ovalis.
J. Ag., S. G. et O. Alg., III, 317.
Harv., Phyc. Aus., II, pl. 83.
G. hydrophora, Harv. Diagnosis deest. Forsitan Kütz., Sp. Alg., 719. Dumontia hydrophora.

HYMENOCLADIA.

H. conspersa, J. Ag. = Chrysymenia meredithiana.
J. Ag., S. G. et O. Alg., III, 315.
Harv., Phyc. Aus., IV, pl. 237. Sub nomine Calliblepharis conspersa.
H. gracilarioides, J. Ag. J. Ag., S. G. et O. Alg., III, 313.
Harv., Phyc. Aus., V, pl. 260. Sub nomine Gracilana ramalina.
H. linearis, Sond. Sond., Bot. Zeit. Diagnosin non vidi.
H. polymorpha, Harv. J. Ag., S. G. et O. Alg., III, 315.
Harv., Phyc. Aus., III, pl. 157. Sub nomine Rhodymenia polymorpha.
H. usnea, J. Ag. J. Ag., S. G. et O. Alg., III, 313.
Harv., Phyc. Aus., II, pl. 118.

Ordo XIV. CHAMPIEÆ.

CHAMPIA.

C. affinis, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 304.
C. parvula, Harv. J. Ag., S. G. et O. Alg., III, 303.
C. tasmanica, Harv. Kütz., Sp. Alg., 861.
J. Ag., S. G. et O. Alg., III, 306.
J. Ag., Flor. Morph., XIX, 10–12.

CHYLOCLADIA.

C. clavellosa, Grev. Kütz., Sp. Alg., 859. Sub nomine Chondrothamnion clavellosum.
J. Ag., S. G. et O. Alg., III, 297.
* C. corynephora, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., VI, p. 23.
* C. foliifera, J. Ag. Species nova, 1886. Nondum descripta.
* C. monochlamydea, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI., p. 22.
C. muelleri, Sond. J. Ag., S. G. et O. Alg. III, 302.
Harv., Phyc. Aus., III, pl. 138.

FAUCHEA.

F. coronata, J. Ag. J. Ag., S. G. et O. Alg., III, 294.
Harv., Phyc. Aus., II, pl. 97.
J. Ag., Flor. Morph., XIX, 5–7.

HOREA.

H. fruticulosa, Harv. J. Ag., S. G. et O. Alg., III, 292.
Harv., Phyc. Aus., III, pl. 156.
H. halymenoides, Harv. J. Ag., S. G. et O. Alg., III, 292.
Harv., Phyc. Aus., II, pl. 67.
J. Ag., Flor. Morph., XIX, 1–4.
H. polycarpa, Harv. J. Ag., S. G. et O. Alg., III, 293.
H. speciosa, Harv. J. Ag., S. G. et O. Alg., III, 292.
* H. wilsonis, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV, p. 38.

Ordo XV. ARESCHOUGIEÆ.

THYSANOCLADIA.

T. laxa, Sond. J. Ag., S. G. et O. Alg., 288.
Harv., Phyc. Aus., IV, pl. 211.

ARESCHOUGIA.

A. conferta, Harv. Harv., Phyc. Aus., III, pl. 166.
J. Ag., S. G. et O. Alg., III, 440. Sub nomine Stenocladia harveyana.
A. congesta, J. Ag. J. Ag., S. G. et O. Alg., III, 281.
A. intermedia, J. Ag. Diagnosis me diligenter conquirentem præteriit.
A. laurencia, Hook. et Harv. J. Ag., S. G. et O. Alg., 282.
A. stuartii, Harv. J. Ag., S. G. et O. Alg., 282.
Harv., Phyc. Aus., V, pl. 294.

ERYTHROCLONIUM.

E. angustatum, Sond. J. Ag., S. G. et O. Alg., III, 278.
E. muelleri, Sond. J. Ag., S. G. et O. Alg., III, 278.
Harv., Phyc. Aus., V, pl. 298.

Ordo XVI. SPYRIDIEÆ.

SPYRIDIA.

S. biannulata, J. Ag. J. Ag., S. G. et O. Alg., III, 267.
S. filamentosa, Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 268.
J. Ag., Flor. Morph., XVI, 11–17.
S. opposita, Harv. J. Ag., S. G. et O. Alg., III, 270.
Harv., Phyc. Aus., III, pl. 158.

Ordo XVII. DUMONTIACEÆ.

NIZZOPHLÆA.

N. tasmanica, J. Ag. J. Ag., S. G. et O. Alg., III, 256.
Harv., Phyc. Aus., II, pl. 115.
J. Ag., Flor. Morph., XVII, 11–13.

Ordo XVIII. DUDRESNAYEÆ.

DUDRESNAYA.

* D. australis, J. Ag. Ms., species nova, 1887.

Ordo XIX GIGARTINEÆ.

CALLOPHYLLIS.

* C. alternifida, J. Ag. Ms., species nova, 1887.
C. carnea, J. Ag. J. Ag., Alg. Syst., IV, p. 37.

C. coccinea, Hook. et Harv. Kütz., Sp. Alg., 746.
J. Ag., S. G. et O. Alg., III, 234.

C. harveyana, J. Ag. J. Ag., S. G. et O. Alg., III, 230.
Harv., Phyc. Aus., IV, pl. 193. Sub nomine C. obtusifolia.

C. lamberti, Hook. et Harv. J. Ag., S. G. et O. Alg. III, 233.

* C. patens, J. Ag. Ms., species nova, 1891.

* C. wilsoniana, J. Ag. Species nova, 1886. An forma Callophyllidis harveyanæ.

POLYCŒLIA.

P. laciniata, J. Ag. J. Ag., S. G. et O. Alg., III, 228.

EPIPHLÆA.

* E. grandifolia, J. Ag. Species nova, 1889.
J. Ag., Alg. Syst., VI, p. 20.

* GLAPHYRYMENIA.

* G. pustulosa, J. Ag. Genus novum et species nova 1884.
J. Ag., Alg. Syst., IV, p. 53.

KALLYMENIA.

K. cribrosa, Harv. J. Ag., S. G. et O. Alg., III, 219.
Harv., Phyc. Aus., II, pl. 73.

K. tasmanica, Harv. J. Ag., Alg. Syst., VI, p. 17.

* MEREDITHIA.

M. polycœlioides, J. Ag. J. Ag., S. G. et O. Alg., III, 687. Sub nomine Kallymenia polycœlioides.

* M. nana, J. Ag. Ms., species nova, 1889.

STENOGRAMMA.

S. interruptum, Mont. Kütz., Sp. Alg., 873.
J. Ag., S. G. et O. Alg., III, 215.
Harv., Phyc. Aus., IV, pl. 220.

* S. leptophyllum, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI, p. 32.

GIGARTINA.

G. binderi, Harv. Kütz., Sp. Alg., 740. Sub nomine Chrondroclonium lividum.
J. Ag., S. G. et O. Alg., III, 191.
Harv., Syn. Cat., No. 565.

G. gigantea, J. Ag. J. Ag., Alg. Syst., IV, p. 31.
* G. lanceata, J. Ag. Ms., species nova, 1889.
G. livida, J. Ag. J. Ag., S. G. et O. Alg., III, 196.
Harv., Phyc. Aus., II, pl. 68. Sub nomine G. pinnata.
G. pinnata, J. Ag. J. Ag., S. G. et O. Alg., III, 196.
G. wehliæ, Sond. J. Ag., S. G. et O. Alg., III, 198.

RHODOGLOSSUM.

R. foliiferum, J. Ag. J. Ag., S. G. et O. Alg., III, 186.
J. Ag., Flor. Morph., XI, 4–8.
R. lanceolatum, J. Ag. J. Ag., S. G. et O. Alg., III, 186.
Harv., Phyc. Aus., V, pl. 288. Sub. nomine Gigartina lanceolata.
J. Ag., Alg. Syst., IV, p. 26.
R. polycarpum, J. Ag. J. Ag., S. G. et O. Alg., III, 186.
J. Ag., Flor. Morph., XI, 1–3.

IRIDÆA.

* I. australasica, J. Ag. Ms., species nondum descripta, 1891.

Ordo XX. CRYPTONEMIACEÆ.

THAMNOCLONIUM.

T. codioides, J. Ag. J. Ag., S. G. et O. Alg., III, 168.

* HORMOPHORA.

* H. australasica, J. Ag. Novum genus et species nova, 1886. Descriptio nondum in tabulas relata.

CRYPTONEMIA.

* C. inequalis, J. Ag. Ms., species nova, 1886. Nondum descripta.
* C. tenuis, J. Ag. Ms., species nova, 1891. Nondum descripta.
* C. wilsoni, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., IV, p. 25.
* C. wilsoni var. major, an species nova. J. Ag., 1887.

GELINARIA.

G. harveyana, J. Ag. J. Ag., Alg. Syst., VI, p. 11.

GRATELOUPIA.

* G. australis, J. Ag. Ms., species nova, 1886.

POLYOPES.

P. constrictus, J. Ag. J. Ag., S. G. et O. Alg., III, 148.
J. Ag., Flor. Morph., VI, 1–4.

PACHYMENIA.

* P. sessilis, J. Ag. Species nova, sic in albo anni 1891, a J. G. Ag. nominata, (an eadem quæ in Till Algernes Systematik descripta est, VI, p. 11. Sub nomine P. apoda?)

HALYMENIA.

H. digitata, J. Ag. Ms., nondum descripta. A me lecta, 1887.
H. harveyana, J. Ag. = H. floresia, Harv.
Harv., Phyc. Aus., IV, pl. 214.
H. kallymenoides, J. Ag. J. Ag., Alg. Syst., VI,, p. 8.

NEMASTOMA.

* N. caulescens, J. Ag. Ms., species nova, 1891. Nondum descripta.
N. feredayæ, Harv. J. Ag., S. G. et O. Alg., III, 126.

Ordo XXI. CERAMIEÆ.

CENTROCERAS.

C. clavulatum, Ag. Kütz., Sp. Alg., 689. Sub nomine Centroceras leptacanthum. J. Ag., S. G. et O. Alg., III, 108.

CERAMIUM.

C. apiculatum, J. Ag. J. Ag., S. G. et O. Alg., III, 105.
C. diaphanum, J. Ag. Kütz., Sp. Alg., 675.
J. Ag., S. G. et O. Alg., III, 98.
C. fastigiatum, Harv. Kütz., Sp. Alg., 678.
J. Ag., S. G. et O. Alg., III, 96.
C. gracillimum, Harv. J. Ag., S. G. et O. Alg., III, 95.
C. isogonum, Harv. J. Ag., S. G. et O. Alg., III, 96.
Harv., Phyc. Aus., IV, pl. 206 B.

C. miniatum, Suhr. J. Ag., S. G. et O. Alg., III, 104.
Harv., Phyc. Aus., IV, pl. 206 A.
C. nodiferum, J. Ag. J. Ag., S. G. et O. Alg., III, 99.
C. puberulum, Sond. J. Ag., S. G. et O. Alg., III, 102.
C. ramulosum, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 95.
C. rubrum, Ag. J. Ag., S. G. et O. Alg., III, p. 100.
J. Ag., Flor. Morph., III, 21–23.

HALOPLEGMA.

H. preissii, Sond. Kütz., Sp. Alg., 672.
J. Ag., S. G. et O. Alg., III, 90.
Harv., Phyc., Aus., II, pl. 79.

PTILOCLADIA.

P. pulchra, Harv. Kütz., Sp. Alg., 674.
J. Ag., S. G. et O. Alg., III, 89.
Harv., Phyc. Aus., IV, pl. 209.

DASYPHILA.

D. preissii, Sond. Kütz., Sp. Alg., 673.
J. Ag., S. G. et O. Alg., III, 88.
Harv., Phyc. Aus., II, 66.

CROUANIA.

C. agardhiania, Harv. J. Ag., S. G. et O. Alg., III, 87.
Harv., Phyc. Aus., V, pl 256.
C. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 85.
C. insignis, Harv. J. Ag., S. G. et O. Alg., III, 87.
C. muelleri, Harv. Harv., Syn. Cat., No. 638.

THAMNOCARPUS.

* T. glomuliferus, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV, p. 6.

PTILOTA.

P. articulata, J. Ag. J. Ag., S. G. et O. Alg., III, 78.
P. rhodocallis, Harv. Kütz., Sp. Alg., 670. Sub nomine Rhodocallis elegans. J. Ag., S. G. et O. Alg., III, 79. Harv., Phyc. Aus., I, pl. 44.
P. siliculosa, Harv. J. Ag., S. G. et O. Alg., III, 79.
Harv., Syn. Cat., No. 646.

GRIFFITHSIA.

G. antarctica, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 68.
* G. corticata, J. Ag. Ms., species nova, 1890. Nondum descripta.
G. elongata, J. Ag. J. Ag., S. G. et O. Alg., III, 62.
G. gunniana, J. Ag. J. Ag., S. G. et O. Alg., III, 68.
G. licmophora, J. Ag. J. Ag., S. G. et O. Alg., III, 63. Harv., Phyc. Aus., II, pl. 90. Sub nomine Callithamnion licmophorum.
G. monile, Harv. J. Ag., S. G. et O. Alg., III, 65.
G. sonderiana, J. Ag. J. Ag., S. G. et O. Alg., III, 62. Harv., Phyc. Aus., III, pl. 160. Sub nomine Callithamnion griffithsioides.
G. tasmanica, J. Ag. J. Ag., S. G. et O. Alg., III, 64. J. Ag., Flor. Morph., I, 14.
G. teges, Harv. J. Ag., S. G. et O. Alg., III, 70. J. Ag., Alg. Syst., IV, p. 5.

BALLIA.

B. callitricha, Ag. Kütz., Sp. Alg., 663.
J. Ag., S. G. et O. Alg., III, 57.
J. Ag., Flor. Morph., III, 1–11.
B. mariana, Harv. J. Ag., S. G. et O. Alg., III, 58. Harv., Phyc. Aus., IV, pl. 212.
B. robertiana, Harv. J. Ag., S. G. et O. Alg., III, 58. Harv., Phyc. Aus., I, pl. 36.
B. scoparia, Harv. J. Ag., S. G. et O. Alg., III, 59. Harv., Phyc. Aus., III, pl. 168.

CALLITHAMNION.

C. angustatum, Harv. J. Ag., S. G. et O. Alg., III, 46.
C. brownianum, Harv. J. Ag., S. G. et O. Alg., III, 49. Harv., Syn. Cat., No. 667.
C. comosum, Harv. J. Ag., S. G. et O. Alg., III, 19.
C. conspicuum, Sond. J. Ag., S. G. et O. Alg., III, 45.
* C. crinale, J. Ag. Ms., species nova, 1889. Nondum descripta.
C. dasyurum, Harv. Harv., Syn. Cat., No. 664.
C. dispar, Harv. J. Ag., S. G. et O. Alg., III, 27. Harv., Phyc. Aus., IV, pl. 227.
C. divergens, J. Ag. J. Ag., S. G. et O. Alg., III, 19.

C. formosum, Harv. J. Ag., S. G. et O. Alg., III, 48. Harv., Phyc. Aus., V, pl. 281.
C. gracilentum, Harv. J. Ag., S. G. et O. Alg., III, 21. Harv., Syn. Cat., No. 701.
C. hanovioides, Sond. J. Ag., S. G. et O. Alg., III, 26.
C. laricinum, Harv. J. Ag., S. G. et O. Alg., III, 42. Harv., Phyc., Aus., IV, pl. 218.
C. latissimum, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 47.
C. mucronatum, J. Ag. J. Ag., S. G. et O. Alg., III, 19.
C. muelleri, Sond. J. Ag., S. G. et O. Alg., III, 27.
C. plumigerum, Harv. J. Ag., S. G. et O. Alg., III, 49. Harv., Phyc. Aus., V, pl. 285.
C. plumula, J. Ag. J. Ag., S. G. et O. Alg., III, 24.
C. polyrhizum, Harv. J. Ag., S. G. et O. Alg., III, 12. Harv., Syn. Cat., No. 712.
* C. tetracladum, J. Ag. Ms., species nova, 1890. Nondum descripta. Prope C. muelleri.
C. verticale, Harv. J. Ag., S. G. et O. Alg., III, 26.
* C. wilsonianum, J. Ag. Ms., species nova, 1883. Nondum descripta. (Inter C. wollastonianum et C. brownianum.)

CHLOROSPERMEÆ.

Ordo I. SIPHONACEÆ.

BRYOPSIS.

* B. baculifera, J. Ag. Species nova, 1880. J. Ag., Alg. Syst., V, p. 21.
* B. clavæformis, J. Ag. Species nova, 1885. J. Ag., Alg. Syst., V, p. 20.
* B. gemellipora, J. Ag. Species nova, 1884. J. Ag., Alg. Syst., V, p. 25.
B. plumosa, J. Ag. Alg. Syst, V, p. 24.

CODIUM.

C. bursa, Grev. J. Ag., Alg. Syst., V, p. 38.
C. elongatum, J. Ag. Alg. Syst., V, p. 46.
C. galeatum, J. Ag. Alg. Syst., V, p. 42.
C. mucronatum, J. Ag. Alg. Syst., V, p. 43.

C. muelleri, Kütz. J. Ag., Alg. Syst., V, p. 42.
* C. pomoides, J. Ag. Ms., species nova, 1890. Nondum descripta.
C. spongiosum, Harv. J. Ag., Alg. Syst., V., p. 38. Harv., Phyc. Aus., I., pl. 55.
C. tomentosum, J. Ag. J. Ag., Alg. Syst., V, p. 40.

AVRAINVILLEA.

A. obscura, J. Ag. J. Ag., Alg. Syst., V, p. 53.

* CALLIPSYGMA.

* C. wilsonis, J. Ag. Novum genus et species nova, 1882. J. Ag., Alg. Syst., V, p. 67.

UDOTEA.

* U. peltata, J. Ag. Species nova, 1885. J. Ag., Alg. Syst., V, p. 74.

APJOHNIA.

A. lætevirens, Harv. J. Ag., Alg. Syst., V, p. 108. Harv., Phyc. Aus., I, pl. 5.

DICTYOSPHÆRIA.

D. sericea, Harv. J. Ag., Alg. Syst., V, p. 118.

CAULERPA.

C. abies-marina, J. Ag. J. Ag., Alg. Syst., I, p. 18.
* C. alternifolia, J. Ag. Species nova, 1886. J. Ag., Alg. Syst., V, p. 129.
C. cactoides, J. Ag. J. Ag., Alg. Syst., I, p. 44. Harv., Phyc. Aus., I, pl. 26.
* C. curvifolia, J. Ag. Ms., species nova, 1884. Nondum descripta.
C. harveyi, F. v. Mueller. J. Ag., Alg. Syst., I, p. 17. Harv., Phyc. Aus., II, pl. 95.
C. hypnoides, R. Br. J. Ag., Alg. Syst., I, p. 33. Harv., Phyc. Aus., II, pl. 84.

C. muelleri, Sonder. J. Ag., Alg. Syst., I, p. 34.
Harv., Phyc. Aus., I, pl. 2.
C. papillosa, J. Ag. J. Ag., Alg. Syst., I, p. 42.
C. scalpelliformis, J. Ag. J. Ag., Alg. Syst., I, p. 12.
Harv., Phyc. Aus., I, pl. 17.
C. sedoides, J. Ag. J. Ag., Alg. Syst, I, p. 39.
Harv., Phyc. Aus., II, pl. 72.
C. simpliciuscula, J. Ag. J. Ag., Alg. Syst., I, p. 41.
Harv., Phyc. Aus., II, pl. 65, figs. 1–2.
C. sonderi, F. v. Mueller. J. Ag., Alg. Syst., I, p. 18.
Harv., Phyc. Aus., III, pl. 167.
C. trifaria, Harv. J. Ag., Alg. Syst., I, p. 16.
Harv., Phyc. Aus., V, pl. 261.
C. vesiculifera, Harv. J. Ag., Alg. Syst., I, p. 40.
Harv., Phyc. Aus., II, pl. 65, fig. 3.

POLYPHYSA.

P. peniculus, Lamour. Kütz., Sp. Alg., 510. Sub nomine Polyphysa aspergillosa.
J. Ag., Alg. Syst., V, p. 161.
Harv., Phyc. Aus., I, pl. 11.

Ordo II. ULVACEÆ.

PORPHYRA.

P. vulgaris, J. Ag. Kütz., Sp. Alg., 692.

ULVA.

U. latissima, J. Ag. Kütz., Sp. Alg., 477. Sub nomine Phycoseris australis.
J. Ag., Alg., Syst., III, p. 164.
U. lætevirens, Areschoug. J. Ag., Alg. Syst., III, p. 167.

ENTEROMORPHA.

E. bulbosa, Lu. J. Ag., Alg. Syst., III, p. 139.
E. clathrata, Kütz. J. Ag., Alg. Syst., III, p. 153.
E. flexuosa, Walf. J. Ag., Alg. Syst., III, p. 126.
E. hopkirkii, Harv. J. Ag., Alg. Syst., III, p. 151.
E. lingulata, J. Ag. J. Ag., Alg. Syst., III, p. 143.
E. opposita, J. Ag. Descriptionem nusquam invenio.

Ordo III. CONFERVACEÆ.

CLADOPHORA.

C. acrosiphonia, J. Ag. Descriptio mihi hactenus ignota.
C. feredayi, Harv. Harv., Phyc. Aus., I, pl. 47.
C. gracilis, Griff. Harv., Syn. Cat., No. 770.

CHÆTOMORPHA.

C. valida, Harv. Kütz., Sp. Alg., 379.

CONFERVA.

C. arenosa, Carm. Kütz., Sp. Alg., 384.
C. valida, J. Ag. Kütz., Sp. Alg., 379.

Ordo IV. OSCILLARIACEÆ.

RIVULARIA.

R. nitida, Harv. Kütz., Sp. Alg., 332.

MEETINGS OF THE ROYAL SOCIETY.

1891.

[N.B.—The remarks and speeches in the discussions are taken down verbatim by a shorthand writer, and afterwards written out at length with a typewriter, for reference and reproduction, if required; and therefore, more is seldom given herein than an indication of their general drift. If any person should wish to refer to the verbatim report, he can apply to the Secretary to the Society, who will give him an opportunity of perusing and copying it, or if he resides at a distance, so much as he requires will, upon payment of the cost of reproducing it, be forwarded to his address.]

ANNUAL MEETING.

Thursday, March 12th.

The President (Professor Kernot) in the chair.

Annual Report.

The Council of the Royal Society herewith presents to the Members of the Society the usual Annual Report for the year 1890. The following meetings were held and papers read during the Session:—

On the 13th March, at the Ordinary Meeting held after the Annual General Meeting, Mr. A. J. Campbell "On the Oology of Western Australia."

On the 8th May, Mr. A. H. S. Lucas, "On Fishes New to Victoria;" Professor Spencer, on "The Nomenclature of Chicken Embryos for Teaching Purposes;" Mr. Arthur Dendy, "On the Victorian Land Planarians."

On the 12th June, Professor Orme Masson, a preliminary note on "The Physical Properties of Ethides considered in reference to the Periodic Law of the Elements;" Mr. Arthur Dendy, "Note from the Biological Laboratory of the University of Melbourne on the Presence of Corpuscles Discharged from the Apertures of the Nephridia and Oral Papillæ of Peripatus;" Mr. D. McAlpine, (*a*) "Observations on the Movements of the Heart of Hoplocephalus superbus in and out of the body," (*b*) "Remarks on a Fluke Parasitic in the Body of Hoplocephalus superbus," and (*c*) "Observations on a Nematode found in the Stomach of Hoplocephalus superbus."

On the 10th July, Mr. A. W. Howitt, "On the Eucalypts of Gippsland."

On the 14th August, Mr. G. S. Griffiths, "On the Marine Sedimentary Strata Beds underlying Warrnambool;" Professor Orme Masson, "The Relations of Molecular Volumes and Boiling Points."

On the 11th September, Postscript by Professor Orme Masson to the last paper read by him; Professor Ralph Tate, "Note on Shell-bearing Mollusca obtained in the Port Phillip Biological Survey;" Rev. R. H. Rickard, "The New Britain Currency or Shell-money.

On the 9th October, Mr. J. Dennant, "Notes on the Pliocene Strata at Jemmy's Point, with Brief Remarks on the Older Tertiary at Bairnsdale;" Mr. G. Gordon McCrae, "Notes on the Coco-de-mer."

On the 13th November, Mr. P. H. MacGillivray, "Description of New and Little-known Polyzoa, Part XIV;" Rev. R. H. Rickard, "The Duk Duk Association of New Britain;" Professor Spencer, "Two Rare Hydroids from Port Phillip;" Mr. John Dennant, "Appendix to Remarks on the Older Tertiary Strata at Bairnsdale."

On the 11th December, Mr. Arthur Dendy, "Monograph of the Victorian Sponges. Part I. The Anatomy and Classification of the Calcarea Homocœla, with Descriptions of the Victorian Species;" Professor Spencer, "Notes on some Victorian Land Planarians;" Mr. T. S. Ralph, "Observations and Experiments on the Coloured Material of the Red Corpuscles."

The following Members and Associates were elected during the year:—Members—Mr. Ludovico Hart, Mr. Pietro Barracchi, Rev. John Mathew, Mr. Alexander Leeper, LL.D., Mr. J. W. Springthorpe, M.D., Mr. H. R. Hogg, Mr. J. Talbot Brett, M.R.C.S., Mr. Sidney Plowman, F.R.C.S., Mr. Lenthal Oldfield, Mr. G. A. Syme, M.B., F.R.C.S., Mr. C. G. W. Officer, Mr. C. N. Hake. Associates—Mr. W. H. A. Pye, Miss Lilian Mary Blair, Miss Louisa Florence Blair, Mr. J. S. Hart, M.A., B. Sc., Mr. Thomas Lambert, Mr. Henry T. Grayson, Mr. Robert Craig, Mr. R. T. Elliott, M.A., Mr. George Gordon McCrae, Mr. P. D. Phillips, Mr. Heinrich Best, Mr. Edward Emerson Rosenblum, M.B., Mr. C. N. Wilsmore, B. Sc., Mr. Elderson Smith, Mrs. Elderson Smith, Mr. Frank Goldstraw. Country Member—Mr. T. S. Hall, M.A.

Your Council regrets to have to record the loss by death of two old Members of the Society—Mr. Gaunt and Mr. Reed. To the latter, the Society owes a debt of gratitude for the generous way in which he had acted gratuitously as its architect from the time of its inception.

The Librarian reports the addition to the Library during the year of the following publications :—From England 210 parts, Scotland 20, Ireland 10, Germany 125, Austria 53, Switzerland 3, France 41, Italy 58, Spain and Portugal 12, Holland and Belgium 30, Denmark, Sweden and Norway 41, Russia and Roumania 24, India and Mauritius 57, China and Japan 5, Batavia 13, Canada 13, United States 99, Mexico and Guatemala 33, Argentine Republic and Chili 11, Victoria 127, New South Wales 34, South Australia 3, Queensland (principally Maps) 332, Tasmania 3, New Zealand 7, West Australia 1. Total publications received, 1365.

The additions to the Library during the year have been somewhat larger than usual. A few books have been purchased, but the bulk of the additions has consisted in Exchanges from other Societies. A good many volumes have been bound, and the Library generally has been rendered more available for reference by this means. It is not found, however, that Members use it very frequently for this purpose, although every reasonable facility is afforded to those who may desire to consult the really valuable works which it contains.

During the year, a gratifying increase has taken place in the membership of Section G (Literature and the Fine Arts), and in connection with this, very successful meetings have been held and good work accomplished. This is dealt with in the report of the Section.

During the course of the year, the Council acceded to the request of certain members and instituted Section E, to deal with Anthropological questions, and Mr. A. W. Howitt was appointed Chairman.

Your Council may fairly congratulate the Society upon a successful year, during which good work has been done. Naturally, the larger number of original contributions to science have dealt with the subjects of Zoology, Botany and Geology—subjects which are of especial importance in a country in which endless opportunities for original research are offered to workers in these particular branches of science. It may also be added, that the Society is offering every facility in its power to assist such workers in the publication of their results. During the year, the second part of the volume of "Transactions" has been published, together with the usual volume of "Proceedings," the increased annual grant from the Government enabling the Society to extend the scope of its publications, and in a manner which there is reason to say is not only received with favour in the Australasian Colonies, but also in the mother country.

Dr. *The Hon. Treasurer in Account with the Royal Society of Victoria to March 1, 1890.* Cr.

	£ s. d.	£ s. d.
To Balance from 28th February, 1889		£192 14 10
,, Government Grant—		
Balance of Vote for 1888-89	£150 0 0	
First Instalment for 1889-90	50 0 0	
		200 0 0
,, Entrance Fees		29 8 0
,, Subscriptions for 1889	260 8 0	
,, ,, 1890	8 8 0	
Arrears	37 16 0	
		306 12 0
,, Rent of Rooms		17 0 0
,, Sale of Transactions		0 17 0
,, Interest		20 0 0
		£766 11 10

	£ s. d.
By Printing and Stationery	£152 9 8
,, Port Phillip Biological Survey	2 4 0
,, Rates	4 15 0
,, Gas and Fuel	8 5 11
,, Salary of Assistant Secretary	62 18 4
,, Shorthand Records	33 3 0
,, Hall-keeper	9 6 0
,, Collector's Commission	38 3 7
,, Insurance	3 10 0
,, Secretary's Postages	41 15 7
,, Repairs and Furnishing	46 11 11
,, Books and Periodicals	46 0 7
,, Freight	2 10 0
,, Refreshments	3 4 6
,, Treasurer's Postages and Petty Cash	3 14 5
,, Balance, 28th February, 1890	307 19 4
	£766 11 10

Compared with the Vouchers and Bank Pass-book and Cash-book, and found correct,

JAMES JAMIESON,
Hon. Treasurer. *28th February*, 1890.

(Signed) H. MOORS, JAS. J. FENTON, } Auditors.

PUBLISHING AND RESEARCH FUND.

Dr.		Cr.	
To Fixed Deposit in Bank	£300 0 0	By Fixed Deposit in Bank of Australasia	£300 0 0
,, Interest on same	12 0 0	,, Interest transferred to General Account ..	12 0 0
	£312 0 0		£312 0 0

STATEMENT OF ASSETS AND LIABILITES.

ASSETS.			LIABILITIES.	
To Entrance Fees (12)		£25 4 0	By Two Debentures	£10 0 0
,, Unpaid Subscriptions for 1890		394 16 0	,, ,, ,, (Interest Unclaimed	8 8 0
,, ,, ,, (arrears)		100 0 0	,, Estimated Unpaid Accounts	200 0 0
,, Rent of Rooms		20 0 0	,, Balance 28th February, 1890	6637 4 8
,, Hall, Library, and Furniture		5000 0 0		
,, Balance of Grant for 1889-90		375 0 0		
,, Two-thirds of Grant for 1890-91		332 13 4		
,, Publishing Fund	£300 0 0			
,, General Account Balance ..	307 19 4			
		607 19 4		
		£6855 12 8		£6855 12 8

The PRESIDENT, after reading the Balance Sheet, said that financially the Society was in a perfectly satisfactory condition. The expenditure was large, and if there was a continuance of the publication of the elaborate Transactions that had been brought out by the Society during the last two or three years, all the money that could be obtained either from the Government or from Members, in the shape of subscriptions, would be required. The Transactions lately issued were illustrated with diagrams, and were highly prized in other parts of the world. The work that was being done, in connection with local Biology, was bringing very great honour and credit to the Society amongst scientists in Europe and America, but that good work would need for its continuance all the funds that could be obtained.

On the motion of Dr. NEILD, seconded by Mr. GRIFFITHS, the Balance Sheet was adopted.

ANNUAL REPORT.

Mr. BLACKETT moved, and Mr. NEWTON JENNINGS seconded a resolution, "That the Annual Report, which had been printed and circulated amongst the Members, be taken as read and adopted." The resolution was carried.

The PRESIDENT said that he considered the Report to be a favourable and satisfactory one. The work done during the year was to a great extent biological, partly geological, and there had been a little chemical work. It was all good work, and was being published in the proper way, thus rendering the Transactions and Proceedings creditable to themselves and valuable to scientists elsewhere.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT announced that, as the nominations of Office-bearers did not exceed in number the positions to be filled, it was his duty to declare the following gentlemen duly elected, on the motion of Mr. White, seconded by Professor Spencer: President—Professor W. C. Kernot, M.A., C.E. Vice-Presidents—J. Cosmo Newbery, C.M.G., B.Sc., and E. J. White, F.R.A.S. Hon. Treasurer—C. R. Blackett, F.C.S. Hon. Librarian—J. E. Neild, M.D. Hon. Secretaries—H. K. Rusden and Professor W. Baldwin Spencer, M.A.

MEMBERS OF COUNCIL.

Members of Council—A. W. Howitt, J. Jamieson, M.D., A. H. S. Lucas, M.A., A. Sutherland, M.A., A. S. Way, M.A., and Professor Lyle, M.A.

For the two vacant seats on the Council, Mr. C A. Topp and Professor Laurie were nominated, and elected.

The non-retiring Members of Council were :—R. L. J. Ellery, F.R.S., G. S. Griffiths, F.R.G.S., Professor Orme Masson, M.A., D.Sc., and H. Moors.

The Annual Meeting having been declared at an end by the President, an Ordinary Meeting was then held. The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Alfred Reeve was elected as a Member.

Mr. John Desmond was nominated as a Country Member.

Mr. T. S. Hall, M.A., signed the Roll.

Dr. Neild, the Hon. Librarian, announced that the number of volumes and parts received this year was 221, and that one of the books received was an In Memoriam volume of the late Dr. H. C. Wigg, whose death all regretted very much. The volume was presented to the Society by the father of the deceased gentleman.

Mr. T. S. Hall, M A., read a paper on "A New Species of Dictyonema."

Dr. Dendy read a paper on "A preliminary account of Synute pulchella, a New Genus and Species of calcareous sponge."

Replying to the President, Dr. Dendy said that the tissue both on the inner and the outer layer was undoubtedly protective against the inroads of parasites.

The President thought it was possible that the attacks of parasites for a great many ages might have led to the form referred to in the paper. He would like to know if the weaker forms were found in sheltered places.

Dr. Dendy said it was the general rule to find the weakest sponges in deep water, and in such places the sponges were more delicate than others. In shallow water they were stronger and more massive.

Mr. T. S. Hall, M.A., read a paper prepared by himself and Mr. G. B. Pritchard on "Notes on the Lower Tertiaries of the Southern portion of the Moorabool Valley."

The President said that the geology of this country was very far from being so thoroughly known as it might be, and such investigations as these would help to fill up the gaps.

Mr. G. S. Griffiths, F.G.S., said that the Society was indebted to the gentlemen who prepared the paper and the sections and plans accompanying it. A very intelligent and interesting account of the valley had been given in the paper, proving that a very careful investigation of the strata thereabouts had been made. He was struck with the large amount of erosion that had occurred in the valley, which was evidently the bed of an old extension of Bass Straits. More knowledge was gradually being gained of the extension of this old arm of the sea, and it was quite evident from what was known, that a Strait once existed between the Otway Ranges and the Main Dividing Range. The Otway Ranges for many ages must have constituted an island in the Straits, about 70 miles long and perhaps 30 wide. There was a considerable amount of identity between the deposits all over the district. The limestone found there, specimens of which had been shown that evening, was very similar in its general character to that found so far away to the west as Portland. Beautiful white cliffs similar to those of Dover, and also lava, could be seen there. There is no doubt that the Strait was a very wide one, and the bores and shafts put down showed that there were narrow channels leading from the sea. Some miles to the west of Steiglitz mountainous country existed, and the river had cut its passage, not through the tertiary beds as described that evening, but through the immensely older Silurian. These ancient Silurian valleys that had been cut by the old Moorabool were immensely deeper than the valleys of the present day. They had been filled up gradually by the sedimentary beds in the same manner as the Strait itself in the course of ages was filled up. In the Moorabool Valley, in the neighbourhood to which he was referring, Pliocene lava was seen on the surface. Beneath that there was sand and gravel and the auriferous wash of the miner. Sinking still further through the shallow level strata, a bed of coralline limestone 13 feet thick was reached. That bed being organic, grew at the time when the whole country was considerably lower than it is to-day; when, in fact, the sea ran up the valley of the Moorabool and when the Moorabool itself was a little creek that had its sea mouth probably many miles further to the north of the section to which he was referring. Below the coralline limestone there was more sandstone, and below that again another layer of lava. It was not a solid bed of lava, as it consisted of a series of thin layers of basalt. Between those layers were sandwiched more layers of the coralline limestone. Between these beds, but lower down the stream, there were very thick beds 60 or 70 feet thick of what the miners term "cement"—sandstone containing quartz boulders. Then there was a false bottom carrying a lot of gold, and below that again there was another bed 30 or 40 feet thick of a different character. It seemed to him that the character of those two beds indicated the climate during the early tertiary period was very different to that of the present time. We certainly had a pluvial period if we did not have a glacial period. Nothing but a pluvial period could account for the scouring off of the central ranges and the carrying down into the gullies and the wide river valleys of the very abundant deposits of boulder, gravel, and sand beds. The deposits are there now, and the size of the valleys proves that the stream of water that flowed off the central watershed was larger than the volume we have to-day. There was in the valley undoubted evidence of the existence in former time of a climate that was characterised by an enormous rainfall, one that was colder than that of the present day.

Mr. Hall agreed with Mr. Griffiths that there was considerable evidence of rainfall during the period in which the gravels were formed.

Thursday, April 9th.

The minutes of the preceding meeting were read and confirmed.

Mr. Alfred Reeve signed the Roll, and was introduced to the meeting.

Mr. John Desmond was elected as a Country Member.

Dr. Neild, the Hon. Librarian, stated that since the last meeting, 79 volumes had been received from various parts of the world. The binding of the periodicals was steadily progressing and it was his intention to ask the Council at their next meeting, to vote a little more money for this purpose.

It had been suggested to him that greater facilities should be afforded to Members desirous of taking books out of the Library. As it had been found very inconvenient to allow Members to take books from the Library at their option, a great many valuable periodicals having been lost through mere forgetfulness on the part of the Members to return them, the Council had resolved that it was expedient that their consent should be obtained when books were taken from the Library. This resolution had been extended, making the consent of only one Member of the Council necessary. He thought that Members would not suffer any hardship through this regulation, which was rendered necessary in view of the fact that many of the books of the Library were very valuable, and practically irreplaceable if lost.

The President agreed with Dr. Neild as to the importance of watching the Library very closely indeed. It was a Library of an unusual character, and likely to be extremely valuable to persons making researches in special branches of science, and it was therefore a matter of importance that the books should not be lost.

Mr. H. K. Rusden moved, "That a Committee be appointed to enquire into and report upon Cremation as a means of disposing of the dead, as well as other methods, the Committee to consist of Professors Kernot and Masson, and Mr. H. K. Rusden, with power to add to their number."

Dr. Neild seconded the resolution.

The President explained that this was merely a motion for the re-appointment of an old Committee, which had first been appointed some time ago, when the question of Cremation had been brought forward by Mr. Rusden at the Australasian Association, since which time, however, little or nothing had been done. The re-appointment of the Committee did not commit the Society to any expression of opinion, but simply gave the Committee power to enquire into the various methods of disposing of the dead, and report at their leisure. Some people regarded the question of Cremation as one of very great importance, and without doubt it was worth investigation.

Mr. Rusden pointed out that it was scarcely correct to say nothing had been done, as some of the books in his possession bearing on the subject, had been read by the Members of the Committee, and so much time had therefore been saved.

The resolution was carried.

A paper, "On the Occurrence of the Genus Belonostomus in the Rolling Downs Formation (Cretaceous) of Central Queensland," by R. Etheridge, jun., F.G.S., Palæontologist to the Geological Survey of New South Wales, and Arthur Smith Woodward, F.L.S., of the British Museum, was read by Professor W. Baldwin Spencer. Some lithographs of the specimen were handed round among the Members.

Mr. Sweet said he had no doubt that very much more perfect specimens could be obtained by persons longer on the area than he himself had been. The fossil was somewhat under two feet in length, but as the fish was turned on itself, it was probably the intention of the writer to suggest the metre as the unit. The fossil was valuable, inasmuch as it helped to fix the geological period to which the area in which it had been found should be assigned. For some time past this area has been regarded as cretaceous, but its exact position in that period was as yet undetermined. The discovery of similar fossils would assist in determining this.

Professor Spencer said it was an interesting fact that this fish was distributed over other parts of the world, and found in such places as Western Europe, Brazil, and India. It was most desirable that the Palæontology of Australia should be worked out. Mr. Sweet had taken considerable trouble in obtaining the fossils, and were there more workers in that branch, the past life history of Australia and its relationship to other parts of the world would be better understood.

Professor W. Baldwin Spencer then read a "Note from the Biological Laboratory of the Melbourne University."

The President, in announcing this paper, congratulated the Professor on the solid character of the work being proceeded with at the University.

A short discussion then ensued, in which the President, Mr. Sweet, and the author took part.

Thursday, June 11*th.*

Mr. E. J. White, Vice-President, occupied the chair.

The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Dawson was nominated as a Country Member, and Mr. J. Strettle as an Associate.

The Librarian's Report, that 175 publications had been received since last meeting, was read by the Chairman.

The Report of the Gravity Survey Committee was read by the Secretary, Mr. Love, who stated that it was necessary to appoint a new Committee, with power to add to their numbers.

Professor Spencer moved that the Report be adopted.

The motion having been seconded by Mr. Love, was put and carried.

On the motion of the Chairman, seconded by Mr. Griffiths, the old Committee was re-appointed, Mr. Russell, Government Astronomer of New South Wales; and Mr. Todd, Government Astronomer of South Australia, being added to it.

Mr. Love stated that, if the pendulums mentioned in the Report were secured, a considerable advantage would be gained, even though the Society might be able to arrange for only a small number of observations. Those observations would be directly comparable with some hundreds that had been made in different parts of the world, but none of them in the hemisphere in which Australia is situated. The Committee considered that the observations should be made in one or two places as nearly due north of Melbourne as was possible. It would be advantageous if one could be made at Thursday Island, and one between Thursday Island and Melbourne. The Committee considered also, that as far as Australia is concerned, a set of observations at six or seven different places would give nearly as much information as could be got. Those observations would not give information as to very minute points relating to local disturbance of gravity. What the Committee was aiming at was the general result as regards the earth. It was also suggested that an observation should be made in Western Australia, probably at Perth. This would be of value, as a check on those made on the other side of the continent.

The CHAIRMAN said that plenty of observations had already been taken in Australia by several nations, but they had been confined to the coasts. The extension of railways into the interior would enable the apparatus to be taken there, and observations there would be of as much value as those made at the coast. The Society would be doing a good work in carrying out this survey.

Professor BALDWIN SPENCER read a paper "On the Anatomy of Ceratella fusca (Gray)."

Dr. DENDY read "Additional Observations on the Victorian Land Planarians."

In reply to a question, Dr. DENDY said that each locality appeared to have its own particular group of species. It would be impossible to state the number of specimens in each locality. At Macedon, a large number were seen on one occasion, but at a later period not a single one could be found.

Mr. HOGG corroborated the last speaker.

Dr. DENDY said that the planarians referred to in the paper occurred in large numbers.

The CHAIRMAN said that worms were more plentiful now than in the days when the colony was first occupied by white people. Not one was to be found at Castlemaine or Sandhurst in the early days.

Dr. DENDY said that planarians were found in the virgin forests where there was plenty of timber.

Professor SPENCER, in the absence of the writer, Mr. A. H. S. Lucas, read a paper "On a New Species of Fresh-water Fish from Lake Nigothoruk, Mount Wellington, Victoria."

Professor SPENCER read a paper "On Land Planarians from Lord Howe Island."

The reading of a paper by Dr. DENDY, entitled "Description of an Australian Species of Land Nemertean," was postponed.

Thursday, July 9th.

The President (Professor KERNOT) in the chair.

The minutes of the last meeting were received and confirmed.

Professor Spencer gave notice that, at a Special Meeting to be called, he would move certain alterations in the Rules. The purport of the alterations would be, to provide for one Secretary of the Society in place of two as at present. He would suggest that the Special Meeting be held on the same evening as that set apart for the next Ordinary Meeting.

The President.—There will be no difficulty as to that.

Mr. Ellery said that a vacancy in one of the offices of Vice-President existed. The matter had been brought before the Council at its last meeting, and in accordance with a resolution then arrived at, he had much pleasure in nominating Mr. H. K. Rusden as a Vice-President of the Society. Mr. Rusden had been a Member of the Society for a great many years, and he had acted as Secretary of it for a long period. In two epochs he had so acted, and on many occasions had contributed most interesting papers. Mr. Rusden was one of their most valued Members.

The President mentioned, for the benefit of those Members to whom the nomination might possibly come as a surprise, that Mr. Cosmo Newbery had been for many years a Vice-President of the Society. As would probably be remembered, Mr. Newbery a few years ago was severely injured in a disastrous railway accident. After that, he was for a long while absent from the Colony, and when he returned, he was very far from being in his full health and strength. He had again left the Colony. His sympathies were always with them, and in the years gone by, he had been a most valuable Member and officer of the Society. Under the circumstances just related, his name was retained for several years on the list of officers as Vice-President, in the hope that he would regain his strength sufficiently to enable him to take as active a part in the Society as he had in previous years. Not long since, he had undertaken a mission from the Government which would entail his absence from the Colony for a considerable time. He then resigned his position, and that resignation the Council had no choice but to accept. They regretted his loss, but considered the acceptance of the resignation the best that could be done under the circumstances. Mr. Rusden, who had served the Society so well for a number of years as Secretary, Member of Council, and reader of papers, had been nominated as successor to Mr. Newbery. In that nomination, he (the President) concurred most heartily. The ballot would take place at next meeting.

Mr. Wm. Lowell Mullen, M.A., M.D., was nominated as an Associate.

Professor Laurie signed the Roll of Members, and was introduced to the meeting by the President.

ELECTIONS.

Mr. John Dawson was elected as a Country Member, and Mr. W. Stratford Strettle, jun., as an Associate.

The PRESIDENT, in the absence of Dr. Neild the Hon. Librarian, announced that seventy-three publications had been received during the last month.

ANTARCTIC COMMITTEE'S REPORT.

The PRESIDENT read the Report of the Antarctic Committee, and stated that it was read at the public meeting in the Athenæum a few evenings ago. Mr. Robert Reid was then present, and made a donation of £1000 to the Fund. The Report was the most satisfactory one the Committee had submitted, and the sum in hand was greater than what was first proposed. Originally, an expedition to cost £10,000 was spoken of, but it had grown into one to cost £15,000. It was, however, hoped that £20,000 would be raised, so as to allow of a margin, and to carry out the expedition in the best style. The state of affairs in Australia was communicated as quickly as possible to their Swedish friends, who were commencing active preparations for fitting out the expedition. In about fourteen or fifteen months from the present time, the ship or ships of the expedition would probably be seen in Hobson's Bay with the veteran Arctic navigator Nordjenskold on board one of them. The objects expected to be attained were primarily scientific, but it would be quite possible that facts of vast commercial importance would be also obtained.

Replying to Professor Spencer, the PRESIDENT stated that it was part of the original arrangement that Baron Nordjenskold should lead the enterprise, and the only fear was that his advancing years would prevent it.

Mr. ELLERY understood that it would be led by the Baron or his son.

Mr. RUSDEN said that although he was unable to produce any authoritative document, yet it was understood that the Baron would lead. One cablegram stated that the second vessel would be lead by the son, who would investigate the opposite side of the circle. He did not know of anyone more suitable to lead the expedition than the Baron, and the arrangements had been left entirely to him. It had been stipulated that two scientific men should be sent by Victoria.

Mr. ELLERY.—Australia.

Mr. RUSDEN.—The Antarctic Committee was in possession of the names of Professor Spencer and Mr. Wragge, of Queensland, as likely to go. Australia should be entitled to send no fewer than four scientists, as its contribution was double that originally proposed.

Mr. White considered it would be a poor return to Victoria if only two of her scientists were allowed to go.

Mr. Ellery considered an expedition costing only £15,000 would be very economically conducted, as the British Government had estimated the cost at £45,000 or £50,000; the understanding at first was that it was not to be purely a scientific expedition.

Mr. Rusden.—The original arrangement stipulated that £5000 should be contributed by Australia. Now that that sum had been exceeded once, further stipulations as were necessary should be made with the Swedish Academy.

The President considered that a biologist and a meteorologist should go, and possibly a geologist. If any of them could combine photography, it would be advisable. In his opinion, three scientists from Australia would be sufficient. He thought the Royal Society might rest satisfied that the Antarctic Committee would see that the vessels started from an Australian port, and that the expedition should be recognised as a Swedish-Australian one.

Papers.

Dr. Dendy read a paper entitled "Description of an Australian Species of Land Nemertean."

At its conclusion, the President congratulated Dr. Dendy on his work.

Replying to the President, Dr. Dendy stated that the proboscis was ejected by the pressure of a fluid. The size of the proboscis was remarkable. It was longer than the animal, and he could not explain how it was packed when drawn in, as it was done in a mysterious fashion. He could not tell what the animal fed on, but it probably captured its prey by spearing it. There was a sticky slime at the end of the proboscis, and to that the prey would adhere and be drawn in. There was nothing akin to budding in the re-productive organs.

Mr. Ellery read a paper on "The Present Stage of the International Photographic Charting of the Heavens," and exhibited a number of photographs. Some of them were reproduced by the oxy-hydrogen lantern by Mr. A. M. Henderson, C.E.

Thursday, August 13th.

The President (Professor Kernot) in the chair.

The minutes of the preceding meeting were read and duly confirmed.

Mr Dudley Dobson, M.I.C.E., F.G.S., of Warrnambool, was nominated as a Member.

Dr. Wm. L. Mullen, M.A., M.D., was elected as an Associate of the Society.

The PRESIDENT said he regretted having to make the announcement that Mr. Howitt had felt compelled to resign his position as a Member of the Council, owing to the pressure of official duties. It would, therefore, be necessary to fill the vacancy by ballot, in accordance with Rule 13.

Mr. WHITE nominated Dr. Dendy, and Professor SPENCER seconded the nomination.

No other nominations being forthcoming, the PRESIDENT said it was his duty to declare Dr. Dendy duly elected a member of the Council of the Royal Society. He desired to express his satisfaction at Dr. Dendy being added to the membership of the Council. He had been so very active in connection with the Society, that he felt sure he would be equally active as a Member of the Council.

Dr. DENDY thanked the Members for the honor they had done him, in electing him to fill such an important post, and trusted he would be able to perform the duties connected with it to the satisfaction of the Society.

Dr. NEILD, the Hon. Librarian, reported that 172 publications had been added to the Library since the last meeting.

PAPERS.

Dr. DENDY read a paper entitled, "On the Mode of Reproduction of Peripatus leuckartii."

Mr J. BRACEBRIDGE WILSON remarked that the structure of the reproductive organs of the species described by Dr. Dendy appeared to differ from that of species hitherto described.

Dr. DENDY said the structure of the reproductive organs was essentially the same. There were only some superficial points of difference.

Mr. J. B. WILSON said that a remarkable point in the structure of these organs was the presence of two curious little sacs, which held the spermatic fluid, and fertilized the eggs as they passed down. That seemed to indicate that the female was fertilized perhaps only once in its life.

Dr. DENDY said that, in this point Peripatus leuckartii agreed with the other species. In regard to the lower part of the oviduct, however, there certainly was a difference. In other species, the uterus was specially modified to allow the embryos to develop in it, the embryos themselves producing placenta whereby they drew nutriment from the mother. There was nothing of this kind to be found in the Australian species. The eggs were simply fertilized, and the shell then developed around them.

The PRESIDENT asked whether there was any uncertainty in the mode of reproduction. For instance, might it sometimes be oviparous and sometimes viviparous?

Dr. DENDY thought there could be no doubt that it was always oviparous. If it were not so, the egg would not be so beautifully sculptured. The viviparous species could not be said to be just viviparous, for they were so viviparous that the young were said to remain in the uterus for no less than thirteen months, and did not leave the parent until they were fully developed. In view of the facts that the egg shell was sculptured, and that there was no trace of embryo in the egg when laid, he thought the species to be truly oviparous.

Dr. DENDY next read a paper entitled, "Short Descriptions of New Land Planarians."

The PRESIDENT asked whether the species of the land planarian were definitely marked off from each other, or whether there was a series of slightly varying individuals connecting one species with another.

Dr DENDY said there was a gradual series. Land Planarians were, perhaps, one of the best illustrations of Darwin's theory of evolution. All the connectlng links were apparently still present. Of course, there were no such things as different species in nature; there had been connecting links at some time. Fortunately, all the planarians remained. Still, he thought it convenient to have a name for each. As a rule, the species in each locality were tolerably constant; and although there were connecting links between them, he did not think that a reason for not using distinct names for each.

Professor SPENCER then exhibited, and read a few notes upon, *Notoryctes typhlops*, the new Australian mammal recently described by Dr. E. C. Stirling.

The PRESIDENT remarked that it seemed strange that a blind animal should come above ground so constantly. Would it not be subject to great danger in so doing?

Dr. DENDY suggested that as it was a desert country there would be hardly anything to molest it.

Mr. J. B. WILSON said it would be interesting to know whether the organ of smell was specially developed. It seemed extraordinary that a perfectly blind animal should be able to get its food, unless it had some special provision of the sort.

Dr. Dendy said it seemed strange it did not form permanent burrows. It could hardly be conceived that the animal was blind, unless it lived underground.

Professor Spencer said the animal apparently lived in sandy soil, in which it would be hard to form permanent burrows.

A paper, "Notes on the Alkaloids of Strychnos psilosperma," by Professor Rennie, M.A., D. Sc., and G. Goyder, Jun., F.C.S., was then read by the Secretary, Professor Spencer.

Professor W. C Kernot then read some "Notes on the Recent Flood on the Yarra."

Mr. W. P. Steane thought that although it might be advisable to improve the portions of the river referred to by Professor Kernot, it certainly would not be desirable to improve it above the Johnston Street Bridge. In fact it would be far better to create rather than to reduce obstructions on the upper reaches of the river. To remove obstructions would have the effect of increasing the velocity of the water, and improvements on the upper portion of the river would have the effect of flooding Melbourne more seriously. He therefore thought that improvements should be made only in localities likely to be flooded, and that where the amount of damage would be inconsiderable, the obstructions should be allowed to remain. Professor Kernot had put down the rainfall in Melbourne at three inches. He had been informed that at the head of the Yarra it was seven or eight inches. If this water were allowed to run down freely, it would have the effect of flooding Melbourne even more seriously than had been the case. He thought that in 1863 the water had taken fifty hours after leaving the head of the Yarra to reach Melbourne. The more its velocity could be impeded, the less danger would there be of a flood. Therefore nothing should be attempted beyond the improvements at the places pointed out by Professor Kernot.

Mr. R. G. Haig said he had noticed at the time of the flood, when the water was flowing over the road on the south side of Queen's Bridge, that on the south side of the woodwork of the wharf, the water was level with the surface, while in the river, only a few feet north of this point, the water was nearly a foot below the woodwork. In fact, the water was flowing over the road on the south side of Queen's Bridge at about a foot higher level than the river adjoining. Would that be caused by the unfinished state of the river between Queen's Bridge and Prince's Bridge?

Professor Kernot replied that Mr. Haig's observation was perfectly correct. At 2 p.m. on the day of the flood, the water in Normanby Road was as near as possible level with the South

Wharf, whereas the water in the river was about a foot below the South Wharf. The water in Normanby Road appeared to flow out of the river about half-way between Prince's Bridge and Queen's Bridge. Leaving the river at this point, the water appeared to make its way between a number of streets and lanes, and flooded Moray Street and Normanby Road up to the level of the top of the South Wharf (whilst in the river it was much lower), escaping in a cascade at the landing place of the steam ferry, near Clarendon Street. When the improvements between the Queen's Bridge and Prince's Bridge were finished, this would be entirely avoided ; and had these improvements been completed at the time, he did not think there would have been any water in South Melbourne. Besides this, the Queen's Bridge had not had a fair chance on this occasion, it having been completely blocked by the wreck of a dredging apparatus which had been placed there for the purpose of improving the river.

Mr. Griffiths said that the data supplied by Professor Kernot seemed to him to point to a danger in the future that had not been discussed so far. They had been given the sectional area under one of the upper bridges, and the velocity and amount of the water that passed under that bridge during the three days of the rain storm. The water that passed under that bridge was estimated to be enough to cover the whole of the watershed of the Yarra to a depth of two and a quarter inches. It was well known, that the watershed of the Yarra constituted one of the wettest portions of Victoria. The rainfall there was always greater than the rainfall in Melbourne, or any other part of the Colony. The rainfall in Melbourne during the three days of the rain storm was five inches, nearly three inches more than the amount of water that apparently must have covered the watershed, gauging the amount by the quantity that passed under the bridge. It was well known that, where rain fell on non-absorbent soil, clear of obstructions, it got away immediately, and with tremendous velocity ; but where the rainfall took place in a forest country, such as the watershed of the Yarra, it got away very slowly, and probably took months to be got rid of entirely. Now, it was almost certain that six, and perhaps seven, inches of rain had fallen over the watershed, and the reason why two and a quarter inches was all that got away during the three days was, that the whole of the country was a forest country, that the surface was absorbent, and covered with obstructions in the way of timber and bush and scrub, which caused the whole surface to act as a sponge, to hold the water and discharge it slowly and spread its discharge over a long period of time. Now this watershed was being cleared. It was being crossed by roads, every one of which had its gutters discharging into it. The land was being taken up for farming purposes ; and the rain got away much more quickly off a farm than off a similar area of virgin forest. This process of reclamation would go on until a very large portion of this area would be in a very different condition to that in which it was at the present time. In the future, the water over that area would be discharged very much more rapidly than it was to-day. What, under such circumstances, would be the condition of the lower Yarra, and to what height would the water in the Yarra rise? It would come down faster than it could get away, and the flood would be greater than ever. This danger seemed to threaten us in the future, and this showed the importance of taking every possible means to clear the lower regions of the Yarra, so as to allow the water a greater sectional area. He would like to ask what was the difference in sectional area between the Richmond Railway Bridge and the Railway Bridge below Prince's Bridge, and what amount of increased water way at the Richmond Bridge would have to be given by the railway authorities in order to give the water the same facilities for getting away as it had in the City; for on that depended the amount of work to be done to give the same relief at South Yarra as was enjoyed at the lower Railway Bridge.

Professor KERNOT, in reply, said that the sectional area between Queen's Bridge and Prince's Bridge would be ample as soon as the excavations were completed. As to the difference in area between the Queen's Bridge and Richmond Bridge, of course the Queen's Bridge was much longer. The difference was about 50 per cent. The sectional area at the Richmond Bridge would still further be reduced when the river was improved about there. The benefit would be felt in Richmond, but not in South Yarra, while the rush through the bridge would be increased to an extent that would probably be dangerous to the bridge itself. It seemed to him that an enlargement of the bridge was inevitable.

On the motion of Mr. GRIFFITHS, seconded by Dr. NEILD, the discussion was adjourned till the next meeting.

Thursday, September 10th.

The President (Professor KERNOT) occupied the chair.

The minutes of the preceding meeting were read and duly confirmed.

Dr. NEILD, the Hon. Librarian, announced that 61 publications had been received since the last meeting.

The PRESIDENT said he was just arranging to leave the Colony for Europe, and consequently that would be the last meeting at which he would be able to be present this year. He had to thank the members for so kindly electing him as their President, and thought the most orderly way would be for them to give him leave of absence till his term of office expired.

Mr. Rusden moved that leave of absence be granted.

Mr. White said he had great pleasure in seconding the motion. He thought it was usual for the Council to deal with such matters, but that was no reason why it should not be dealt with there.

The motion was carried.

The adjourned discussion on Professor Kernot's paper, entitled "Notes on the Recent Flood on the Yarra," then took place.

The President said he had re-written the latter portion of his paper, but had made very few alterations. He had re-written it mainly with the object of including in it the revised levels furnished by the Public Works Department. Last month the Inspector General had given him a list of the levels taken by his officers, but these had not been thoroughly checked. He had now received the revised levels, but the difference was only trifling, and, as a rule, did not exceed two or three inches at any given spot. With that exception the paper remained practically as it was when read on the last occasion.

Mr. White said he was surprised to learn of the absence of records at the Public Offices. As to the flood of 1863, there was a great difficulty in finding records. As to the flood of 1849, years ago there was a plan in the Public Works Office, containing a view of the scaffold of what was then called the new Prince's Bridge, on which the highest level was recorded. Had the President seen that?

The President.—I have not heard of it before.

Mr. White said that he had referred at the last meeting to the flood of 1839. It appeared that there were scarcely any records of the flood; but in *The Argus* of Saturday, September 5th, there was an extract from Mr. Robert Russell's diary. Mr. Robert Russell was Surveyor in Melbourne then, and laid out the town, and was superseded by Mr. Hoddle, who sold the allotments. In his diary he referred to the flood of December 1839. Mr. Skene, the late Surveyor General, had at that time arrived in Melbourne, and he said the flood of 1839 was very much more pronounced than the recent one. Melbourne had at that time been laid out about two years, and the Government thought the flat land south of the Yarra would be a splendid site for a town, but the flood came down on the very day that the sale was to have taken place, and there was water to the depth of ten or twelve feet on it. The Government had, therefore, come to the conclusion that it would not do to sell the land; but since the new course of the

Yarra was made the land had become covered with buildings. He hoped an effort would be made to collect these records. The newspapers published at the time were Strode's and Fawkner's. It was very important indeed that some Institution like the Royal Society should try to collect these things, and to bring under the notice of the Government the importance of doing something in this direction. Some time ago it had been found that the original plans and maps at the Crown Lands Department were getting torn and defaced, and a Committee had been appointed to consider the best way of keeping them. Not only should the original plans be preserved, but any documents relating to the history of the Colony.

Dr. Neild quite agreed with Mr. White as to the desirability of taking care of such records.

The President said he felt sure that any information that was obtainable should be obtained and placed on record without any delay. He would be very glad if someone would endeavour to obtain such particulars, as they would form a very useful addendum to his paper. He thought the flood of 1878 was very much below the present one. He had to confess he had not taken much trouble in the way of investigating the matter; but Mr. Davidson had told him that he had arranged the water pipes crossing the river at the Kew Asylum, and put them five feet above the level of the water in 1878, and during the recent flood these had been five feet under the water. The flood of 1878, therefore, did not appear to possess any particular interest. Thanks to the Public Works Department, he had been able to include in his paper the most minute information as to the present flood all the way down to the Dight's Falls. If that information could be obtained with regard to previous floods it would be most interesting. The papers during the year 1864 were rather concerned with criticising certain schemes for reducing the damage done by the flood, and did not trouble to include actual figures as to the height of the flood itself. The Public Works Department had furnished him with what purported to show the height of the flood of 1863 up as far as the railway bridge at South Yarra, but beyond that he could obtain no information. The flood level was shown by the wharves down at Prince's Bridge, and up to Brander's Ferry. Going towards the Cremorne Railway Bridge there was not more than about three inches between the floods. If the figures given meant the height of the water above the bridge, then the 1863 flood was three or four inches below the recent one. The Public Works Department thought that the two floods were about identical. Mr. Gordon had prepared a plan, now in the possession of the engineers of the Department, according to which the flood of 1863 was lower than the present one at Hawthorn, but seemed to rise again at Dight's Falls. According to Mr. Gordon, the 1863 flood had been about equal to the present one between Richmond and South Yarra and below that was higher than the present flood. Mr. Gordon had left for England before he had discovered this anomaly, and he had, therefore, not been able to get much information.

Mr. White said that the Yarra before 1863 was full of snags, which would probably cause a great number of weirs.

The President said the 1863 flood was some feet lower than 1891 flood, from the Hawthorn Railway Bridge to the Johnston-street Bridge. If the 1891 flood had been lower than the 1863 one, it might possibly be explained by the snags; but why should it be higher? The Victoria-street Bridge was the largest on the river, and consequently made the least obstruction.

Dr. Dendy gave a summary of a paper by Mr. J. B. Pritchard, entitled "On a New Species of Graptolitidæ (Temnograptus magnificus)."

Dr. Dendy read a paper "On the Presence of Ciliated Pits in Australian Land Planarians."

As there were not a sufficient number of members present to form a quorum, the elections were postponed until the next ordinary meeting.

Thursday, October 8th.

In the absence of the Secretary, Dr. Dendy read the minutes of the preceding meeting, which were duly confirmed.

Nominations.

Dr. J. W. Barrett was nominated as a Member, and Miss Agnes Murphy as an Associate.

Mr. H. K. Rusden was elected as Vice-President, *vice* J. Cosmo Newbery, C.M.G., resigned; and Mr. A. W. Dobson, F.G.S., was elected as a Member.

Mr. R. L. J. Ellery read a paper entitled "Notes on the Magnetic Shoal near Bezout Island, North-west Australia."

Mr. Rosales asked what was the geological formation of the Island?

Mr. Ellery said that the mainland (of which the Island had evidently once formed a part) and the Island itself contained a good deal of iron sandstone. A good deal of hematite was found on the mainland, and a few hematite blocks were also to be seen on the Island; but no specimen of truly magnetic iron ore had been found either on the Island or mainland. As a matter of fact, the hostility of the natives rendered it a difficult matter to carry on geological exploration and on some occasions exploring parties had narrowly escaped spearing. The magnetic action of the shoal was exactly similar to what would be produced by a ridge of magnetic iron ore. At that place the water was only about 75 feet deep.

Mr. Rosales said that in going about Ballarat his compass was very often affected in the way that had been described. In some places the granite had become greatly decomposed, and formed a magnetic iron ore.

Mr. Ellery said that there were a good many magnetic centres on basalt formations in the Colonies.

Mr. White said that in Madagascar and other places it had been found necessary to disregard the compass altogether for the purposes of surveying, and indeed, he was astonished, not at so many wrecks taking place, but at so few. Flinders, who was not equalled as a careful navigator in his day of wooden ships, had stated that in his opinion, by extreme care a course could be made good to a quarter point, or three degrees, about one mile in nineteen. It was nothing unusual in these days for a ship to run 400 miles in twenty-four hours, and thus, by trusting to the compass, a navigator could not make for any point with greater certainty than that he would arrive at within twenty miles of it. When captains of vessels found themselves out of their course, they generally set it down to the action of some unknown current. His impression was that it was generally due to some abnormal action of the compass. In fact, anyone who would trust the compass for absolute direction would be a madman.

Mr. Lucas asked if Mr. Ellery could give any reason why the north-seeking pole should be uppermost. He thought the iron ore would attract either pole.

Mr. Ellery said it was only surmise. Judging from the effect produced, that was the conclusion that seemed most probable.

Mr. Rosales said that if the deflection of the needle were due simply to a large mass of magnetic iron ore, the deflection would be greater and greater as the ship neared the Island, but there would be no deflection to the other side.

Mr. Ellery said that no doubt the mineral, whatever it was, was polarised.

Mr. Lucas asked whether it could become polarised by lying in a certain position.

Mr. Ellery replied that if it were lying anywhere parallel to the magnetic axis, it would become polarised. As the Chairman had said, when mistakes in navigation were made, people generally looked out for currents to excuse them, but in nine cases out of ten it was caused either by manifest carelessness, or by some defect in the compass. In some parts of the world—and this was the case on the Australian coast—certain classes of fogs disturbed the compass very much, and sometimes dangerously so. There was no doubt about this being a fact, although it was not generally believed, because many Captains of ships had been in fogs and had never noticed it. Certain fogs occurred sometimes in Port Phillip that threw the compass off a great number of degrees and when he had been first informed of this, a few years ago, he had been at a loss to account for it. But all old and trustworthy mariners spoke of having experienced it, and he thought it quite possible, because in this country a certain kind of fog sometimes prevailed on the mountains and plains and over the Bay that seemed to form an electric couple with the surface of the earth, or rather with a layer of atmosphere varying from five to ten feet thick, and if during the continuance of the fog, one explored between the surface of the earth and say five or six feet above it, and perhaps five or six feet above that, it would be found that there was a space with scarcely any tension whatever, whilst below there would be a tremendously strong positive tension, and above a tremendously strong negative tension. In fact, one would imagine that were very much more disturbance to take place, there would be flashes of lightning. This state of things would continue for some hours, and then all would become balanced again, and the two layers would be equally electrified. He had experienced this some three or four times. He had read a paper a good many years ago, giving some observations he had made on Mount Macedon. These observations were always made in a fog. The registrations at the Observatory made with the electrometre showed signs of this state of the atmosphere existing for short periods of time. From this it would be easy to see that some fogs must disturb a ship's compass, and it was only fair to captains of vessels that this should be known.

A Member said that an old resident of Apollo Bay had once remarked to him, that sometimes the weather at that place was so bad that it turned the compass round, and assured him that in certain fogs compasses were quite unreliable.

Mr. E. F. J. Love, M.A., read portions of a letter received by him from Sir George Stokes, President of Royal Society of London, concerning the Gravity Survey of Australia.

Mr. Ellery said he had received a letter a week or two ago from Mr. Wipple, of Kew, who said the pendulums were being made ready to be sent out. In a previous communication, he (Mr. Ellery) had mentioned that the Council had voted a sum to pay the expenses of their transportation, and asked that the pendulums should be sent as soon as possible. Mr. Wipple now stated that they would cost about £24 or £25 to pack and send away, and as he did not know whether the vote would cover that amount, he would await a reply. That was how the matter stood at present. The information given by Sir George Stokes would be very valuable in helping them to decide what was to be done, and he was inclined to think that the work would be more valuable and likely to be better done if new pendulums were made. A great deal of trouble had been experienced with the old pendulums in India, and they had seen a good deal of work. The Americans when near Australia a few years ago had used a small invariable pendulum made in America for their observations, but so far as he had been able to ascertain, the work was not very satisfactory.

Mr. Love said that from the drawings he had seen, he thought the construction of the Russian pendulum was very bad. From an engineering point of view, it was weak where it should have been strong, and *vice versâ*. He objected more particularly to the shape. As a matter of strength of materials, it was just as bad as it could be.

Mr. A. H. S. Lucas, M.A., B. Sc., read a paper entitled "Notes on the distribution of Victorian Frogs, with description of two new species."

Dr. Dendy said Mr. Lucas was to be congratulated on his work in connection with Victorian vertebrates. He had now added very materially to our knowledge of the higher animals of Victoria, and several new species were due to his researches.

Mr. White said that forty years ago the noise made by the frogs at St. Kilda could be heard miles away.

Mr. Lucas said he thought the noise was made by the green and gold bell frog. The common frog was a tree-frog, which had taken to the water. Its discs, which, though reduced, were still present, showed that it belonged to that order. The green and gold frog was the loudest.

Dr. Dendy said that at the University many hundreds of frogs were used in the dissecting-room, and they found that the male frog's vocal organs were much more largely developed than the female's, and in a different form, and specially adapted for making a great noise. He inferred from this that the male did most of the croaking.

Mr. Lucas said that that was so.

Thursday, November 12th.

E. J. White, Esq., F.R.A.S. (Vice-President) occupied the chair.

Mr. Rusden, V.P., in the absence of the Hon. Secretary through indisposition, read the minutes, which were duly confirmed.

Messrs. Dobson and Williams signed the Roll and were introduced to the Members.

Dr. J. W. Barrett was elected a Member, and Miss Agnes Ross Murphy an Associate.

The Librarian's report was to the effect that, since the last meeting of the Society, eighty-five publications had been received.

Mr. Rusden read the report of the Antarctic Exploration Committee, and moved :—"That Professor Kernot, Mr. R. L. J. Ellery, C.M.G. and C , and Mr. Griffiths, F.R.G.S., be re-appointed Members of the Antarctic Exploration Committee, with power to add to their number."

Mr. Griffiths seconded the motion, which was put by the Chairman, and carried unanimously.

Mr. Rusden read the report of the Port Phillip Biological Survey Committee.

Mr. Lucas said that since writing the report, he had been informed that Mr. Wilson had received a communication from Professor Agardh, with regard to the algæ of Port Phillip A large number of new species and genera had been added, and Mr. Wilson considered he would now be able to draw up a complete list up to date, and perhaps as nearly as possible altogether complete of the algæ of Port Phillip, which would be published in a systematic form, in the same fashion as the catalogue of fishes.

Dr. Dendy said he thought the suggestion of Mr. Lucas in the report, that the material should be retained in the colony instead of being sent home, was a very wise one. A large number of things had been sent home at considerable expense, and, with the exception of a few cases, they had received no return for their labour. He thought that in the future it would be desirable to retain the material. They had a number of workers—old established workers, and workers coming on at the University, and he thought they would be able to deal with it themselves far more satisfactorily than by sending it home, and at much less expense. If the money were spent instead by buying the publications suggested in the report, it would be a permanent benefit to the scientific literature of the colony.

The Chairman said the suggestion was that the Public Library should obtain the books, and the Trustees of that

Institution had always shown themselves very willing to procure any technical work required. He certainly agreed with the proposition that as much of the work as possible should be done in the colony. Would it be necessary for the Council to approach the Trustees of the Public Library in the matter ?

Dr. Dendy thought the first thing to be done was to get the individual naturalists in the colony to take up particular groups, and then these gentlemen might be asked to furnish the Committee with a list of the books they required. The Council might then be asked to obtain the books. He did not think the Public Library should be asked to obtain any books, until it was determined what books would be required.

Mr. Lucas moved "That the Members of the Port Philip Biological Survey Committee, viz., Mr. Wm. Bale, F.R.M.S., Rev. A. W. Cresswell, M.A., Dr. Dendy, Mr. A. H. S. Lucas, M.A. (Sec.), Mr. P H. McGillivray, Professor W. Baldwin Spencer, M.A., Mr. J. Bracebridge Wilson, M.A." The resolution was carried.

Mr. Rusden read the Report of the Cremation Committee, and moved "That Professor Kernot, Professor Orme Masson, and Mr. H. K. Rusden, F.R.G.S., be re-appointed Members of the Cremation Committee." The resolution was carried.

On the motion of Mr. Rusden, the old Members of the House Committee, viz., Mr. C. R. Blackett, F.C.S., Professor W. C. Kernot, M.A., Dr. Neild, Professor Orme Masson, M.A., and Mr. H. K. Rusden, F.R.G.S., were re-appointed Members of the House Committee.

Mr. Rusden read the Report of the Gravity Survey Committee.

Mr. Love moved the re-appointment of the old Members of the Committee, viz., Mr. R. L. J. Ellery, C.M.G., Professor Kernot, M.A., Professor Orme Masson, M.A., Professor T. R. Lyle, M.A., Mr. E. J. White, F.R.A.S., Mr. E. F. J. Love, M.A., and at a later stage added the names of Messrs. Russell and Todd. The resolution was carried.

On the motion of Mr. Rusden, seconded by Mr. Love, Professor W. Baldwin Spencer, M.A., Mr. R. L. J. Ellery, C.M.G., Professor Orme Masson, M.A., Mr. G. S. Griffiths, F.R.G.S., were re-elected Members of the Printing Committee.

Mr. G. S. Griffiths read a paper "On the Geology of the Barwon Heads."

Mr. Dobson asked why, if the lava was horizontal when it flowed from the volcano, it should now be level and the upper beds tilted. His reason for asking the question was, that he had been very much puzzled to account for the formation of the rocks on the south coast, near Warrnambool. The upper beds were evidently æölian. At present they were lying in the direction of the prevailing winds, and the lee side of the slopes, which were at an angle of about 32°, had evidently been very little disturbed. The slopes that were to leeward were the ones in which the quarries were worked. The seaward beds were very much disturbed, and if traced down to high-water mark would be found to be quite hard, instead of soft as at the top, and as in most modern beaches. But, as far as he could judge, the levels seemed exactly the same.

Mr. Griffiths said he was of opinion that whatever movement there had been had carried the whole of the locality up evenly, and lowered it again evenly, and that the divergence between the levels of the calcareous beds and the conglomerates intercalated between the calcareous beds and the levels of the old land surface which ran parallel to the lava bed surface, was not due to any tilting at all that had taken place in the locality (the beds having moved up and down together); but that the surface angles were due to the way in which the sandstone beds were deposited, or to the way in which those beds had eroded.

Mr. Dennant asked Mr. Griffiths if he had found any sign of any rock beneath the basalt. It would be interesting to know what rock was found underneath the basalt. He thought these deposits would be found underneath the basalt at the Barwon, if it could be penetrated. He would also like to know if there was any evidence as to whether that basalt was the newer basalt or the older basalt. That might afford some clue perhaps as to the age of the overlying rocks. As a matter of fact, the newer basalt was never overlaid by the limestone referred to by Mr. Griffiths. He knew of no instance of such being the case in any part of the colony. As Mr. Griffiths had hinted, the basalt might be continuous across the Straits, and possibly might extend right across to Western Port. With regard to the term "sandstone" he supposed Mr. Griffiths had used it as a common term. He believed it was composed mainly of portions of shell, the same as at Warrnambool. He had heard lately of an analysis of the Warrnambool sandstone, and, speaking from memory, he thought there was something like 95 per cent. of carbonate of lime in it. As to the doubt expressed by Mr. Griffiths with reference to the origin of the rocks—whether they were æölian or sedimentary—he would like to know whether any attempt had been made to isolate particles. He thought that might enable them to decide the question. If the particles of which the rocks were composed were angular, they were not sedimentary rocks; if they were rounded, they probably were sedimentary. Æölian rocks always had angular particles. He had no doubt that the rocks referred to at Warrnambool were æolian, and the particles of which they were composed were never rounded, but always angular. Then again, it had been said that these rocks were Tertiary or Pliocene. He would like to know why they were called Pliocene or Tertiary. In the absence of fossil evidence, he did not know how it was to be decided whether the rocks belonged to one age or another, unless there was an underlying or an overlying rock to be guided by. In this case, there was neither. If they were æölian rocks, as represented by those at Warrnambool and further to the west, he would be inclined to catalogue them amongst recent forms.

Mr. Wilson asked whether it was probable that the flow of lava came from the neighbouring Mount Duneed. With reference to the rock above the basalt, had Mr. Griffiths noticed a capping of true limestone, or something approaching a true limestone, on the top, above what he called the calcareous sandstone. At Sorrento and Queenscliff there was a capping a good deal purer than what had been described. He could not help thinking that the capping on Barwon Heads bore some similarity to that which was found on the other side of the Straits. Mr. Griffiths had said that the lava did not show itself further west. By that it was to be presumed was meant that it did not show itself very close, because at a little distance the basalt came out again at a place commonly called the Black Rocks, about half way between the Barwon Heads and Bream Creek. As to its going across the Straits, he could not of course say positively ; it did not go some distance across the Straits, but in dredging off that place he had occasionally brought up boulders of basalt rock ; but a little beyond that distance, sandstone was met with, which he believed to be of the same character as the sandstone at Bream Creek, and which was also found on the opposite shore, in the immediate neighbourhood of Ocean Grove, which he had heard called Eocene.

The Rev. A. W. Cresswell asked Mr. Griffiths whether the age of the underlying volcanic rock could not be estimated by simply comparing it with the volcanic rock at Phillip Island. He presumed if it were recent rock it would be harder, to begin with, and would differ altogether in its mineral contents from the older Miocene basalt. A Miocene basalt was easily distinguished from a more recent one, partly because of its peculiar mode of decomposition, and its texture, softness, and so forth ; and partly by its mineral contents. He thought that under consideration very much resembled what one saw all along the coast, and especially at Phillip Island ; but he did not recollect the bands of conglomerates spoken of. Dr. Wilson had observed that these rocks had a capping of what appeared to be true limestone. He himself had observed that capping, and had noticed that it was very solid. His opinion was that the whole of the rock was a plastic limestone. It was a form of comminuted shells; and here and there, owing to different causes, there had been a sufficient decomposition of the limestone, so to speak, to fuse masses of this plastic limestone on certain horizons.

Dr. DENDY read a paper on "Land Planarians from Queensland."

Mr. LUCAS remarked that it was strange that in the Queensland collection there should be so many genera and so few species.

Dr. DENDY said that Professor Spencer, who had collected the specimens described, had remarked that Queensland was not nearly so good a collecting ground for Land Planarians as Victoria.

Thursday, December 10th.

The minutes of the preceding meeting were read and duly confirmed.

Mr. GRIFFITHS stated that, at the last meeting of the Antarctic Exploration Committee, the question whether there should be two Secretaries had been raised. Hitherto, Mr. Rusden had represented the Royal Society as Secretary on the Committee, and the Royal Geographical Society had also been represented by a Secretary. Mr. Rusden having resigned this position, Baron von Mueller had raised the question as to whether the Royal Society should appoint a second Secretary.

Mr. ELLERY did not think there was any advantage to be gained by having two Secretaries, and moved "That nominations of members of the Royal Society to the Antarctic Committee be nominations of members only."

Mr. GRIFFITHS seconded the motion, which was carried.

Mr. Baker, Associate, and Mr. Oldfield, Member, signed the Roll, and were introduced to the meeting.

Messrs. J. Lillie McKay and A. E. T. Swanson were nominated as Members.

On the motion of Professor SPENCER, seconded by Mr. ELLERY, Messrs. Fenton and Moors were re-elected Auditors.

Professor SPENCER gave notice that, at the next General Meeting, he intended to propose certain amendments of the Laws of the Society, which would be fully set out in the notice paper for the March Meeting. These alterations had two objects, first, consequential alterations to allow of there being one Secretary instead of two, and second, amendments dealing with the Sections of the Society.

Mr. Ellery called attention to an article which had appeared in *The Australasian* with respect to the Society, and which spoke of its decline and approaching fall. He had been connected with the Society from its inception, and he had not known a time in its history when it had manifested more real vitality in the work of the advancement of science. Perhaps the writer of the article in question had confused the work done by the Society with the proceedings of Section G, and if that were so, he could not wonder at the conclusions he had arrived at, if the reports of those proceedings were correct. As one of the oldest members of the Society, he was sure it was ahead in many respects of what it had ever been before; and although in earlier times a good deal of work of a popular kind might have been done, for original research and for good work, which would compare favourably with that done by any other Society, the present time had never been exceeded.

Professor Spencer said he had interviewed the Editor, who had promised to insert a letter with regard to the matter, and read a letter which he had written accordingly.

The Hon. Librarian reported that since the last meeting 83 publications had been received and added to the Library.

Professor Spencer read a Preliminary Notice of Victorian Earth-worms. Part I.—The genera Megascolides and Cryptodrilus.

After a short discussion, Professor Spencer observed that an interesting point in regard to the earth-worms of Victoria was that they did not seem to throw up the soil at the mouth of their burrows to the same extent as European earth-worms. What Professor Drummond had said with regard to Africa seemed to be perfectly true with regard to Victoria, that in the matter of throwing up the earth, the ants took the place that was taken by the earth-worms in other parts of the world.

Professor Spencer read a note on the habits of Ceradotus forsteri.

Mr. Ellery asked whether it had not been stated that the Ceradotus was a migratory fish?

Professor Spencer replied that it could not be a migratory fish as its limbs were not strong enough to support it out of water. It was found only in two rivers, the Mary and the Burnett, and nowhere else.

Mr. Baker said that in the Murray District it was a commonly accepted idea that the fish would cross from pool to pool.

Professor Spencer said that such an idea was erroneous. He had tried the fish out of water, and had come to the conclusion that it was unable to move.

On the motion of Mr. Ellery, seconded by Mr. Griffiths, it was resolved that the papers entitled "Notes on Victorian Rotifers," by Messrs. H. H. Anderson and J. Shephard, and "A Note on the Amphioxus of Port Phillip," by Mr. A. H. S. Lucas, should be printed in the Transactions of the Society, subject to the approval of the Secretary.

On the motion of Mr. Ellery, seconded by Mr. Griffiths, it was resolved that letters of condolence be sent to the widows of the late Dr. Perry and Sir William McLeay.

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