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OF THE

MICROSCOPICAL SOCIETY

OF

VICTORIA.

VOL. I-II.

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In consequence of the amalgamation of the Microscopical Society with the Royal Society of Victoria, the publication of this Journal will henceforth be discontinued.

Future papers will be published in the "Transac tion and Proceedings of the Royal Society of Victoria."

TABLE OF CONTENTS.

Vol. I.

Vol. II.

QUARTERLY JOURNAL

OF THE

Microscopical Society of Victoria.

AUGUST 1879.

PREFACE.

In these colonies there is a wide and almost untrodden field for microscopic investigations in every branch of natural science, and it is believed there are many workers throughout the country who labour under serious difficulties through the want of association. To these the *Quarterly Journal of the Microscopical Society of Victoria* will afford the means of communicating their observations to scientific authorities in other parts of the world, and thus enable them to aid in endeavours to solve some of the vexed problems of the day. The younger members of the Society, and other tyros in microscopy, will find the Journal instructive as indicating what lines of observation may be adopted most advantageously.

Kindred societies throughout the world are earnestly desired to forward their publications in exchange, and thus help to remedy a defect inherent in all young communities, viz.: The want of a library replete with all the serial scientific publications of other countries. As an immediate consequence of this defect, it is probable that occasionally some of the articles in this Journal may be found to be on subjects previously described elsewhere; but every endeavour will be made to avoid this difficulty.

It may be useful to state, that the Society meets on the last Thursday in each month, for the reading of papers, exhibition of specimens, and the transaction of business generally; while practice meetings are held every week. These weekly meetings have become very enjoyable, partaking more of the character of club meetings, where the members bring their microscopes, and, unfettered by formalities, converse freely on subjects of interest; and where they may seek and obtain such help as they require. And thus already, in the first year of the experiment, it is found that many young workers are gradually settling down into fixed grooves of useful study, that must eventually yield good results. Open air excursions are occasionally made by the members, for the purpose of collecting objects, and those made during the last season afforded much enjoyment to the members present. It is by work such as this, undertaken in earnest, and steadily carried out, that the Microscopical Society of Victoria hope to attain success. In the meantime, while not venturing to hope that the proceedings of so young a society will be of much interest to more advanced associations, having kindred aims, it is believed that eventually this Journal may become a valuable record of systematic observations and original researches in Australian microscopic science.

MELBOURNE,

August 1st, 1879.

ANNUAL ADDRESS OF THE PRESIDENT,

THOMAS SHEARMAN RALPH, M.R.C.S. Eng.
Assoc. Linn. Soc. Lond.

[Delivered to the Members at the Annual Meeting, held on the 31st October, 1878.]

GENTLEMEN OF THE MICROSCOPICAL SOCIETY OF VICTORIA,

Again it has devolved upon me, as your president, to address you at the close of another year, and in so doing, I must recount the progress and position of the society as a working community in the large field of natural science. I shall first of all briefly place before you what work has been done in our midst, and then glance at general matters connected with our peculiar pursuits. Our last annual meeting was held on the 25th October, 1877, and since then this society has held nine general meetings, at which subjects of various kinds have been discussed or brought to the notice of the members by communications in the form of papers, notes, or specimens. For instance, we have had an interesting paper contributed to the society by Mr. Wooster, on some native *Sand Flies;* exhibition of various forms of *Gorgonia* and *Foraminifera* by the Rev. J. J. Halley; a notice of *Phylloxera,* with specimens of the larval state and perfect insect, from the vineyards at Geelong; also, a brief notice, by Mr. T. Burrows, of a peculiar form of *Spider*, the body of which was prolonged into a remarkable tail-like appendage. I may here notice, that I believe a splendid work, with plates, on Spiders, is now to be found in the Public Library, and that it contains descriptions of spiders which belong to this country, and may be of service to us in determining genera and species. Mr. C. M. Maplestone contributed a paper, descriptions of some Victorian marine *Polyzoa,* together with some excellent drawings of the same, executed by himself. A short notice and specimens of the

Coffee Fungus affecting the leaves of the coffee plant in Ceylon were brought before you by your President. Mr. J. R. Y. Goldstein exhibited, on one occasion, a series of *Polyzoa*, collected during several years. Mr. Barnard exhibited an *Ixodis*, from the Platypus, and some nematoid worms, which made their appearance in its fur. The same member also exhibited some living diatoms which had been obtained from the shores of Williamstown. Mr. Allen on one occasion exhibited diatoms, sections of coal, and other interesting objects, which had been prepared in England, and were much appreciated by those who examined them. The Rev. J. J. Halley also exhibited specimens of typical diatoms from England, and Mr. J. R. Y. Goldstein also some living species of diatoms. Also, a paper by the Rev. J. J. Halley, entitled "Diatoms, what are they?" which proved very interesting, and also suggestive of work to be done in this department of living beings. Also, a paper contributed by Mr. Barnard—"Diatoms: where they live, and how to find them." Also, we had lastly an exhibition of the "*Spectroscope*," with remarks on its use by Mr. J. J. Thompson. In addition to these, I have to notice that the members, by invitation of the Royal Society, exhibited specimens and various objects of interest at the conversazione lately held by that society. Besides this, I have to inform you that nine new members and one honorary member have been added to the society, and I think it may be stated we have now more members at work and learning to work with the microscope than in time past. The following changes have been brought about in our community. First of all, our late hon. secretary, Mr. T. Burrows, retired from the post which he had diligently held for some time, in consequence of his removal into the country. His place we have been able to fill by our new hon. secretary, Mr. J. R. Y. Goldstein, and I trust we are already beginning to feel we have efficient help afforded us in the discharge of the duties of his office. In the beginning of February last, we were enabled to make a change for the better, in obtaining the room in which the society now meets, and which is open to the members every Thursday for work and meetings; and in consequence of our more advantageous position we have been able to lay out three Thursday evenings in every four as evenings to be devoted to steady work with the microscope, the object being chiefly to help those who require some instruction in using the instrument, and in carrying on any special study with it. With this in view, we hope our gatherings will be continued regularly, and that in due time the younger members of the community will be able to come forward with work of their own as contributions to the society. There has also been a move made to invite ladies to partake in the monthly meetings, and I am sure if by this means we can persuade any to work, as some are doing elsewhere, I for one shall be glad; at any rate, I believe their attendance will induce us to render our work more interesing, as well as instructive to them, in hopes of some advance on their part.

I must now advert somewhat to our work, and what we must endeavour to look forward to. In the first place, we have no distinct collection of objects which may some day be valuable for reference. This must be remedied, and I beg members to make efforts to remove this blank from the society by presenting preparations and objects for our cabinet. It will be quite easy for any member, when he can, to supply a better specimen, in the place of any which may be of inferior quality or importance. I therefore beg them to bear in mind the necessities of the society, and at once seek to fill the cabinet which is available for this purpose. Besides this, you may perceive that we have laid out money with this view in providing appropriate furniture for our convenience of meeting, and also for the preservation of papers, books, and objects, and I may also add for an instrument for general use, which I trust we shall possess ere you are again addressed by your President, at an annual meeting. I hope the proposal for this addition will shortly be taken into consideration by the committee and members. Of books we have but few, for they may be numbered on one's fingers; but I think we may now look forward to obtaining more, and especially such as are of local interest and are productions in the colony. I have to notice that the following have been presented to the society:—*American Journal of Microscopy and Popular Science, Quarterly Journal of Microscopical Science, Chemist and Druggist's Journal, Beales' Microscope in Medicine,* presented by the honorary secretary, *Schmitt's Atlas of Diatomaceæ,* purchased by the society, now comprising 13 numbers, several *Parts of the Proceedings of the Linnæan Society of N.S.W.*

I will now return to an important point for us to consider, if we are to prosper as a society. Not long ago I had occasion to defend our position as such against an imputation that we were not practical—that we did nothing which was of use to any but ourselves. I endeavoured to point out that in order to come to practical work we must first of all be educated to do that work—that such was the history of the Royal Microscopical Society of Britain, which for years consisted of men of all grades and occupations and tastes; and that besides doing much to advance the microscope as an instrument, by holding out inducements to improve its powers and the appliances connected with its use, there had been much done to forward our general knowledge in histology, and the outcome of all this has been the formation of a Medical Microscopical Society, in which medical matters alone were being advanced. And so if *we,* in this colony, were to look forward to any such workers here, it would be promoted by the existence and work of a microscopical society, whose aim would be that of training men to work and carry on inquiry into branches of study which might not at first appear to be of a practical nature, but must in the end lead to the establishment of a class of workers who would bring forward work which would prove to be of great importance. We all know that many hands make quick work; so work, by many heads, properly trained (as we may suppose those hands must have been), with certainty, advances, not in any given direction which we may think to indicate, but according to existing circumstances and the men who come to the front. I therefore take this occasion of endeavouring to press upon the members the necessity which exists, not only for training, but that our aim should be to draw in as many workers, or men minded to become such, as we can induce to join our ranks, and every man who finds his place in the society, if he be a worker, will certainly bring out something fitted for the common weal. It is a popular and a common error to suppose that any man or any society has at once made its mark; it has been always done by patient and steady endeavours, and the more the patience exhibited the greater and the more lasting has that work been. I may also here note, that if any method or plan can be adopted by us, or by some of our members, by which we can enlarge our training, we certainly should try and carry it out, but it should be well considered and then fully carried out. I believe there has been among us a proposal to carry out a field-day, or a day of excursion, wherein we may obtain materials for study, and whereby we may become more familiar with modes of obtaining such objects as may conduce to our work. I am inclined to think we may be able to compass this if we take advantage of those occasions which are public holidays, wherein we may be able to muster more to our advantage. Such excursions may, perhaps, induce some to join us who otherwise would not. I have no idea of converting our society into a natural history club, but of obtaining materials for microscopic work and training; and if we are to enter upon some such plan, the sooner we do so the better. I beg to remind the members that we ought to keep our Thursday evening meetings, as they are essential to the carrying out of the plans which we have lately proposed, for training for work, and I trust all the older members, and any who have acquaintance with the microscope, will give a helping hand in this endeavour, in order to prove what can be done in the matter. I must say that, on looking back to the past, I think we may hope we have tided over a period of dulness and comparative difficulty, and that our prospects are somewhat brighter than they were a year ago. And trusting we shall each be able to add our quota in the future to the work which lies before the society, I beg to close the past year and open the incoming one to your welcome.

Notes on the Examination of Thin Slices of Rocks under the Microscope by Means of Polarised Light. By A. W. Howitt, F.G.S.

[Read 30th November, 1876.]

An examination of thin slices of rocks under the microscope by ordinary light reveals to us their general structure. We are in this way able to distinguish, in many cases, the outline of the constituent minerals, and in those cases in which these minerals are present in a crystallised shape, to judge from their outlines as to the probable form of the crystals themselves. The various colours with which certain minerals become transparent also afford means for arriving at conclusions concerning them. We can distinguish other constituents by their strongly-marked character, as, for instance, *magnetite.* With high powers we are enabled to perceive minute cavities containing portions of once glassy substances, or of fluids; or again, other cavities which may be regarded as having contained imprisoned gases.

Much also may be ascertained as to the processes by which various rocks become metamorphosed or decomposed, and as to the minerals resulting from such changes. Thus, an examination by ordinary light yields much information of importance to the petrologist; but it is to the results obtained by the employment of polarised light that the greatest interest attaches, and it is in respect to these that I propose to note a few of the principal points of interest.

It would be out of place to enter into any general consideration of the subject of polarisation of light, and I shall therefore start with the assumption that we have before us a compound microscope arranged for work, and fitted with the usual polarising apparatus, the polariser being placed in such a position that its shortest diameter is parallel to the perpendicular plane of the instrument in which the light is incident. The analyser being accurately crossed so as to produce obscurity in the field, we are in a position to make some of the most interesting observations in connection with the optical relations of the minerals to be examined. To enter into a consideration of all the beautiful and important phenomena of chromatic polarisation from which the petrologist draws some of his conclusions would extend these few notes to the length of a treatise, and I must, therefore, confine myself to those observations which are most readily made use of for the purpose of distinguishing to which of the six classes of crystallisation the mineral under observation may belong. And this will often be sufficient when taken together with the morphological appearances and the colour by ordinary light, and the presence or absence of dichroism even to determine to which particular species the mineral may belong.

If we, therefore, suppose ourselves to be now observing some thin rock slice by polarised light, the instrument being adjusted as I have said, we may observe that the first distinction to be noted is this:

The mineral constituents may be placed in two classes:

Class (1), those which remain permanently dark, even when rotated between crossed nicols. These substances will be—(*a*) amorphous; (*b*) crystallising according to the isometric system; or (*c*) seen in the direction of an optic axis, or axis of no double refraction. These last are so rarely met with that we may pass them over from this discussion.

Examples of (*a*) are *glass, opal, tachylite.*
(*b*) *garnet, hauyne,* &c.

Class (2), those which generally show light and colour when placed under crossed nicols, and on the nicols being placed parallel show the complimentary colours of those first seen.

These may be subdivided into:—(*d*) becoming obscured in four positions, when rotated between crossed nicols, and (*e*) which do not become totally obscure in any position, but show light and colour. The former are doubly refracting minerals; the latter are aggregates.

Examples: (*d*) *Fibrolite, augite, hornblende.*
(*e*) *Serpentine rock,* &c.

When a pencil of polarised light passes through a plate of some doubly-refracting mineral, it is resolved into two rays which are polarised, and vibrate in accordance with a well-known physical law, in two planes, which are perpendicular to each other. One of these rays vibrates in the direction of the greatest elasticity pervading the mineral, while the other ray vibrates in the direction of the least elasticity. Where such a thin plate is cut parallel to the optic axial plane of a mineral having two optic axes, one of these polarised rays vibrates in a direction bisecting the acute angle formed by the optic axes, and this direction, which is that of the greatest or least elasticity, is called the bisectrix or intermediate section. The other polarised ray being perpendicular to the first, bisects the obtuse angle formed by the two optic axes, and is termed the normal or supplementary section.

This I may illustrate by a diagram (Plate I. Fig. 1) copied after Rosenbusch; it represents a flake of gypsum in the clino-diagonal cleavage, and in which lies the optic axial plane.

It is principally to the application of these principles to micro-petrographical researches that I propose to refer.

We find that in the isomorphic system of crystallisation the optical conditions pervading the crystal are the same in every direction. It is a simply-refracting substance; the crystallographic axes of the system are all perpendicular to each other, and of equal value, and the optical properties of such minerals conform to the symmetry of the system. In whichever direction a thin plate may be cut from an isometric mineral, the same observation will be made, that between crossed nicols it remains dark.

In the next system, the *tetragonal* minerals, commence the series of the doubly-refracting substances. They have one optic axis, which is also the axis of the greatest or of the least elasticity. We find that one of the three crystallographic axes is differentiated from the two others—it is either longer or shorter, but all three are perpendicular to each other. This differentiated axis also conforms to the position of the optic axis, and to one of the axes of elasticity. The optical emanations show also that the crystal does not permit the passage of the light undulations in every direction, as was the case in the isometric system, with equal facility. A plate cut perpendicularly to the chief axis still behaves as an isotropic or isometric substance. In any other direction the light becomes doubly refracted, the plate showing light and colour between crossed nicols.

In the minerals of the *hexagonal system*, the optical characters are absolutely the same as in those of the tetragonal. The distinction will here depend mainly upon morphological characters.

In minerals of the *orthorhombic system* we find a further divergence in character. We have three crystallographic axes, which are certainly perpendicular to each other, but which are of different values. We no longer find a single optic axis conforming in position to the chief crystallographic, but we have two optic axes, which are symmetrically placed as regards two of the crystallographic axes, one of which bisects their acute and the other their obtuse angles, We have also three axes of elasticity, the greatest, the least, and the mean, which accord in position with the three crystallographic axes; and the optic axial plane, that is, the plane in which lie the optic axes, lies in one of the chief crystallographic sections.

In the *monoclinic system* we have a still further departure from the primary symmetry of the isometric system.

We find here three crystallographic axes of unequal value, two of which are inclined to each other, whilst the third is perpendicular to the two others. It is this crystallographic axis—the orthodiagonal—which alone falls into position with one of the axes of elasticity. The optic axial plane may be found in the plane of symmetry, but it may be perpendicular to it. Thus the position of the optic axes and of the two remaining axes of elasticity which bisect their angles has no constant position throughout this system.

In the *triclinic* we have a complete departure from the symmetry of the isomorphic system. We have here three crystallographic axes of unequal value, unequally inclined to each other. We find the optic axial plane not conforming in any case to the crystallographic section, and none of the three axes of elasticity conform to any one of the crystallographic axes.

The application of the foregoing to practice is simple.

A consideration of the crystalline outlines of an isotropic mineral will usually show whether it is one belonging to the isomorphic system, or whether the section has been cut perpendicular to an optic axis. This is not common in tretragonal minerals, and becomes more rare in the succeeding systems.

Were it possible to examine the mineral sections under the compound microscope by means of convergent polarised light, as is done in Norremberg's polariscope, it might be, in many cases, readily determined whether the mineral belonged to the uniaxial or biaxial systems.

In default of this, inferences may be drawn from the positions of the directions of greatest and least elasticity in regard to some crystallographic constants, such as the outlines indicative of the prismatic planes or known directions of cleavage. For instance, in sections parallel to the chief axis in the tetragonal system, the axes of elasticity will accord with the prismatic sides, or be perpendicular to them; that is, parallel to the basis.

In the *hexagonal system* it will be the same, and this and the former may be then distinguished by their different morphological character.

In *orthorhombic* minerals, both in sections parallel and perpendicular to the chief axis, the directions of the greatest and least elasticity will conform to the prismatic sides or to the basis.

In the *monoclinic system* of minerals this will only be the case when the plate is cut precisely in the direction of the orthopinnacoid.

In the *triclinic system* we shall find that in no case do the axes of elasticity fall into accord with the prismatic sides or the basis; we might expect this from the unsymmetrical character of the system.

The mineral species crystallising in the triclinic system which are of most frequent occurrence in rock sections are those of the triclinic felspars commonly and conveniently termed by petrologists, "*plagioclase.*" They are sufficiently distinguished from all other species by their remarkable structure.

The diagrams on Plate I. will illustrate the above remarks, and will also enable me to refer shortly to the dichroic effects observable in some minerals, which also serve as a means of discriminating between them and other minerals which resemble them, but are not dichroic.*

Fig. 2. *Biotite Mica, Hexagonal System.*—On being placed between crossed nicols, so that the lines indicating the basal cleavage (which is perpendicular to the chief axis) are in accordance with the optic section of the polariser (placed as before described), the mineral will become dark. Thus *A*, chief axis, and *a*, axis of elasticity, agree, as do also *B* and *b*. This mineral is therefore, according to its optical conditions, either tetragonal, hexagonal, or orthorombic. Morphological characters and dichroism, to be described by-and-bye, will suffice to determine which of the three.

Fig. 3. *Hornblende, Monoclinic.*—On rotating such a section of hornblende between crossed nicols, one axis of elasticity will be found in the position of *a*, and the second, of course, perpendicular to it, as *b*. They form small angles with the two crystallographic axes *A* and *B*, the former of which may be inferred as to position from the prismatic cleavage, which is almost always evident.

Fig. 4. *Augite, Monoclinic.*—In sections of this mineral, such as the one figured, one axis of elasticity will be found, as at *a*, and another at *b*, both forming more considerable angles with and in different positions towards the crystallographic axes, or the crystalline planes which are parallel to them.

In the last cases we have mineral species which, in some cases, are morphologically difficult to distinguish, and it is often the case that illdefined laminæ are met with, of which at sight it is difficult to say to what species they may belong. If, however, any characters are present from which the crystallographic conditions of the laminæ may be inferred, the above principles may be used with advantage.

Finally, the observation whether any thin plate, or lamina, is or is not dichroic will often determine its character, as, for instance, in discriminating biotite from Muscovite mica, or hornblende from augite.

In observing light which has traversed doubly-refracting coloured minerals, it may be observed, with greater or less distinctness, that in different directions they show different colours, or intensity of colour. This is called polychroism, and depends upon a partial absorption of the traversing

* Polychroism is a more proper term, but in any one slice only two colours can be observed; hence the term dichroic is appropriate.

light, and as regards the difference of colour, upon the absorption of those undulations which are of some certain wave length. Thus the emergent ray would only show that colour resulting from the compounding of those rays which had escaped absorption. As the elasticity of doubly-refracting minerals differs in certain directions as regards light undulations traversing it, we can see that the light emerging in these directions will have been unequally absorbed, and will, therefore, differ in colour.

We must further remember that a ray of polarised light passing through a plate of some suitable mineral, is resolved into two polarised rays, vibrating in the directions of the greatest and the least elasticity. If we were to examine such a plate slowly rotated over the polariser—the analyser being removed—we should observe that in two positions, perpendicular to each other, the light passing through assumed two different colours or tints. Thus we should be enabled to observe in sequence the two colours which together give the tint proper to the plate; and we should further be able to distinguish between mineral species, such as hornblende, which are distinctly dichroic under such conditions, and other mineral species, such as augite, which are not.

These statements are a brief and somewhat imperfect outline of some of the methods now in use in micro-petrography. Those who are desirous of obtaining a further insight into this most interesting and important branch of microscopical research may consult a little work lately published by Dr. Spottiswoode on "Polarisation;" the admirable "Mikroskopische Physiographie der Petrographisch Wichtigen Mineralien" of Rosenbusch, or the more special optical studies of the "Lehrbuch der Physikalischen Mineralogie" of Dr. Schrauf.

Notes on Sponge from Northern Territory. By F. Barnard.

[*With Plate.*]

[Read 26th July, 1876.]

At the last meeting of this Society it will be remembered several natural history specimens, collected by Dr. Sturt in the Northern Territory and kindly sent by him for the use of the members, were distributed. Among them were three varieties of sponges, to one of which I would more particularly direct attention.

It was of a white colour and very peculiar growth. The shape and general appearance led me to think I had obtained a new variety of gorgonia, but to my great surprise, on treating it with potash, I found it produced no material effect upon it, as in the case of gorgonias. I then subjected it to nitric acid, when I found I had a sponge containing very remarkable silicious spicules which, though small, measuring about 1-1000 inch, and taking a ¼-inch objective to resolve them, fully repaid me for my trouble.

The spicules are stellate, with three, four, five, and six arms—I cannot call them points, as in a star. In most cases these spicules are flat, the arms radiating from a common centre, and instead of being sharp-pointed, as in the ordinary sponge, the spicules are terminated by an irregularly jagged, club-shaped end.

In some cases there is another arm projecting upward from the centre, while in others there are arms both above and below the centre.

The spicules are interspersed with the ordinary long, straight, and some few slightly-curved pointed sponge spicules. I would strongly advise those members who obtained a specimen to treat it with acid, and to separate the stellate spicules for a slide by themselves.

The drawings I have made are very much enlarged and are shown on plate I., figs. 5, 6, 7, 8.

Infusoria in Australia. By Chas. M. Maplestone.

[*With Plate.*]

[Read 31st May, 1877.]

In many points the objects in the animal kingdom are more interesting to microscopists, beginners as well as experts, than those of the vegetable kingdom. The fact of their having life and motion is in itself sufficient to make them attractive, and it is the privilege of the microscopist to be enabled to see the various lower forms which are invisible to the naked eye, to trace the different steps from the simplest to the most complex, and to observe the various organs and tissues of the higher forms.

The simplest form of life is that of the Amœba, which is only a small speck of jelly-like matter, without any apparent covering. Next comes the Rhizopoda, of which Difflugia is an example. These have an apparent covering, but from the appearance of the pseudopodia, or arms, which they protrude, are not very far advanced in the scale of animal life. Further on are the Infusoria proper, which have cilia, or hairs, by means of which they move and procure their food. They have a definite shape, and in the bodies of some of them are vacuoles and a vesicle which is contractile, and in some expands and contracts in rhythmical intervals, but its use in their economy is not perfectly known. The Vorticella are small, bell-shaped infusoria, which are anchored by a long stalk that has the power of coiling up suddenly when alarmed, and slowly extending again: their forms are, however, so varied that I cannot here attempt a description of them, but will proceed to notice those I have seen.

Infusoria may be found in almost any drop of water, yet they are really very difficult subjects to treat of properly, unless one has plenty of time to devote to their special study; they cannot be preserved, and it takes a considerable time to make sure of their forms and structure, especially as to the disposition of their cilia. They are always moving about so quickly that only occasionally can their details be properly seen, and then perhaps only for an instant; they are, therefore, very difficult subjects to draw, and without accurate drawings it is impossible to be certain of their identity; memory is not sufficiently trustworthy, and as to details, the best descriptions cannot compare with correct drawings.

The history or biology of their forms (especially of the most minute) has lately been made known in some very valuable papers by Messrs. Dallinger and Drysdale, in the *Monthly Microscopical Journal.* These papers seem to point to the inevitable conclusion (although they treat only of the minutest forms yet known) that many, probably *most,* of the forms drawn and described as *distinct* species, may only be the different forms of comparatively few species in the various stages of their lives. I can only speak of those that I have seen as different *forms,* attempting very little in the way of naming them. It does not fall to the lot of many in Australia to be enabled to keep the same forms under long-continued observation, as described in the papers above alluded to; and until we can do the same our knowledge of the majority of the species in this class must remain in its present unsatisfactory state, while careful observation would clear up many points.

Most of the forms I have seen seem to bear a great resemblance to European species; the names I give are for the most part mere approximations.

The first that I saw was one shaped somewhat like a Paramœcium, but not so large; it was either a Kerona or Chilomonas; with it was a small monad which moved very fast across the field of view. A few days later, in the same water, I found the Chilomonas undergoing subdivision, in some cases longitudinally, in some transversely.

On another occasion, in some greenish matter, from a dried-up pool, which I had put in water, I found a few monads and conferva threads; a few days later the same water yielded myriads of monads, and, to my delight, the first Vorticella I had seen. I watched, with intense interest, the movements of its cilia, the sudden retraction and subsequent gradual extension of the stem; it seemed very like *V. microstoma.* I also found some Oscillatoriæ, and soon afterwards my first Rotifer, also some Anguillulæ.

Several months elapsed before anything fresh came under my notice, and then I saw some Amœbas, whose protean forms are always interesting to watch, as they extend a part of their protoplasm in the form of an arm, catch hold of, and eventually surround, a particle of food, causing it to enter into the body. Its substance is accommodating enough to make a mouth and stomach at any part. Associated with them I saw an *Actinophrys,* not distinguishable from *A. sol,* and a form which I took to be *Glaucoma scintillans.* I had not at this time adopted my present plan of drawing all new forms I saw, so I have no illustrations of these to give.

Other objects, chiefly higher forms of marine life, occupied my attention for a long time, and there is an interval of nearly ten years before my next record of infusoria. Being one day in the Botanical Gardens, Melbourne, I noticed that the water of a small lagoon looked as if there ought to be plenty of infusoria and other microscopical desiderata present, and on a subsequent visit, shortly after, I collected some water which yielded several forms new to me, all of which are shown on plate II.

Fig. 1. *Euglypha alveolata,* the external markings of which are very curious. Fig. 2, a *Paramœcium-like* form, in which, besides the outer row of cilia, there was on the curved side an inner row, also a large vacuole, possibly a contractile vesicle, but I have not noted it as such, and four smaller ones. Fig. 3,

a *Trachelocerca,* or swan-neck. Fig. 4, a *Coleps.* Fig. 5, an *Actinophrys* (*A. sol?*), and a *Paramæcium,* of which I could only get an outline. A *Monad,* fig. 6, and fig. 7 an *Astasia* with a very long anterior cilium or thread, which it waved about when moving from place to place; it had a cleft in its posterior end. A small *Vorticella,* fig. 8, evidently not *V. macrostoma;* an *Actinophrys difformis,* fig. 9; and a small *Infusorium,* fig. 10, with globules in it, which kept moving quickly from the smaller to the larger end, coming back, I presume, on the other side, out of focus. This lagoon, as may be inferred from this single gathering, furnished good hunting grounds, but I moved away from the locality soon after and never had another chance of dipping into its waters. More than twelve months passed before I again observed any new infusoria, when I found at Maryborough a peculiar *Vorticella,* fig. 11, the body of which was ringed, and it had a small circular vacuole, or nucleus, also a small, round *Infusorium,* fig. 12, with very strong cilia, or spines, of which those at one end were parallel, or nearly so, and which did not seem flexible; those round the remainder of the circumference were radial; it moved so quickly across the field of view as to be almost invisible until it came to rest, which it did suddenly, and after remaining still for a second or two darted off again, resting again after a short interval, and keeping this up as long as I watched it. A little while later I found a *Trachelocerca,* fig. 13, of a form different from fig. 3; it had a short tail and seven round vesicles, small cilia at the end of its proboscis, and from the cluster of cilia near its junction with the body the mouth appeared to be there. Several other forms were present, such as I had observed before, and a very peculiar one, fig. 14, which appeared to be remarkably like what I should fancy a living *Polycistina* would be, for it had as shown a framework which appeared to be inflexible. I only saw a single specimen. A few days later, from the same locality, I found a *Chætonotus,* fig. 15, a large number of *Euglypha alveolata,* and a *Euglena viridis,* fig. 16.

The last I have recorded is fig. 17, a very curious form, much resembling a small marine medusa in appearance; it may have been a *Vorticella* in the free state, but I think it was too large.

A New Species of Polyzoa. By Chas. M. Maplestone.

[*With Plate.*]

[Read 29th May, 1879.]

I wish to bring under the notice of the Society a new species of cheilostomatous polyzoa, which presents peculiar features.

Bicellaria annulata *n. s.* plate III., figs. 1, 2, 3, 4.

Cells elongated, contracted in front below; aperture oval; four to five marginal incurved spines on outside edge; one spine on summit of aperture extending behind superior cell; one spine on lower portion of aperture extending inward underneath marginal spines; back of cell with a bifurcate elevation; cells growing on a corneous, tubular, spindle-shaped growth, with annulated branches bearing cells.

The drawing sent with this shows at fig. 1 the shape of the cells, some of the spines being left out, with the arrangement of the spines as seen from the front. Fig. 2 shows back view of cells, with the upper spine growing up behind the superior cell. It will be seen that the cells from the back view show that they are adnate, not free, as is usual. Fig. 3 shows the spindle shaped main stem, and the annulated branches springing from it. Fig. 4 shows the natural size.

The great peculiarity of this species is the structure upon which the cells grow; and from the ringed appearance of the individual spindles and the more strongly annulated branches I have derived the specific designation. In fact, I almost think a new genus is requisite for its reception. It is rare at Portland. I have a portion of a tuft about three inches high.

On a New Species of Polyzoa. By J. R. Y. Goldstein.

[*With Plate.*]

[Read 29th May, 1879.]

The new species of polyzoa herein described belongs to the second order Gymnolœmata of *Allman*, sub-order 3, *Ctenostomata*, family 1, *Serialaridæ*, and was first found by me at Portland in 1864. It was not until 1874 that I figured and described it in MS., and would have sent the paper to this Society but was prevented by illness. Being the first new species I had found, gratitude for much valuable aid and direction in the study of the class, received from the Rev. J. E. Tenison Woods, naturally induced me to bestow that gentleman's name upon the species.

Genus, SERIALARIA—*Lamarck.* Character: Polypidom confervoid, horny, fistular, and branched; cells, tubular, uniserial and unilateral, disclosed in close parallel companies in internodes at stated intervals.—Johnston, "British Zoophytes," vol. i. p. 368.

SERIALARIA WOODSII, *n. s.* plate III., fig. 5.

Polypidom of a brown colour, light to dark; horny, fistular, branched, forming dense tufts three to four inches in height; branches alternate, spreading, subdichotomous towards the extremities; basal tube corrugately jointed between the internodes; cells tubulous, *biserial*, unilateral, adnate to each other, gradually shorter outwards, apertures thickened, arranged in companies of five to ten pairs on each internode, straight, and much inclined outwards. Two tapering, slender, hollow processes, jointed to basal tube immediately behind the outer cells of an internode; not constant, sometimes a fresh branch taking the place of one. These setaceous processes frequently have septæ across them at irregular intervals, and are sometimes branched. Their length varies much, often three times the length of an internode, sometimes quite short, one of a pair frequently much shorter than its fellow, and sometimes club-shaped. Masses are frequently found cast upon the beach without these appendages, as they soon drop off when dead. Ovicells not seen. The animal has eight tentacles.

The only species with which it has any affinities is *Serialaria Australis*, described by Rev. J. E. Tenison Woods, in a paper read before the Royal Society of N.S.W., 4th July, 1877, and, like it, has peculiar characteristics, notably the fact of the cells being biserial, which will necessitate a modification of Lamarck's generic description given above.

My friend, Mr. Chas. M. Maplestone, was fortunate enough recently to find the animal alive, and hopes to obtain it again at Portland, so as to be able to make more extended observations thereon. He writes me that, on a cursory examination, the tentacular crown seemed to arise from a calyx, as in the fresh-water polyzoa. A most interesting fact, if verified.

On the Radula or Lingual Ribbon of Australian Mollusca.

By the Rev. J. E. Tenison-Woods, F.L.S., F.G.S., &c.

[Read 29th May, 1879.]

It will be readily conceded that there is no subject which more legitimately belongs to a microscopical society than investigations on the radula or lingual ribbon of mollusca. I may add that there is hardly any other subject where so much is to be done, or where such important results may be expected as this one in Australia. It is, I may say, a clear field, and quite, or almost quite, an untrodden one. I cannot call to mind any special publication on the subject except an article in a popular science serial some years ago. In this there were no names of the species from which the radulas had been taken, as the writer did not know them. The scientific value of the contribution was thus lost. I do not know of any other published memoir especially devoted to this subject. In the course of my own small investigations on the habits and economy of Australian mollusca, I have necessarily met with many curious facts connected with the radula. Some I have published, as in an article on some Tasmanian *Patellidæ*, published in the "Proceedings of the Royal Society of Tasmania," in 1876, p. 43. A few others I have kept by me as notes, which I shall endeavour to embody in this paper. My object is rather to review the subject, with a view to excite interest and encourage investigation, because I do not suppose that the very small contribution I can make to knowledge in this respect would otherwise be worthy the attention of this Society, or a place in its records

The lingual dentition of mollusca has lately taken a large place in attempts made to review the classification of this sub-kingdom. The "Genera of Recent Mollusca," by Messrs. H. and A. Adams, was one of the first works that dealt with the matter systematically. In nearly all their descriptions they refer to the presence or absence of the radula, and the mode of dentition. They point out in their introduction, that the radula is a membrane covered with hooks or prickles, which are usually arranged differently in different families. It commonly forms a triple band, of which the central part is termed by them the rachis, and the lateral parts pleura. The teeth on the middle part are termed central; those on the pleura are named uncini or laterals. It is sometimes broader than long, as in *Tritonia* and *Doris*, or it is elliptical and spoon-shaped, as in the *Helicidæ*. In others it is a long narrow ribbon, which is either transparent or coloured, and is often many times longer than the animal. In the carniverous animals they say that the radula is forked and fleshy, armed with sharp curved teeth and placed at the end of the muscular proboscis, while in the plant-eating tribes it is very long and spiny. There is no radula in *Tunicata*, and in bivalves it has the form of a cartilaginous styliform body enclosed in a sheath, with a tricuspid free extremity, and attached to the sides of the stomach.

It was Mons. Lovèn who was the first to demonstrate that important generic and specific characters may be derived from a careful examination of this organ. It is not my object to give a *résumé* of the history of this subject, or an account of its bibliography, so I will merely say now, that it will be easily studied by a reference to "Gray's Guide to the Systematic Distribution of Mollusca," in the British Museum catalogues. Excellent notes are to be found also in Woodward's "Recent Fossil Shells," and I would recommend any one who wishes to understand the structure of the radula amid air-breathing mollusca to study the masterly and philosophical essay of W. Thompson, in the "Annals of Natural History," for 1851, p. 86.

Dr. F. H. Troschel has recently published an attempt at classification of mollusca, founded on the dentition alone. His work is not yet complete. It is published at Berlin, and is entitled "Das Gebiss der Schnecken zur Begründung einer natürlichen classification untersucht." The author divides the sub-kingdom into the following orders:— 1. *Campylodonta*. 2. *Orthodonta*. 3. *Heterodonta*. The first he divides into two families:—the *Tænioglossa*, *Rhipidoglossa*; the second into *Toxoglossa*, *Rachiglossa*, *Ptenoglossa*; the third into *Docoglossa*. After having studied all the radulas that he had at his disposal the author has altered the classification or rather the position of many genera. He finds, for instance, that the long narrow spiniform teeth amongst *Ianthina* brings them very near to *Acteonidæ* and *Scalariacea*. He thinks, also, that the *Solariacea* should be arranged with the *Ptenoglossa*, because the teeth furthest from the centre begin to show signs of cusps, and consequently to be sensibly distinct from the *Rachiglossa.* He includes the genera *Navicella, Nerita* and *Neritina* in his family of *Rhipidoglossa.*

Without entering into the niceties of these distinctions it will be seen that the radula is now recognised as occupying an important position in molluscan economy, and that Australian observers can largely contribute to the conclusions which await facts to determine them in one way or another. It is certain that our coasts possess a large number of important and characteristic forms, the dentition of which are quite unknown. And even amongst our land and freshwater shells important results may be expected. The very fact of an animal belonging to a well-known genus does not necessarily imply that its dentition will not depart from the normal type. Messrs. Bland and Binney, in America, have revised much of the classificatian of the land shells by a study of the radula. See especially their remarks on Shuttleworth's genus *Gæotis,* in the 10th vol. of the "Annals of the Lyceum of Nat. Hist. of New York." The same authors describe and figure the jaws and radula of a *Physa,* with a finely striated shell from Guadeloup, which departs widely from the generic type. The radula is quite different, and presents none of those long transverse ranges of teeth in the form of a comb which is characteristic of the genus. Mr. Binney, again, in the "Proc. Academy of Natural Sciences of Philadelphia, U.S.," vol. 2, part 3, p. 140, gives most interesting and important details on the jaws and radula of the terrestrial pulmoniferous mollusca of North America. These observations are the results of Mr. Binney's labours during the last thirty years. He deals with the best methods to extract the jaw and radula, and gives the most ample details of their position and the *modus operandi,* so as not to injure the delicate membranes. Mr. Binney thinks that the jaw and radula furnish together a good basis for classification, and from the results of an examination of a very large number of species he divides the whole of the known terrestrial pulmonata into two great divisions, characterised by the absence or presence of a jaw. Those destitute of that organ are also deficient of lateral teeth; some being without centrals, but all having aculeate marginal teeth. The genera *Onchidium, Onchidella, Peronia,* and perhaps *Buchanania* are characterised by their quadrate marginal teeth. For the second division, those possessing jaws, the genera are arranged into two families, namely, those with quadrangular, and those with aculeate marginal teeth. The following genera possess teeth of the aculeate type: *Limax, Ibycus, Parmacella, Tementia, Mariella, Parmarion, Dendrolimax, Vitrina, Vitrinoidea, Vitrinopsis, Nanina, Stenopus, Vitrinoconus, Macrocyclis,* and *Zonites*. The remaining genera have quadrate marginal teeth, and are divided into three sections, according to the character of the jaw, which is either in one single piece, or one single piece with an accessory upper quadrate piece, or in numerous pieces. Then follows an essay on the value of the jaw and radula for the purpose of classification.

My own observations are epitomised in the essay on the molluscan fauna of Tasmania.* I may say that a fact which I have not seen prominently brought forward by any of these writers is that the radula is often a tube. The term ribbon is therefore unfortunate, as the organ is by no means a strap-shaped membrane with teeth set upon it. The basal membrane is in most cases the only part preserved, the upper and enclosing portion which goes over the teeth is of such extreme tenuity that it is destroyed in drying. This I believe to be the structure when the teeth are few in number, as in *Patella* and *Littorina*. In *Siphonaria* the membrane is broad and strap-shaped, and in dentition it approaches the pulmoniferous freshwater mollusca, of which it is the marine representative. When the animal is alive the radula is a tube, a small portion of the lower and outer edge being everted for the purpose of feeding. In all our *Littorinidæ*, which includes, in my opinion, properly speaking, very few genera—as I should suppress *Risella* and *Tectaria*—the radula is a long narrow transparent tube, with three cuspidate teeth on each side of a small central one. The membrane and teeth are quite colourless, and lie coiled up in the stomach, or perhaps just above the stomach, at the back of the head. My opinion is that all the food has to pass along the whole length of this tube before reaching the stomach, and it is then in a sufficiently fine state of subdivision for assimilation. In the *Patellidæ* we have a very long radula, the teeth being a deep brown colour, and

* See Proc. Roy. Soc. N.S.Wales, 1878.

the membrane a rich golden yellow. It is of great length in *Patella tramoserica*, the common species on all the coast of Australia, and lies in a peculiar coil or plexus, which will repay examination. All our species of *Acmæa* have a radula of similar structure, but tho generic differences ought to be peculiar, as the branchial apparatus is entirely different. I have not been ablo to study them closely, but as far as I could observe, the teeth were more numerous and complicated, and the radula always shorter. In *Trochocochlea, Diloma, Thalotia* wo have short radulæ, with a very complex dental system, mainly distinguished by the comb-like rows of uncini on the outer edge. In this they resemble all tho *Trochidæ*, but with modifications which will well repay study. I have tried to find if thore were specific differences between *Trochocochlea constricta* and *T. tæniata*, two species which can only be very doubtfully separated from ono another. The results of all the examination I could afford to them did not clear up the question. In somo specimens the differences were marked more than in others. In this case, and in all the family, I believe that the radula closes on itself into a tube, and that the two combs of uncini form the upper lining to the passage, forcing the food, which is vegetable, against the longer central cusps, and thus tearing it to tho finest shreds. Tho common food of these is the *Ulva latissima*, so common on the rocks. The best animals for the study of these organs would be *Chiton Australis* and *Haliotis nævosa*, both of which are of large size, so as to show the structure without much microscopic aid, and both of which are easily obtained alive.

I cannot quite agree with European observers as to the structure of the radula, at least for our carniverous mollusca. One of the most ravenous, as well as common forms upon our coasts is *Buccinum alveolatum* (Kiener). The radula is not easily extricated, but when taken from the end of the proboscis is not a bifid organ. It is a short spear with very prominent sharp cutting barbs at each side. I should say that its only purpose was to tear away the fragments of flesh from its prey. It is very easy to procure living specimens of this mollusc. A small limpet or chiton thrown into a rocky pool will very soon be covered with these little scavengers of the rocks.

Our freshwater shells are mainly distinguished by the possession of a thick periostraca, which is often densely clothed with hairs arranged in spiral lines. From this fact I am of opinion that the radula will be found to vary very much from the generic type. Some of our *Limneadæ* are introduced from Europe, notably *Limnea peregra* (Muller), which is found near Hobarton, and I think near Melbourne. I should not wonder, also, if we have come by some European *Physæ* in a similar way. Nothing has been done to elucidate their dental peculiarities, though the animals are, of all others, easy of access. We have a new genera and species, called by me *Tatea Huonensis*. The examination of the radula would be a delicate piece of microscopy, of real value to science. In this and all similar instances it would be well to bear in mind the importance of the jaw as a specific or generic organ.

Nerita atrata can be obtained in abundance in Victoria. Its radula is very easily examined. It seemed to me longer than any of the *Trochidæ*, though very much of the same character. *Thalotia, Phasianella, Elenchus, Gibbula, Minolia,* and *Monilea* are all nearly unknown; and want the hand of some careful microscopist to work them out. In *Bulla, Haminea, Bullina,* we have no radula, but a kind of calcareous or shelly pair of external jaws, which hang outside the animal. I am not quite sure that this is the structure in *Bullina lineata* * (Wood), as the animal differs from other members of the family in the possession of a horny operculum.

I have merely indicated in the above remarks a line of inquiry which may be followed, and I am quite sure that with a very little trouble a large number of valuable facts will be met with in every way worthy of the records of the Microscopical Society, and tending materially to enhance their value.

The following points to be noticed in the Radula of Mollusca may be worth bearing in mind :—

1. Position in the body of animal, and the form it assumes therein—Whether tubular or flat, curved or straight, coiled or folded ?
2. In Land and Freshwater Mollusca—The presence or absence of a jaw; its form and position when present.

* The small striated white Bulla, ornamented with two delicate red spiral ines.

3. Dimensions of Radula—Length and breadth when unfolded.
4. Teeth—How disposed on the pleuræ and rachis, and their relative numbers on these parts? Total number.
5. Specific differences, if any. These will require close attention, as they are probably very slight, perhaps only relating to dimensions.

PROCEEDINGS.

31st October, 1878.

ANNUAL GENERAL MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous monthly meeting were read and confirmed.

Mr. W. A. Hartnell was elected a member.

The election of officers was then proceeded with, when Dr. Ralph was re-elected as President, Dr. R. Robertson re-elected Treasurer, and Mr. J. R. Y. Goldstein re-elected Secretary.

Messrs. Maplestone, Mortimer and Allan, having been nominated for the two vacancies in the Committee, the ballot was taken, resulting in the appointment of Messrs. Allan and Mortimer.

The Treasurer's Balance-sheet, showing a credit balance of £28 2s. 3d., having been duly audited, was then read and adopted.

The President then read his Annual Address.

Several microscopes were set up, and a great variety of objects exhibited.

A pleasant conversazione terminated the proceedings.

28th November, 1878.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed. Mr. Herbert Hart, Dr. Le Fevre, and Mr. Scourfield were duly elected members.

The Secretary read a paper contributed by Mr. Chas. M. Maplestone: *Polyzoa, what they are,* and illustrated same on the blackboard.

Mr. Barnard read his notes on two species of fresh water Polyzoa, and exhibited living specimens.

Mr. J. R. Y. Goldstein read his notes on some twenty species of marine Polyzoa, which he had obtained alive.

On the invitation of Rev. J. J. Halley, the first excursion of the Society for open-air work was decided to be held at Williamstown, on 30th inst.

30th January, 1879.

ORDINARY MEETING.

Mr. Mortimer in the chair.

The minutes of previous meeting were read and confirmed.

The Secretary acknowledged receipt through the Treasurer of parts 15 and 16 of *Schmidt's Atlas of the Diatomaceæ.*

Resolved: That this Society offer two prizes of £3 and £2 for collections of microscopic objects for the proposed Intercolonial Juvenile Exhibition, the money to be raised by subscription among the members.

Messrs. R. P. Lord, Ager M. Atkin, John Trowbridge, and George Trowbridge were duly elected members.

The Secretary reported that the first excursion had been most successful, and that the members had been most hospitably entertained at tea by Mrs. Halley.

A unanimous vote of thanks to Mrs. Halley was directed to be entered on the minutes.

A scheme, suggested by Mr. Chas. M. Maplestone, for a circulating magazine in MSS., was considered, and deferred for further consideration.

27th February, 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of last meeting were read and confirmed.

The Secretary read letter from Mr. James Dawson, accompanied by specimens of insect eggs on stones, and distributed pieces among those members who undertook to try and ascertain by hatching what insect had deposited the eggs.

The Secretary acknowledged receipt from the Hon. the Chief Secretary of five decades of *Palæontology of Victoria,* and two decades *Natural History of Victoria.*

Resolved: That the next excursion be by steamer, for dredging in Hobson's Bay, to be held on 8th March.

27*th March,* 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed.

Mr. Henry S. Patching was duly elected a member.

A report was received from the Committee relative to printing the proceedings of the Society quarterly.

This was adopted; and an editorial Committee was appointed, consisting of the President, the Secretary, and Rev. J. J. Halley, to carry out the recommendation of the report.

The Secretary reported the successful nature of the late dredging excursion.

24*th April,* 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of last meeting were read and confirmed.

Letters were read from M. Gustave Beckz and Mr. James Dawson, the latter forwarding a fresh supply of insect eggs deposited on different substances. These were distributed.

The Secretary acknowledged receipt, through the kindness of M. Beckz, of eleven *fascicles* of the *Proceedings of the Belgian Microscopic Society for* 1878; also from Dr. Ralph, his pamphlet on *A Recent Case of Soft Cancer with Hydatids.*

Messrs. R. Josephs, W. Hardy, P. E. Muskett, F. W. Morton, Joseph Clothier, and Dr. Heffernan were duly elected members.

Mr. Barnard read his Notes on a Diatom found growing at Mordialloc, and exhibited several slides showing its increase by deduplication.

Resolved: That the next excursion be to a swamp near Brighton, to be held on 3rd May next.

29th May, 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of last meeting were read and confirmed.

Messrs. P. C. Alcock, G. S. Manns, C. Horsley, D. Morris, Stanford Chapman, Henry Butler, and Frank W. Fenton were duly elected members.

The Secretary read a paper contributed by Rev. J. E. Tenison Woods, *On the Radula, or Lingual Ribbon of Australian Mollusca.*

The Secretary read a paper contributed by Mr. Chas. M. Maplestone, describing *Bicellaria annulata, a new species of Polyzoa.*

Mr. J. R. Y. Goldstein read his paper describing *Serialaria Woodsii, a new species of Polyzoa.*

26th June, 1879.

ORDINARY MEETING.

Mr. Barnard in the chair.

The minutes of previous meeting were read and confirmed.

Professor M'Coy, Messrs. J. E. Edwards and Harrie W. Taylor were duly elected members.

The Secretary read letter from the Ceremonial Committee of the International Exhibition, respecting the desire of the Commission to hold a Social Science Congress while the Exhibition is open.

Resolved: That the President, Secretary, and Rev. J. J. Halley be delegates to represent this Society.

Rev. J. J. Halley read his *Notes on Tubularia Ralphii, a new species from Williamstown.*

Microscopical Society of Victoria.

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Hon. Treasurer:
ROBERT ROBERTSON, M.R.C.S. Eng.

Hon. Secretary:
J. R. Y. GOLDSTEIN.

Committee:
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F. BARNARD.
W. W. ALLEN.
R. HAIG.
J. T. MORTIMER.

Members:

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BLACKETT, C. R., M.L.A.
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CLOTHIER, JOSEPH.
CHAPMAN, STANFORD.
DAWSON, JAMES.
ELLERY R. L. J., F.R.A.S., &c.
EDWARDS, J. E.
FENTON, J. J.
FENTON, FRANK W.
GAUNT, T.
GODLEY, W.
HOWITT, E.
HOWITT, A. W., F.G.S.
HARRISON, THOS.
HARTNELL, W.
HART, HERBERT.
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MEYLER, H.
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MUSKETT, P. E.
MORTON, F. W. W.
MANNS, G. S.
MORRIS, D.
M'COY, Professor, F.G.S., &c.
PATCHING, HENRY S.
SPRINGTHORPE, J. W.
SCOURFIELD, R.
THOMPSON, J. J.
TROWBRIDGE, JOHN.
TROWBRIDGE, GEORGE.
TAYLOR, HARRIE W.
WOOSTER, W. H.
WOODS, Rev. J. E. TENISON, F.G.S., &c.

OFFICE: 117 COLLINS STREET EAST, MELBOURNE.

EXPLANATION OF PLATES.

PLATE I.

Figs. 1, 2, 3, 4. Diagrams described on pages 10 and 13.
„ 5. Sponge, natural size. See page 14.
„ 6, 7, 8. Spicules from same. See page 15.

PLATE II.

Infusoria. See page 17.

Fig. 1. Euglypha.
„ 2. Paramecium.
„ 3. Trachelocerca.
„ 4. Coleps.
„ 5. Actinophrys.
„ 6. Monad.
„ 7. Astasia.
„ 8. Vorticella.
„ 9. Actinophrys.

Fig. 10. *Unknown.*
„ 11. Vorticella.
„ 12. *Unknown.*
„ 13. Trachelocerca.
„ 14. *Unknown.*
„ 15. Chœtonotus.
„ 16. Euglena.
„ 17. *Unknown.*

PLATE III.

Fig. 1. Bicellaria annulata. Cells, front view. See page 19.
„ 2. „ „ back view.
„ 3. „ Main stem.
„ 4. „ Natural size.
„ 5. Serialaria Woodsii. See page 20.

Plate I.

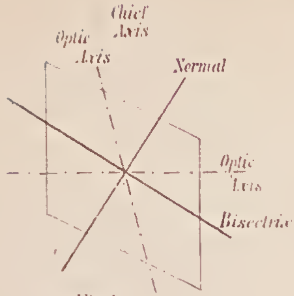


Fig. 1.

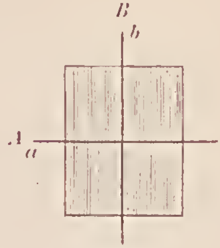


Fig. 2

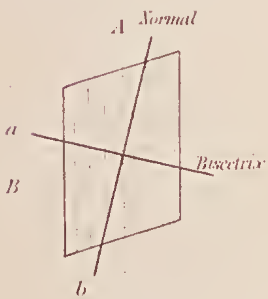


Fig. 3.

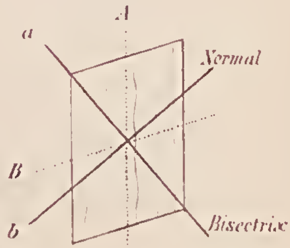


Fig. 4.

Fig. 6 × 600

Fig. 7 × 600

Fig. 8 × 600

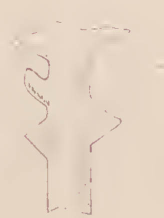
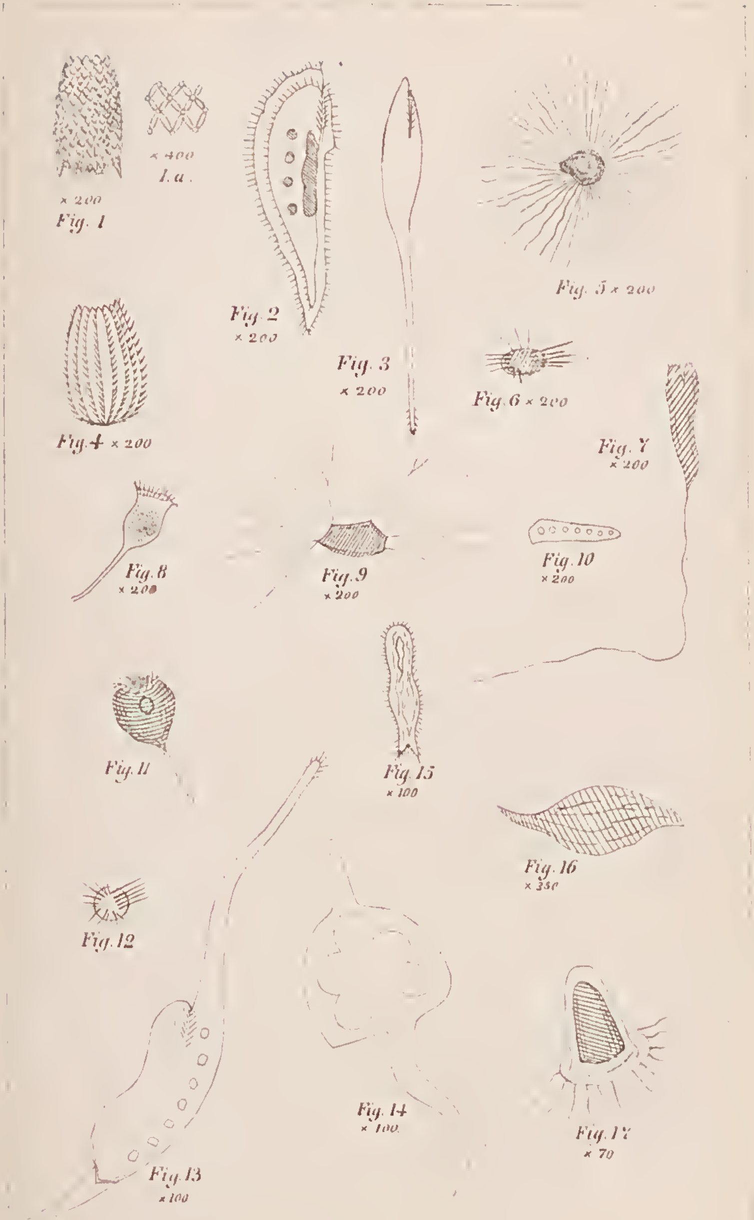


Fig. 5.

J. R. Y. Goldstein Del. [illegible] Lith.

Plate II.



Chas. H. Maplestone Del. Hamel & Ferguson Lith

Plate III.

Fig. 1 × 25

Fig 2 × 25

Fig. 3 × 8.

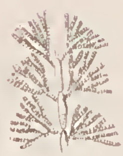


Fig 4 nat. size

Bicellaria annulata

Chas M. Maplestone. Del.

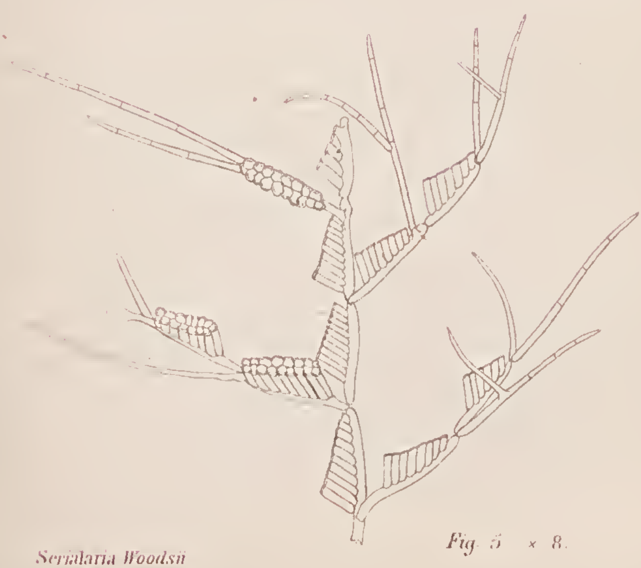


Fig. 5 × 8.

Serialaria Woodsii

J. R. Y. Goldstein Del.

Hamel & Ferguson Lith.

JOURNAL

OF THE

Microscopical Society of Victoria.

MAY 1880.

PREFACE.

UNFORESEEN circumstances interfered with the production of the second number of this Journal, and delayed its appearance so far beyond the proper date, that it was considered advisable to issue a double number to include parts 2 and 3. And while the Committee will use every endeavour in future to issue the publication once in each quarter, they have resolved to discontinue the use of the term "Quarterly"; thus admitting not only of a little delay when convenient, but also the advantage of being enabled to publish more frequently, should occasion demand the issue of more than four parts annually.

That this latter contingency will soon arise may fairly be expected when we look at the large increase (twenty-one since last issue) in the list of members, and more particularly when we take into consideration the known scientific ability of several gentlemen who have joined recently.

The contents of the present issue, it is confidently hoped, will prove to be of considerable value, while the improvement in the character of the illustrations may be taken as an earnest of the desire to render this portion of the Journal in as perfect a manner as possible; and that all papers requiring figures will be illustrated as carefully and completely as possible, as it is considered that, without plates, such papers suffer great diminution in value.

ANNUAL ADDRESS OF THE PRESIDENT,

THOMAS SHEARMAN RALPH, M.R.C.S. Eng.
Assoc. Linn. Soc. Lon.

[Delivered to the Members at the Annual Meeting, held on the 30th October, 1879.]

GENTLEMEN OF THE MICROSCOPICAL SOCIETY OF VICTORIA,

Again the duty of addressing you has devolved upon me at the end of this another year of our existence and work as a society; and as it is usual on such occasions, I am called on to take a retrospect of our proceedings, and set before you our present status and probable future; and in so doing I shall endeavour to point out what may be well for us to know, *i.e.* some of the leading facts connected with work done by kindred societies.

Since our last annual meeting here, we have held ten general or ordinary meetings of the society, in which various papers and notices have been read, and after which the evenings have terminated in the production and exhibition of some interesting and instructive objects.

The following is a list of the principal communications which have been read:—A paper by Mr. Chas. Maplestone on *Polyzoa*, "What they are, their classification and position in the animal kingdom." Mr. Barnard gave us a paper on two new species of freshwater *Polyzoa*, and exhibited living specimens of *Plumatella* and *Fredricella*. Mr. Goldstein, our honorary secretary, furnished us with notes on living marine *Polyzoa* observed by him at Portland, and he described some twenty species. In January last we received a communication from the Council of the International Juvenile Exhibition, Melbourne, requesting our co-operation, which was replied to on our part by offering two prizes for the best collection of microscopical objects of Australia and New Zealand properly prepared and mounted; the competitors being from 15 to 21 years for the higher, and under 15 for the lesser prize. Mr. James Dawson sent some specimens of a singular form of insect egg for determination. The notes for these, I believe, are forthcoming to the society. Mr. Barnard has also favoured us with notes on a *Diatom* from Mordialloc, which proved interesting. A paper was contributed by the Rev. J. E. Tenison Woods, "On the Radula or Lingual Ribbon of Australia Molluscs," which I consider to be an important contribution to our knowledge on this subject. A paper by Mr. Chas. Maplestone "On *Bicellaria Annulata*," a new species of *Polyzoa*, was read, and illustrated by a drawing, and has been published in our journal. Mr. Goldstein has given us a communication on *Serialaria Woodsii*, a new species of *Polyzoa*, with a drawing, which has also been published. We have had also a short paper by the Rev. J. J. Halley "On a new species of *Tubularia*," from the bay. Mr. Barnard has also furnished us with an abstract of a paper which appeared in the *Science Gossip* on preparing and mounting leaves, &c., to show the crystals contained in the cells, the leaves having been first bleached. Mr. Goldstein has given us a paper on the preparation of specimens by means of carbolic acid, the process being chiefly directed to the preparation of balsam mounts. Mr. Barnard read a short paper, and exhibited and explained a new form of cell for mounting, *i.e.* wax cells prepared after a new method, and intended chiefly for the production of deep cells. Mr. J. B. Wilson, of Geelong, gave us a few notes on *Catenicellæ* and other *Polyzoa* found by him in a fossil state in some miocene rocks. He also exhibited specimens of the same. We have had also a short paper from Mr. Bale on covering and cementing slides; a process which may be found useful.

Twenty-one new members have been added to the society during the past year, and I have to report the death of one of our former members, Mr. T. Burrows, our late honorary secretary.

Four excursions were made by the members, and yielded considerable satisfaction to those who attended.

The following journals, &c., have been received and acknowledged with thanks:—Five decades of the "Palæontology of Victoria," two of the "Natural History of Victoria," from the Government of Victoria, eleven fascicles of the Belgian Microscopical Society's publications for 1878, "Proceedings of the Linnæan Society of N.S.W.," two parts.

On looking at the work done in other quarters during the past year, I have only time, on the present occasion, to glance at one or two leading points. Work is still being carried on and needs to be more fully developed with reference to microphytes (or minute vegetable organisms) which have been found in the blood, and their relation to disease. This is fully dealt with in a contribution of some importance by Surgeon Lewis, of the Army Medical Department. The paper will be found, with illustrations, in the *Quarterly Journal of Microscopical Science* for July last, and a full notice of the same appears in the *American Journal of Microscopy* for last June, taken from "Nature" in a paper by Mr. Bastian. The question is, whether these organisms are the cause of the diseases with which they are associated. At present I am inclined to think they should be regarded rather as carriers of contagion than as originators of disease; and it appears that their presence is not a constant occurrence in every case of fever or septic poisoning. There is one point which needs to be kept in mind, *i.e.* that investigations of this kind cannot be carried out in haste. Time must be taken in order fully to determine the absence of the particular organisms. Besides this, it is quite needful the observer should be well acquainted with their appearance; and that in some cases it may be needful to cultivate these organisms—that is, give them time to develope, so that the blood should be under observation during many hours.

Amongst some matters of importance, I notice one which I must here comment upon, namely, whether the red corpuscle of the mammalian blood contains a *nucleus* or not. This is an old inquiry, and up to this period it has been held that no such body is present, and that all appearances in favour of it are due to the effect of chemical substances which have been brought to bear on the contents of the corpuscle. In this view I fully concur.

Amongst other notices in journals, I observe that the old story of the angle of aperture of lenses comes up again to trouble some, but as this is a subject which a young society like ours cannot yet handle with profit, I turn to another, namely, modifications of oblique illumination of objects. This is an important subject, and I hold it to be an axiom in microscopy to be able continually to focus the light we are using, just as much as we absolutely need to focus every object which we examine under the microscope.

A balancing of the light by which we view an object in this way is as needful as our own natural apparatus in the eye, namely, the *iris*, or *veil*, which divides the eye into an anterior and posterior chamber. And if anyone will be at the trouble of watching his neighbour's eye while he is examining ordinary objects around him, or even if he observes his own pupil, or contractile opening in this veil, by looking into a mirror, he will perceive that this opening is in continual action, dilating or contracting in order to adjust the amount of light needed by the eye as it wanders over near or far off objects, or variously-coloured objects. The fact is, it is a continual focussing of the light for special definite work which this organ (the eye) is constantly engaged in; hence the importance of being able to modify the light admitted to an object viewed under the microscope. Hence, in working with high powers, that is above the quarter-inch objective, on very delicate objects, the light must be shut out or let in gradually. The action of oblique light under the stage or object partakes of the nature of focussing the light, for in such cases, under oblique illumination, the eye in great measure sees the object by the light reflected from it, and not directly through it. Of course with objects requiring low power, it is easy to moderate the light by distance and other ordinary contrivances.

An easily applied method of oblique illumination consists in adopting the plan of Dr. Woodward, U.S.A.: Of a small right angle prism fastened to the slide by a little glycerine—a little skill and patience being requisite to become acquainted with this plan. Another is that of adjusting a silver speculum immediately below the object, so as to throw the light into the slide from some angle. By the use of the silver speculum the light is not confused by producing a double reflection, as in the case of light thrown from a glass silvered mirror.

I must not pass over the subject of diatoms, lest I should acquire the character of a diatom hater by that part of the community of microscopists who are sometimes styled Diatomaniacs, because they choose to spend much of their time on such objects. The study of these objects in the hands of those who have had money and leisure, has been the means of advancing the production of excellent objectives, and if any such workers like still to pursue their favourite study, I, for one, will not oppose them; but calling attention to a further study of these objects while in a living state, I would point out that like all other minute organisms, their life-history will certainly repay investigation and lead on to further discoveries in biology. The few notices which have come under my observation are directed to this point; as for example, a paper by Dr. Lanzi, of Rome, on the "Thallus of Diatoms," in which he points out that the study of the functions of the thallus in this family is full of interest. This paper leads on to another, on the sexual process in diatoms, from which it would appear that there are five modes of reproduction of the auxo-spores of diatoms.

On looking back on work which has been done by men in the same line of inquiry which occupies our attention—and I refer to work done during several decades past—I notice how gradually the workers themselves have become classified, and also how the work which has been carried out has brought out facts and information which, after having been utilized and properly arranged, have been reared up into classified studies.

In times past we find that workers were, so to speak, acting in a desultory way; but their investigations are now assuming a much more definite and stable character. And then we find one man takes up Petrology, or the study of rocks, and endeavours by means which have been perfected through the efforts of others who have preceded him, to determine in a more minute and exact manner, the chemical and morphological characters of the constituents of our globe, and this to an extent far beyond what our forefathers of half a century ago could possibly have hoped to have done. And not only is this true in one direction, but it is also becoming a decided fact in other directions. Take as an example, the work with the microscope is beginning now to take form with the pharmaceutic chemist, who is turning his attention to the investigation of his drugs and chemicals; and this not merely from a mercantile point of view, that he may supply the best articles in the market, or assist the medical practitioner, but I feel sure from a conviction that in a scientific point of view it "will pay," *i.e.* it will lead him to the scientific production of reliable pharmaceutical substances—their adulterations and variations being but a part of his inquiry.

In accordance with these views, we find another man is led to investigate the character of the saliva in supposed cases of poisoning; and this toxic inquiry does not confine itself to the investigation of a criminal intent, but also as to the toxic influence brought out in the system of an individual as the result of the use of remedies—such as the action of arsenic, lead—besides possibly that of the alkaloids, as aconitine, morphia, and very likely a number of other agents at present unthought of and uncared for by us, as investigators.

The spectroscope in microscopy has not, to my mind, made much advance; and one reason for this may perhaps be found in an unwillingness of some to work ploddingly on without a clear idea that any good and useful result will be the reward of their labours. This I fear is a deterring cause with many, and partakes much of that pecuniary wisdom which some men give vent to when they say "will it pay?" will it put money into my pocket? Letting alone such to their own ideas, I would remind those who are willing to work, and that without immediate reward, that the wise man has said—"in all labour there is profit," and taking this stand we may be assured that work steadily carried on will bring its own reward. Besides this, there is an additional spur, and a very legitimate one, for each of us to accept, and it is this, that even without the reward which every one may legitimately covet and hope to obtain, he has this satisfaction, that he is, if he deals fairly with himself, training his mind as well as his eyes and hands, and thus more or less effectually improving his status; and when he has done this, he has insensibly aided others to do the like.

There is another subject which is connected with microscopy, or study with the microscope, to which I desire to direct attention, and this is photography with the microscope. This will yield results which will become useful in furnishing exact records or representations of many objects which require publication and dissemination. But its employment involves additional skill and knowledge in order to be applied. One at least amongst our number is inclined in this direction. I allude to our friend and colleague Mr. Barnard, who I hope will by his efforts give an impetus to this method of advancing scientific inquiry in our midst.

I now turn to a point of importance to us as a society, and one which I trust promises well for our future success, *i.e.* that we have ventured on publishing a small record of our proceedings in the form of a journal, somewhat perhaps under a rather pretentious title and form; but if we respond to it, it will be no more than what we ought to accomplish as a society if we have more than a name to live.

Let me pass in review some advantages which will accrue to us by such a publication. It is due to every man, if he does any work, that the same should find record and expression, even if that work cannot be said to be new. The publication of work done is a means of assisting others to do the like, and I am sure there are many who would work more decidedly if they knew that the little they have to give would be beneficial to others, and that it could be communicated to them.

How it may be in other societies I cannot say, but I suppose the same amount of corporate action exists, and must exist elsewhere, as the law of being of every society, that of giving and taking, and taking and giving.

So we, in opening up a channel of communication with others, and conveying even a modicum of information, shall no doubt be benefiting ourselves as well; and I am inclined to think that amongst that class which goes by the name of microscopists there exists a desire to spread and communicate information in as great a degree as among other workers in scientific matters.

Besides, there are men who will publish their work if they can obtain a proper channel to deliver the same to the public, as they have no wish that their acquired knowledge should be laid aside or misdirected, and hence such may be induced to become contributors, and I think we should be ready to open our pages to the essays of others besides members of this society, provided these contributions shall have been first communicated to the society, or passed the Editorial Committee.

In carrying on the work of publication by a society like ours I consider it is an essential point to bear in mind, that the more the matter in hand can be subjected to illustration, as by the publication of plates or wood-cuts, the more valuable and reliable will it become. This procedure requires funds in order to maintain it, and a wise use of means will, I believe, tend much to the advance of the journal; and while our object should be to be careful not to be losers in a monetary point of view, we should exclude any idea or effort at any possible advantage or increase in that direction.

I should be very glad if we could steadily publish in a clear and accurate form delineations of such objects and forms as the *Polyzoa* of our colony, together with figures of *Confervæ*, whenever we can manage to collect and determine them, as far as their generic characters are concerned; and when this has been done, then they will be able to be published in a volume by some one who will be able to go into further details, as specific characters, &c.

To what does all this point? That men who work must needs inform their eyes and hands. They should endeavour, whenever they have acquired the knowledge of a new object, to delineate the same for their own satisfaction, if not for the information of others. A worker who, for the first time, has seen a young oyster alive under the microscope or viewed the circulation of protoplasm in the cells of a plant, should at once set about to express what he has seen by putting it on paper by a sketch. Never mind, even if he cannot draw, let him try; the delineation of flat or plane objects should soon become an easy matter to him, and a rough note book thus produced will soon be looked on by him as one does on an old friend.

On looking over the various matters I have alluded to in our society there is one which I must take notice of more particularly, it is the Juvenile Exhibition, towards which we, as a Society, have contributed our quota of good wishes in offering a couple of prizes to the best collections of local specimens properly prepared for the microscope. I trust there will be a good competition for the same, and as there are some of our members who are of eligible age to enter the contest, I hope they will not allow the prizes to be carried off without a proper contention for the same.

You are all aware, I have no doubt, that next year the Melbourne International Exhibition will engage our attention, and that from this society delegates will appear. Besides any action which these may be called on to fulfil, I think, as a society, we might take it into consideration, if we are not able to make some advance to the public on that occasion which will be of service in bringing our studies more particularly before them, and that for this purpose we might seek for some room, which would be granted, for a specific exhibition on our part.

I have now to recall your attention to the condition of our collection of specimens. I find, on inquiry, we cannot make any show, nor have we any specimens which can be regarded as having been added with a view to composing a cabinet of reference for future use. This was a matter I mentioned to the Society last year, and I find very little response has been made to it. I think we ought each of us to give a definite quota to the general stock, and make up our minds to this end and carry out our intention during the coming months.

I must not forget our expeditions, which we formed last year, for the purpose of exploring the neighbourhood for marine and terrestrial specimens, as these can be always turned to some profitable account if they are properly arranged and carried out. I trust this will be taken in hand, and be increasingly interesting and profitable to all of us.

It is on occasions of this kind we are led to perceive how little we really know of and about the objects by which we are surrounded, and when we encounter what to us is a novelty we then begin to perceive the great pleasure which attends any acquisition of knowledge which is directed towards natural objects. Hence the great service which such expeditions may be made to yield to those who will undertake them with a view to obtain materials for study, as well as learning their habitats, and the method of obtaining them for investigation.

Looking back on the past year, I think the society can congratulate itself on its position and prospects. Let us deserve success and we will obtain it.

Notes on living Polyzoa. By J. R. Y. Goldstein.

[Read 23rd November, 1878.]

In penning the following notes of observations on living *Polyzoa*, my chief desire was to illustrate how easily any person possessed of a microscope can be of use to the world of science by jotting down, as they occur, whatever incidents he may consider peculiar in the appearance, habits, and general life-history of the various forms of minute life to be met with during quiet hours with the microscope.

It is true, many such notes will be repetitions of what has previously been observed by others, but it is equally true that just as many of them will be new. None can study closely any rare form of microscopic life without observing something never before recorded. When the student, conversant with the work done by others on the subject under examination, first discovers a new truth, he feels a joy equal to that which rewards the philosopher upon gaining the object of his researches after years of toil; and when he renews his pleasure by narrating the result of his observations to a society like ours, he experiences the full benefit of association, through having his work lovingly criticised, and being encouraged to further labours in the same direction.

While on this topic, I may be allowed to express wonder that men with valuable instruments, and all the costly appliances thereto belonging, will persistently fritter away their time in mere gazing, say at the beautiful markings on the frustules of diatoms. Diatoms are certainly beautiful, but they are by no means the most beautiful of nature's fashionings. I dare assert that the lovely forms of cell architecture to be met with among the *Polyzoa* will run them close on comparison, while any one of the species of this family, alive, would leave the much-loved diatoms far behind in any contention for a prize.

Then the desire to accumulate slides is too frequently little better than evidence of the mere love of having. In many cases approaching to the mania for tulip bulbs, or for old china. The general run of men with microscopes require to be lifted out of a groove and forced to enjoy the pleasures of observation and thought, soon opened out for their delectation in the study of any one branch of microscopical science. As has been remarked by one of our members, on a previous occasion, "The observer who works out and records the life-history of any one of the simplest forms of minute animals, will have done more for science than a whole host of Diatomaniacs." And again, when we consider that here in Australia the scientific observer has at his feet whole worlds of undescribed life, where everything is new and strange, nothing can be advanced to excuse him from setting to work steadily and usefully to record his observations by means of papers for publication by this or kindred societies. He will find helping hands around him, and soon discover that his work is useful, and that it will be eagerly accepted and acknowledged by more able and learned workers in other parts of the world.

I fear that I have allowed myself to run too far in the direction of a homily, and that my *few* opening remarks will be considered anything but introductory to the subject of this paper. I will only say further that it must not be supposed that, in collecting the *Polyzoa* here described, I met with no other objects of interest, each haul of the dredge or scraper brought up literally myriads of minute forms of life, consequently the pages of my note-book, scant though they be, are not wholly occupied by notes on *Polyzoa*, but embrace observations on a variety of other objects well worth the attention of any student. From these notes I have, however, selected only such as refer to the favourite object of my study, the *Polyzoa*.

The most of the species, some twenty, which I was so fortunate as to secure alive, were obtained from the piles of the jetty at Portland some thirteen years ago. And, as evidence of the wealth of life in these waters, I may instance a piece of *Retepora*, in size about the bulk of two fists, which comprised within itself a veritable museum of curiosities. It contained tiny starfishes of lovely hues, *serpulæ* and *terrebellæ* of different sorts, *nerides*, *sponges*, two *sertularians*, several minute crustaceans, and a variety of molluscs, besides other things I had not time to identify. Why, here alone was work for a week! But *Polyzoa* was my chief object, so I placed a small piece of the *Retepora*, with a little sea water, in a common watch glass under the microscope. What a sight was there! No diatoms were ever half so lovely. Fancy a field of animated flowers of most graceful shape—that of the lily—whose tiny petals curved and twisted, and waved themselves about as if in the most intense enjoyment of life. These tiny petals, like living threads of silver, were the expanded tentacles of the occupant of each cell, and were in number from sixteen to twenty, their motion rendering them difficult to count. Each tentacle was clothed with minute cilia, the rhythmic motion of which was well displayed under a power of fifty diameters. Words fail me to describe the scene. The cells were close together, and from each was extended the vase-like bunch of tentacles arranged in a circle on the lophophore or crestbearer, as this organ is styled. The whole was in constant motion, seeking food, which the currents caused by the cilia soon brought within their power. One or two tentacles might be noticed curling or gliding as if searching for some dainty, which, when obtained, was speedily secured by the contraction of the tentacles, when immediately the whole would disappear as if by magic; so quickly would the closed tentacles recede within the cell that the motion could not be discerned; they were simply gone, how, I could not even guess. After a little while the tentacles would be gradually thrust out and slowly expanded to their full beauty.

The whole field presented a busy, pleasant scene, that charmed beyond description. Each *Polyzoon*, as the animal is called, seemed to act independently of its neighbours; some would be fully extended, while others were in the safe recesses of their cells. If one was touched by a needle or a hair, it would instantly vanish without alarming the others, and when it again ventured forth, from the cautious manner in which it gradually expanded its tentacles, seeming half afraid, yet anxious, one could not avoid fancying the creature possessed intelligence of no mean order.

Irregularly scattered among the cells I noticed another form of *Polyzoon*, altogether different, which I afterwards ascertained was a *Pedecellina*, a genus of *Polyzoa* belonging to the order *Ctenostomata*.

This *Pólyzoon* is invested with a thin transparent covering so slight as to make the animal appear to be naked, and grows on a pedicle, which starts from a creeping, adnate, tubular stem. The tentacles are very short and curled inwards. On these the ciliary motion is well displayed, while the whole animal frequently bends and waves itself about on its pedicle as if moved by some fairy wind. This *Polyzoon* having no cell to retreat to, and being exceedingly transparent, affords a fine opportunity for studying its internal economy. The currents caused by the cilia were easily seen, and were strong enough to draw within reach objects floating at some distance, which, if nutritive, were immediately engulfed. The course of each particle of food was easily observed throughout the operations of mastication and digestion. The motion of the stomach was constant, food being continually pouring in, not in great quantities, truly, but still with such regularity that its powers of feeding seemed enormous. It is probable that at times there must be a dearth of food in the surrounding water, else it were impossible to understand how this constant absorption failed to cause a fracture somewhere, to say nothing of the minor ailments of dyspepsia.

The next species to describe was a *Diachoris*, the tentacles of which, twenty or more, were well displayed. This species possesses that truly wonderful appendage called an avicularium. In general appearance it is just like a parrot's head with rather long beak, the lower mandible open to its widest extent, occasionally shutting with a snap, and then re-opening slowly. Sometimes the avicularium moves sharply on its stalk, as if pouncing on some prey. It moves independently, whether the *Polyzoon* be extended from its cell, or not. The use of this strange organ is unknown. Various surmises have been offered by different observers, but nothing is certain. I regret to say my observations did not help much to elucidate the mystery. On another species—*Bugula dentata*, tentacles, sixteen—the avicularium has a motion peculiarly bird-like, and almost continuous. On one occasion I saw one with the mandibles closed, grasping a tuft of confervoid-like substance, just like a bird with a wisp of hay in its beak. This it retained for some days, while the peculiar waving motion was still kept up. The only explanation seemed to be that the decaying conferva would attract minute infusoria, which would thus be brought within easy reach of the tentacles of the *Polyzoon*. Busk says they are organs of prehension, but I confess my inability to understand exactly what this means.

On *Scrupocellaria scrupea,* another genus of the *Cheilostomatous Polyzoa,* there is another organ, the use of which in the economy of the *Polyzoa* is also uncertain. It is called a vibraculum, and consists in this species of a long spine attached to a socket joint, on which it can move in any direction, and with considerable force. Busk asserts that, in the majority of cases observed, this organ is mainly defensive in its character. In the few instances that came under my notice, they seemed to be used purely for cleansing. In *Scrupocellaria,* the motion of the vibraculæ was continuous, rising upwards and outwards with a slow, steady motion, and then back with a sudden jerk, as if by the snap of a spring, the jerk being downwards across the cells at back or front, sometimes alternately, thus apparently sweeping the surface of the cells free from any particles whose presence might disturb the comfort of the *Polyzoon.* This species was not so liberal in the display of its beauties as others had been, the tentacles being seldom fully extended, but I was enabled to ascertain that their number was invariably twelve.

Emma crystallina had also twelve tentacles. This is a very difficult species to make out, owing to the peculiar way in which the branches of the *Polyzoary* curl inwards. The cilia on this species are very short, so that it requires a power of about one hundred diameters to observe them with any clearness.

In most species of the *Cheilostomata,* the polyzoon only extends from its cell the lophophore or collar bearing the tentacles. In *Eucratea chelata,* however, tentacles twelve, nearly the whole animal would be extended. Not only the gullet, but almost the whole of the stomach could be observed outside the cell mouth. From this circumstance, and also owing to its extreme loveliness, this species is very interesting and well worth further study.

Although the genus *Catenicellæ* comprises so many species, twenty-four at least being found on this coast, I was only able to find one alive. This was *C. formosa,* a very lovely species, but like all true beauties, it seemed chary of displaying its charms.

On one occasion I sat constantly for five hours vainly endeavouring to ascertain the number of its tentacles. There seemed to be more than twelve, probably sixteen ; but during the whole of that time not one polyzoon would remain motionless sufficiently long to satisfy me on this point. Although frequently moving out and in, the animals seemed to be exceedingly cautious and shy. While other species would seem oblivious to severe shaking of the table or the microscope, this one would instantly vanish from view on the merest movement of the fine adjustment, so sensitive was it to external influences. The aviculariæ in this species affords a good sight of the muscles and their action in closing and opening the mandible. This snaps upwards sharply, and re-opens just as quickly.

Bicellaria ciliata is another lovely species, but difficult to make out, owing to the long spinous processes that form a sort of cage about the cells, thus interfering with definition. As well as I could make out there seemed to be about twenty tentacles on each polyzoon. The spinous processes seemed to be immovable.

Of *Caberea lata* I got a fine specimen, but unfortunately it got so covered with dirt while bringing it home in a bottle with other objects, that it never could, or never would, display its tentacles. The only motion to be seen was in the vibraculæ, which, in this instance, were very busy; certainly they had a heavy job of cleansing to do. On this specimen the ovicells were numerous, and very transparent. The ova were granular, and of a bright scarlet colour.

This species is specially interesting to me as being the first Polyzoon I had ever seen alive. On a previous occasion, some years before, I had got a fine branch of it, and was of course charmed. The motion of the vibraculæ was strong, and the animal fairly extended. Being anxious that others should share my pleasure, I sent for two friends, gentlemen of scientific tastes. They were very anxious to verify my remarks, and watched the specimen carefully for about an hour, but to my intense chagrin, could not observe the slightest sign of life. All was quiet. Five minutes after they had left every spine was in rapid motion, waving and jerking in every direction in the most excited manner, as if amused at my disappointment.

Of *Membranipora pilosa*, a very common species, found encrusting seaweeds of various sorts, I may remark that for liveliness it presents a strong contast to *Catincella formosa*. Every polyzoon fully extended; tentacles, twelve; movements very rapid. Ciliary motion beautiful and very distinct, the cilia being much longer than in any other species observed by me.

In most of the above species the colours were dull, and of sober hues, such as light browns and creamy whites. *Bugula dentata* was of bluish green, deeper in shade towards the tips of the branches, while the colour of the polyzoon was a light brown; but even here the colour was not brilliant. If nature seems to have denied to these moss-like Polyzoans the additional beauty of varied colours, she seems to have gone to the other extreme with the calcareous kinds. Of *Lepralia* I found three species; of *Cellepora* four. The colours in all being simply magnificent.

In the scarlet *Lepralia, L. Ellerii* (?), the colour is very bright, and seems to be located in a fleshy epidermis, with which the stony polyzoary is coated. This epidermis is granular and of considerable thickness, as plainly seen by strong daylight, while on the points of many of the older spines or bosses this epidermis is thin, as if rubbed or worn, showing the usual crystal clearness of the calcareous base.

In other species the colours were intense and beautiful. One had an olive green epidermis minutely and irregularly spotted with pure white. In another the colour was a bright black, with a golden tracery of yellow spots connected by fine lines. Another had crystal walls, spotted with opal white, while the polyzoon was a bright brick red. There were sixteen tentacles on this species, and inside of some of the cells I noticed small masses of intense crimson near the aperture, seemingly unaffected by the motions of the animal, similar in appearance to the contents of the ovicells.

Lepralia punctata (?) * is a lovely species, and very interesting. Tentacles, twenty; lophophore fully extended from cell; outer cell wall widely perforated. In some instances the perforations run into each other, forming largo apertures, showing the thin wall of the inner cell, between which and the outer cell there is an open space, affording free access for the water. This was evident upon seeing a tiny Rotifer swim in and out. Through these perforations almost the whole length of the animal can be clearly seen; the cell walls being also very transparent. The polyzoon is coloured yellowish brown.

* Probably *L. monoceros.*

The spines on this species, a solitary one on one side of each cell near the aperture, seem to be only on the newly-formed cells, those near the edge of the polyzoary. In the newest cells, or rather in those being formed, can be seen the immature polyzoon, like a bunch of short fingers closed together, the thick outer cell being still unformed. This outer cell seems to grow up gradually from the outer edges until the various irregular projections meet and coalesce, forming a reticulated pattern. I thought I could discern a small sessile avicularium on the front margin of the aperture of cell. There are no spines to be seen on the old cells, but I could see the places where they had been. On turning over the polyzoary, the back of the cells was seen to be very thin and transparent, showing the whole of the polyzoon, in some cases seemingly free, and in others attached to the cell by a muscle at the base. Altogether this is a lovely and highly interesting species.

I feel a regret that the few notes I have here recorded have been put together so hurriedly as to merit the charge of meagreness, but I crave indulgence, and trust that the work I have set myself to do, in conjunction with my friend, Mr. Maplestone, to prepare a full list of all Australian Polyzoa, will prove of more real use than could be expected from the poverty of this paper. We propose to describe and figure all species observed, giving particular attention to their characteristics when alive, and will deposit at the National Museum a complete collection of type specimens and duplicate slides. We have a goodly number of new species.

In conclusion, I would again urge upon the junior members of this society, each of them, to take up one branch of study, and work it out regularly and consistently. Books on natural history are plentiful, and nowadays they are so low in price that anyone may speedily get together such books as may tell him what work has been already done in the subject of his choice. He will then know what to look for, what problems require to be worked out, and his note book will afford ready means of jotting down his own observations; only let him not observe without noting, it is waste of time. This society will be glad to have such recorded observations when it publishes its transactions, and will then have something valuable to exchange for the transactions of other kindred societies throughout the world. And so our library may become a valuable aid to future explorers in the realms of microscopic science.

On the Use of Carbolic Acid in Mounting Microscopic Objects.
By J. R. Y. Goldstein.

[Read 28th August, 1879.]

The mounting of objects in Canada balsam, by means of turpentine, has long been a serious difficulty to students, and a nuisance even to practised hands. Turpentine evaporates so slowly that the hardening, or baking, and finishing of slides becomes a serious obstacle where time is concerned, while the previous preparation of objects saturated by water is exceedingly troublesome, and a general characteristic of messiness pervades the whole operation.

The members of this society have for some years adopted, with advantage, a method suggested by the President, Dr. Ralph, in 1874, by which much of the unpleasantness of mounting in balsam is avoided, and the time occupied considerably shortened. Now that the process has stood the test of years, and has proved so decidedly beneficial, it is considered advisable to publish in the journal of the society a detailed description of the process, in order that microscopists generally may know and use what may properly be called "Ralph's carbolic process."

When first calling attention to the subject, Dr. Ralph suggested the use of glycerine as a means of withdrawing water from objects before using the acid, but experience has shown that this is not necessary, as by the use of heat carbolic acid will readily absorb, and eventually replace the water in any object saturated therewith.

The carbolic acid used should be the purest that can be obtained, and it will be well to keep the greater portion as stock in a dark-blue glass-stoppered bottle, so as to prevent it being discoloured by exposure to light. From this can be transferred, as required, a small quantity to a working bottle of about two drachms capacity. If the acid is so pure as to be crystalized, melt what is in the smaller bottle, and add a few drops of spirits of wine, which will easily mix with the acid, if held for a few minutes over the spirit-lamp. The acid will then be less likely to crystalize, and the small quantity of spirit used will not affect the process. Should there be any difficulty in procuring stock of perfectly clear acid, the ordinary coloured acid of the shops, if in crystals, may be used without fear. As will be noticed presently, we drive off all the carbolic acid used, replacing by clear balsam or dammar, therefore the coloured acid can do no harm. Perfectly clear acid soon becomes discoloured by exposure to light, and heat has a similar effect; when we boil objects in acid and allow them to remain for a few days, the acid will then have changed to a rich brown, but as this does not affect the objects steeped therein, it need not trouble us further.

The advantages claimed for this process are, that objects need never be allowed to dry before mounting in balsam or dammar; that the operation, from first to last, is simple and cleanly; while, compared with the old turpentine process, this is wonderfully rapid. A tiny insect may be caught alive, boiled, cleared, mounted in balsam, the slide finished off and put away in the cabinet, all within half-an-hour.

Objects saturated with water should be drained as well as possible without allowing all the water to run off, as in that case air might be admitted, then transferred to a clean test tube, covered with carbolic acid from the working bottle, and boiled for a few minutes over a spirit lamp. Corked tightly, a test tube full of objects in acid may be put aside for any length of time before mounting. When we desire to mount one of these objects we transfer it to a clean slide, put on a thin glass cover, and with the aid of a small pipette allow enough clean carbolic acid to run in to flood the object. Having examined under the microscope, and arranged it to our liking, we warm the slide over a spirit-lamp, and place sufficient balsam or dammar on the slide close to the cover; liquified by the heat, either medium will at once run in and drive the acid out at the other side. This will be greatly facilitated by inclining the slide and holding a small piece of blotting paper under the thumb close to the lower edge of the thin cover. When all the acid has been drawn off, the slide is then placed on a hot plate to harden, and afterwards finished in the usual manner by scraping off the superfluous balsam, wiping the slide carefully with a clean rag moistened with spirits of wine, and finished on the turn-table by sealing the cover with a ring of Brunswick black, or other varnish.

Another aid to the thorough displacement of the acid is to use the balsam in as thick and pasty a condition as possible. At the same time this is not essential to success, as thin balsam works very well. Benzine* should be used in preference to turpentine to liquefy balsam that has become too stiff. Newly-purchased balsam is often very thin. In this case it is advisable to bake it in a cool oven for some days until it is hard enough to resist slight pressure, and then add about one-fourth part of benzine, placing the bottle in a hot-water bath, which will ensure perfect mixture. Balsam thus prepared will harden quickly, which it does not do if liquefied by turpentine. Turpentine may therefore be excluded from the microscopist's laboratory.

When mounting it is well to be provided with several pieces of blotting paper, about an inch square. These should be used, as above described, to aid the substitution of one liquid for another, particularly when displacing watery carbolic acid by pure acid.

Vegetable tissues, such as plant leaves, sections of wood, &c., after washing in water may be drained and transferred at once to the slide, covered by thin glass, flooded in carbolic acid, and then boiled over the spirit-lamp, adding fresh acid from time to time until the object is perfectly clear. Air bubbles may thus be boiled out, and the object decolorised and rendered beautifully clear by the process. When cool, add fresh acid and follow with balsam, as above.

Insects whole, or their organs, and animal tissues generally may be treated in the same way, which seems to suit such organisms better than the old method. The action of the acid under heat is rapid,† and can easily be stopped when required by simply blowing upon the cover.

In preparing *sertularians* and *polyzoa*, where the empty cells retain air so pertinaciously, this annoyance may be overcome by

* Some prefer chloroform, which will liquefy the balsam without heat, but we think the benzine much superior in subsequent operations.

† As some objects are injured by heat, these may be cleared by soaking in cold carbolic acid for a few days or until cleared sufficiently.

boiling in water and allowing to cool, replacing the water by carbolic acid, when alternate boiling and cooling at intervals more or less lengthened will effectually dispose of air in the cells. Those who have opportunities of collecting on the sea-shore will find that, just after storms, many species will have been washed upon the beach, some possibly alive. Objects thus obtained, or by means of dredging, should at once be placed in small phials, in a fluid consisting of spirits of wine and water in equal parts—sea-water will do. When these are taken home, they should be washed several times in fresh water, to get rid of the salt, sorted, and transferred to a mixture of spirits of wine and fresh water in equal parts. They can thus be kept in good order for any length of time, or they may be mounted at once by the carbolic process.

Radulas or palates of molluscs should be boiled in strong liquor potassæ for a few minutes, well washed in three or four waters to remove all traces of the potash, and then, treated with the carbolic acid as above described, may be mounted very quickly.

To ensure clear mounts the balsam should always be immediately preceded by perfectly clean acid, displacing with the aid of blotting paper the acid previously used. If this be neglected, and the acid first used should not be completely removed, a little cloudiness may result from the admixture of the balsam with the water in the acid. In this case the slide must be flooded in fresh acid, to soften the balsam, heated, and the cloudy balsam drawn off by blotting paper, substituting fresh balsam.

A New Method of Making Cells of Wax for Mounting Opaque and Transparent Objects. By F. Barnard.

[Read 25th September, 1879.]

Having lately been making some experiments to get a more conveniently made cell than those generally in use, I am desirous of making the result of my work known to the members of this society, hoping it will be at least some use to the younger members and give an opportunity to others to improve on it.

It is well known to all mounters of microscopic objects that a useful cell, having a neat appearance, is by no means an easy thing to make, especially if required of a great depth. Of course there are plans adopted by individuals which they recommend, and may be successfully adopted by some, though often failures in the hands of others.

We are advised to make cells of paper, card, tinfoil, and tea lead, by punching holes through and cementing to the glass slip. Rings of gold size, black japan, and a variety of varnishes made on purpose and applied by means of the turn table coat after coat till of a sufficient thickness; these all prove very frequently difficult to make and unsatisfactory. They are sometimes so brittle, they will hardly bear a touch; another time, perhaps, so soft that you must be careful how you handle them for a long time. Glass cells which, though made with some risk of breakage, are not difficult to make with a sharp file wetted with turpentine; also metal and Indian-rubber rings, fastened by cement to the slips; and writers in late periodicals have been advising the use of a metal ring, as a curtain ring, in which a disc of wax nearly the same size is placed and melted, which, when allowed to cool, forms a cell with a concave surface, which is more or less objectionable. With all these there is the same difficulty of fixing the covers.

The process which I now confidently bring under your notice is one which I have never seen mentioned, and may yet bear some improvement. It is making the cells of bees' wax, white wax, parafine, or stearine, or a mixture of these substances.

Years ago I tried to make cells by puncturing holes in sheets of wax and stearine, but always had a difficulty in removing the cells from the punch without pulling them out of shape or spoiling the face of the ring.

My present process is thus:—I take a small piece of wax, according to the size and depth of the cell required, place it in the middle of the glass slip, warm it thoroughly over a spirit lamp then press it upon the slide perfectly flat and even with a smooth surface. This is easily done by means of what I call a gauge, made thus—on each end of a slip of glass, cement with balsam small pieces of paper, card, or glass of the thickness of the required cell, moisten the underside, and press upon the warm wax till down as far as the end pieces will allow; by moving this gauge about a little you will have a tolerably smooth and level cake of wax on the slide the thickness of the gauge.

When cool, place the slip on a turn-table, and with a pen-knife or other convenient tool, turn out the centre to any size required, thus a cell is formed, which it is necessary to clean, as the marks of the knife will remain on the bottom. This is easily done with a small piece of rag moistened with benzine. For opaque objects this can be dispensed with by placing a piece of black paper at the bottom of the cell and mounting your object upon it. I prefer mounting the specimen on the glass after cleaning it.

Having placed the specimen in position, proceed to cover it. The cover—whether round or square matters not—has to be warmed over a spirit lamp, and while warm to be dropped into its place, being very careful as to its position, because you cannot remove it when once placed warm on the slide without spoiling the cell. I would caution you also against heating the cover glass too much, as your wax will then run, and you will perhaps have a shapeless cell instead of a neat round one.

When cold, cut away with a warm knife the superfluous wax, and clean off with benzine. If you have not placed the black paper in the cell, paste it on the under-side of the slip, or paint with some black varnish to form a back ground.

Before using the wax material, you can, if you please, colour it and make a great variation in the external appearance of your slides, without in any degree affecting the efficiency of the cell. Thus:—Melt the wax in a small cup, and mix thoroughly with lamp or ivory black, yellow chromes, white oxide of zinc, red vermillion, or brown carbonate of iron. In fact, any colour you please can be made by having recourse to painters' dry colours, and with advantage also, as the colours will tend to harden and give more solidity to the wax.

Having thus spoken of wax cells for mounting opaque objects, to which I have more particularly applied them, I may add, for balsam, glycerine, jelly, and Farrant's medium there can be no objection, as those materials will fasten the covers down of themselves, and will require less trouble than the cells in ordinary use.

As to fluids, I have sealed up glycerine, glycerine and water, spirits and water, and water, but perhaps I ought not to say much about them, as they have been but a short time finished. Of course, to fasten up fluids, it requires more care, and as yet I can hardly say which I shall call the best method, but will, when I have fairly completed the experiments I am making, give you some hints.

Of the advantages of wax cells, one is that it is no more trouble to make a thick or deep cell than a thin or shallow one, and takes no more time. It is a very expeditious method—no waiting for varnish to dry before you can apply another coat. Again, the cell is not soft enough to crush by any ordinary accident, and the tenacity of wax will enable it to withstand any ordinary, or I might even say extraordinary, blow without removing the cover, which is a great advantage over the ordinary cement cells.

NOTE.—Since reading the above paper before the Microscopical Society, I have endeavoured to adopt some plan to meet the objection of a member—the difficulty of cleaning the cell with benzine.

This can easily be accomplished by covering the glass slip with a coating of solution of gum tragacanth to which a small quantity of sugar has been added, allowing it to dry before the application of the wax, when the marks of the knife left in turning out the cell can be removed by merely washing in water only. But these cells would not do for mounting objects in glycerine, water, &c., and of course the question of the adhesion of the wax to the slide would be raised; but carry the process a little further—that is, soak the slide with the cell on in water, and the cell will be freed; then carefully wash it well to remove all gum and when dry apply to another slide.

By this use of gum you can make any number of cells, and keep them by you, as you would glass and vulcanite cells.

I would also mention that a late number of the *English Mechanic* contains a paper by Mr. G. Fell, of Buffalo, U.S.A., giving a long account of his mode of proceeding in making wax cells, but the whole process is based upon having a metal ring for the groundwork.

As to cell making, I am afraid his system is so complicated that few who have tried mine will care to work with his. As I have pointed out, by my process there is no limit to *size* or *depth*, by his you must be guided by the metal rings procurable.

In mine, once on the turn-table is all required; by his process, three or four times he seems to recommend; by mine, no varnish is required—by his, the covers are varnished or cemented to the rings.

On Covering Fluid Mounts to avoid Leakage or Running-in.

By W. M. Bale.

[Read September 25th, 1879.]

In mounting objects in fluid one of the principal requirements is to fasten the cover of the cell securely, so as neither to permit leakage nor running-in of the cement. There are two methods described in most of the text-books, both of which have disadvantages that impair their utility to a greater or less extent. The first, which is recommended by Davies, is to paint the cell on its upper surface, and the cover on its under surface near the margin, with thin coats of gold size or other cement, and to press down the cover, forcing out the superfluous fluid in doing so, when the varnished surfaces of the cover and cell, not being affected by the fluid, will adhere together. It is a serious defect in this process that it will not permit of sliding the cover to one side after fixing it, if, as frequently happens, it should be necessary to re-adjust the position of an object which may appear, on examination under the microscope, to require alteration. Moreover, thin pellicles of fluid frequently remain between the cover and the surface of the cell, preventing the perfect adhesion of the cement, and allowing the ingress of air. The other process, which is preferred by Dr. Carpenter, is to simply apply the cover upon a cell a little larger than itself, and when the outside is dry to paint it round the margin with varnish, giving several coats as they successively dry. This has the disadvantage of not holding the cover sufficiently firmly to the cell, and of being peculiarly liable to "running-in."

These evils are to a great extent obviated in the following plan, which is especially adapted to cells of any thickness not greater than that of ordinary card or thin glass. An essential point consists in reversing Carpenter's rule, and using a cell *smaller* than the covering glass, so that when the cover is in position it projects beyond the cell for about one-sixteenth or one-twelfth of an inch on every side. The cells may be made of any suitable material—thin tissue paper will serve for minute objects, and common cardboard for those of considerable thickness. The cell may be attached to the slide, or simply placed in the position which it is to occupy, without being cemented. The objects are immersed in the fluid in the centre of the cell and the cover pressed gently down, forcing out the fluid which is in excess of the capacity of the cell; and after it is ascertained, by examination under the microscope, that the object requires no re-adjustment, the fluid must be removed from the space between the cover and the slide *outside* the cell wall. This is easily accomplished by simply allowing the slide to stand till the superfluous fluid has evaporated, or where the cell is thick enough, blotting paper may be inserted under the margin of the cover to absorb it. If this plan be adopted, care must be taken, after the fluid is removed, to allow the slide to stand for a minute or two till the slide and the under surface of the cover-margin are quite dry, otherwise the cement will not adhere. Two or three drops of thin balsam or gold size are then to be applied at different points of the edge of the cover, when it will run in by capillary attraction and fill the space outside the cell and beneath the cover. Directly this cavity is filled any superfluous cement remaining on the slide must be removed, otherwise the running-in process will extend too far, and the cement will enter the cell. The slide may then be put aside to harden. It will often be found after a day or two, especially with cells of considerable thickness, that the cement will be so shrunk from evaporation as no longer to quite fill the space destined for it, when a little more may be applied at the edges till this space is refilled, care of course being taken to scrupulously remove the superfluous cement as soon as the requisite amount has run in. It occasionally happens that some of the fluid is forced out of the cell in process of drying and occupies part of the space which should be filled only by the cement. This "running-out" is no doubt caused by the shrinkage of the cement drawing the cover down more closely, and if the fluid extends only a very slight distance beyond the outer margin of the cell no injury is done; but if enough is expelled to make a passage nearly or quite through the cement wall there will be a liability of leakage. The best safeguard against this mishap is to be cautious that the cement is not run in till the whole of the fluid has evaporated from outside the cell, or even till the thin film between the covering glass and the upper surface of the cell has commenced to dry. When this occurs the cover will generally be drawn down as closely as is necessary, and the cement may be applied with reasonable security.

The result of this operation is to secure a double cell;. the inner part consisting of the paper or whatever material may be used, and the outer of a solid wall of cement firmly uniting the slide and cover, and as wide as may be required. I use a cell about one-eighth of an inch less in diameter than the cover, giving a margin of one-sixteenth all round. Care must be taken in finishing slides mounted in this manner, as I have found one commence to run in on the application of varnish, after being mounted some months, the fresh varnish having softened the original cement. This difficulty would probably be obviated by using a rapidly-drying varnish, and only applying a thin layer at once, or by making a narrow circle of gum round the margin of the cover and allowing it to dry before using the finishing material; or by using paper covers, and thus dispensing with varnish entirely. There can be no doubt that slides mounted in this way will have almost the permanency of balsam mountings, so far as freedom from external influences can secure it.

A modification of the above process may be used with media, which will not evaporate to dryness, such as glycerine and castor oil. In this case it will be advisable to place the object in the centre of the cell, in a quantity of the medium so small that on pressing down the cover the drop will not quite fill the cell, and consequently none will be forced out. The cement may then be run in under the margin, as above described. If the medium be thin and likely to spread over the floor of the cell before the cover can be applied, it will be better to suspend a small drop from the centre of the cover, and bring it down upon the object; and in any case the cover should be moistened with the medium before applying it.

Note.—I find that Tuckett advises the use of a cover larger than the cell, in order to prevent running-in; but as he does not withdraw the fluid from the space round the cell, his method gains no advantage over the ordinary plan in security from leakage.

Fossil Catenicellæ, from the Miocene Beds at Bird Rock, near Geelong. By J. Bracebridge Wilson, M.A.

[Read 25th September, 1879.]

I desire to call attention to certain peculiarly interesting forms, which I have been so fortunate as to discover in the Miocene Tertiary rocks of the Spring Creek section, fifteen miles south of Geelong. To show the value of the discovery, it is necessary first to state that this deposit is regarded as belonging to the same geological horizon as the beds at Mount Gambier and at Muddy Creek, near Hamilton.

From the remarks made by the Rev. J. E. Tenison-Woods, one of our greatest authorities on fossil Polyzoa, it will be gathered that the occurrence of *Catenicellæ* in our Miocene deposits is of no little interest, and some scientific importance. He says in the "Quarterly Journal of the Geological Society," vol. xxi. p. 393:—"The Bryozoa of the Hamilton beds, and of Mount Gambier, resemble each other in the absence of those forms, such as *Catenicellidæ*, *Menipea*, *Dimetopia*, &c., which give to the recent genera of the Australian seas so peculiar a character. It would appear from this that *Catenicellidæ* are peculiar to the recent period." The value of the discovery of fossil *Catenicellidæ* will further appear from the statement of Busk respecting the genus *Catenicellidæ*, which he regards as a characteristic of Australian seas. "For although," he says, "it occurs elsewhere in the southern hemisphere, it does so but rarely, and is almost unknown in the northern hemisphere."

It is interesting therefore to find, that when our Miocene beds were being deposited at the bottom of a deep and tranquil sea, the Polyzoic Fauna presented precisely the same peculiar facies as at the present day.

At least twenty distinct species of *Catenicellæ* have already been observed. The cells are isolated, the corneous connecting tubes having perished; but their most delicate features are often perfectly preserved. Geminate bifurcating cells are of frequent occurrence. None of the species yet obtained are identical with existing forms, though several have a great resemblance to them. Some, however, are quite distinct and not a little remarkable.

I hope, at no distant date, to lay before the society figures and complete descriptions of all the species of *Catenicellæ* to be obtained from the Miocene rocks of the Geelong district. As far as at present appears the same groups are to be recognized, except that, at present, no *auritæ* have been met with. The *fenestratæ* and *vittatæ* are abundant, and *simplices* are represented.

Sub-order, CHEILOSTOMATA. Family, CATENICELLIDÆ. Genus, CATENICELLA. Group 1, FENESTRATÆ.

C. species i.—Cell broadly cuneate, aperature large, scutum small, flat, occupied by six fenestræ radiating from a suboral pore; lateral processes very wide in line with the lip, narrowing sharply below, giving a triangular appearance to the lower half of the cell. Avicularia minute, two slight lateral projections just above the widest part indicate their position. Superior processes, acerose, from a narrow base, projecting nearly straight upwards, in the same plane as the face of the cell. Back of cell obtusely carinate, smooth; size about that of *C. elegans*.

C. species ii.—Cell ovate, aperture large, fenestræ 9. No superior process, a shallow lateral excavation for the avicularia. Back rounded and smooth.

C. species iii.—Cell cuneate, aperture large, scutum occupying nearly the whole front of the cell. Fenestræ 9. Avicularia minute. A slight lateral projection in line with the aperture. Superior processes very large, thick, and broadly triangular, their bases nearly meeting above the aperture.

C. species iv.—Cell broadly ovate, large, scutum large, slightly convex. Fenestræ numerous, 10-12? Avicularia gaping, directed laterally. Upper processes wanting; lower processes extending to base of cell, which thus becomes very broad below. Back smooth.

C. species v.—Cell ovate, broad below, scutum small, about the size of the aperture. Fenestræ 10-12? Shallow excavation on one side for avicularium, on opposite side wanting. Superior process short, triangular, broad at the base. Back faintly striated, especially on the dorsal aspect of the superior processes.

C. species vi.—Cell ovate, rounded below, aperture large, scutum large. Fenestræ 10-12. Avicularia minute. Back rounded, smooth, compressed.

C. species vii.—Cell cuneate, scutum large, oval, with mesial line, and lines radiating thence to the very numerous small fenestræ. Number of fenestræ? Superior processes sharply accrose, projecting backward. Back smooth, rounded, gibbous. Size about that of C. *ventricosa.*

C. species viii.—Cell broadly cuneate. Scutum flat, small. Fenestræ 7-9? Avicularia minute. Upper and lower processes very large. Upper process hollow, broad at the base, narrowing to a fine retroverted point, spreading slightly outwards. Back of cell gibbously carinate, faintly striated. Striæ very clear on back of processes.

C. species ix.—Cell oblong cuneate, slender, and greatly attenuated towards the base, which projects forwards. Aperture large and prominent. The part round the aperture and upper part of scutum projecting in a convex form, sinking below to a flat surface, which joins the upward curve of the base. Scutum undetermined, but appears to extend low down, and follow the contour of the cell. A circular pore just above the base. Avicularia small, slightly inclined backwards. Superior process narrow at the base, inclined backward, and tapering above to a slender rounded point. On each side of the back a perfectly distinct lateral tooth or spine, extending outwards and backwards. The whole cell resembles porcelain, and is singularly graceful.

Group 2. Vittatæ.

C. species x.—Cell elliptical, long, slightly curving forward at the base. Aperture and lateral processes occupy only one-third of length of cell. Vittæ lateral. Avicularia deeply excavated, slanting forwards. No superior appendage. Front and back of cell smooth.

C. species xi.—Cell oblong, elliptical. Aperture rather small and round. Vittæ very broad, extending to near aperture. Avicularia small, in a shallow excavation below the superior process. Upper process conical, thick, extending slightly outwards. Back rounded, smooth.

Group 3. Simplices.

C. species xii.—Cell sub-globular. No appearance of fenestræ or vittæ. Avicularia obscure. Upper and lower processes immensely large in proportion to the cell. Back acutely carinate. This strongly resembles *C. carinata* in structure, though very unlike in shape.

A New Species of Polyzoa. By J. R. Y. Goldstein.

[*With Plate.*]

[Read 27th November, 1879.]

Catenicella ponderosa. *n. s.* Plate V. figs. 1, 2, 3.

Cells ovoid, massive, irregular in outline; front and back strengthened by clasping bands of considerable thickness; mouth arched above, sub-triangular below, with a strong denticle on each side, to which is hinged the operculum; the mouth surrounded by a portion of a band in the form of a stout collar, widened superiorly; avicularia minute; fenestræ five, large and irregular in shape; ovicell large, hooded, surmounted by, apparently, an abortive connecting tube; top of ovicell, under the hood, sparsley studded by strong papillæ, with, on each side superiorly, a dense band of short papillæ; mouth gaping, the fenestræ being lengthened so as to appear like a grating.

This species is peculiar in the thick, heavy cells. It forms dense tufts, about four inches high, and the branches are frequently altogether composed of acutely triangular, geminate cells. It has affinities with *C. plagiostoma*, and, like it, when fresh, presents a remarkable contrast of colours, the cell walls proper being of a bright orange red, while the bands are ivory white, but these colours soon disappear, and the dry specimens present the common horny appearance of other catenicellæ. It is not uncommon; I have found it pretty generally along the coast from Portland to Queenscliff, and have dredged it alive in six fathoms.

A New Species of Polyzoa. By Chas. M. Maplestone.

[*With Plate.*]

[Read 27th November, 1879.]

Catenicella pulchella. *n. s.* Plate V. fig. 4.

Cells ovate, rather flat, with a row of small bosses or beads round the sides and lower portion of the cell; mouth semicircular, with a notch in the lower lip; avicularium sub-conical, with a small boss or bead underneath; ovicell galeriform, ornamented with bosses and surmounted by two avicularia, geminate, not terminal; back of cells sulcate.

I have only found one small tuft of this, growing on kelp root at Williamstown. It is a very interesting form, and does not come under any of Busk's subdivisions of the Catenicellæ, the ornamentation of the front of cell by raised bosses being peculiar to this species.

On a New Genus of Polyzoa. By J. Bracebridge Wilson, M.A.

[Read 27th November, 1879.]

[*With Plate.*]

The genus described below is closely allied to *Catenicella*, and to express that affinity, at Professor McCoy's suggestion, the name *Catenicellopsis* has been given to it. The two species as yet known are separated from *Catenicella* on the same ground that was considered sufficient to justify the separation of *Alysidium* from that genus, namely, the mode of branching.

Order, Polyzoa infundibulata. Sub-order, Cheilostomata. Family, Catenicellidæ. Genus, Catenicellopsis (new genus).

Cells arising, for the most part, from the upper and back of other cells, by a short chitinous tube. Cells at each bifurcation commonly geminate. Cells also frequently arising, by a short chitinous tube, from the side of another single cell, immediately below the lateral process.

I.—Catenicellopsis pusilla. *n. s.* Plate IV. fig. 1.

Cells pyriform, attenuated below, posteriorly rounded. Aperture looking upwards and forwards. On each side of the aperture towards the front, a thick, hollow, blunt process, slightly incurved at the apex; towards the back, a more slender, longer, and more pointed hollow process on each side. Avicularia minute, situated on the two anterior processes, just under the curve.

Front of the cell sparsely papillose, furnished with a circular opening having a distinctly marked border or margin, and immediately below a minute circular pore, best made out when mounted in balsam or other transparent medium.

Back smooth, ovicells broadly galeate, papillose. The ovicelligerous cell always springs from the lower portion of a geminate cell, forming with it a very peculiar tricellate group.

Habit.—Grows in small glassy tufts, about half-inch high. At present, only observed upon *Cystophora.*

First found in August, 1879, near Spring Creek, fifteen miles south of Geelong.

CATENICELLOPSIS DELICATULA. *n. s.* Plate IV. fig. 2.

Cells elliptically ovate, attenuated below, minutely papillose in front; back of the cell rounded, faintly striated; vittæ sublateral, short, often absent; lateral processes very small, projecting slightly forward, excavated below the point for a minute avicularium.

Aperture nearly circular, directed partly upwards; ovicell smooth, ventricose. The ovicelligerous cell is the upper of two, which are often so amalgamated as to appear one only, surmounted by two slender lateral processes pointed forward.

Habit.—Grows in tufts one and two inches high, on seaweed or larger forms of *Catenicella.*

First found near Spring Creek in November, 1879; since obtained by dredging near Port Phillip Heads, and on the Back Beach at Sorrento.

On Selecting and Mounting Diatoms. By W. M. BALE.

[Read 27th November, 1879.]

In the following observations, I shall endeavour to describe, as briefly as possible, first—the ordinary method of selecting and mounting diatoms, but with fuller details than are usually found in books, in order to suit the requirements of beginners; and secondly, a slightly different process which I have lately adopted, and which, in many cases, I find more convenient.

Asuming, in the first place, that the cleansing of the diatomaceous material (full directions for which may be found in any book on microscopic manipulation) has been satisfactorily accomplished, the first thing to be done is to take up with a pipette some of the material from the bottom of the vessel where it has been allowed to settle, to deposit it on a clean slide, and to evaporate the water from it over the lamp. If the diatoms are plentiful, it may be sufficient to prepare two or three slides in this manner; when they are scarce, I frequently prepare fifteen or twenty. These are to be placed on the table, convenient to the left hand. I then take several perfectly clean slides (one for each species to be mounted), and slip them under the stand of the microscope on the left side to protect them from dust, leaving the ends projecting, for the purpose of drawing them out when requisite. One of the slides, with the material upon it, is then placed upon the stage, and examined till a good specimen is found, when a needle, moistened with the tongue, is brought under the object-glass (a one-inch) till the point is seen in the field of the microscope, when it is brought down on the slide and pushed along till it touches the diatom, which will generally adhere to it. The needle with the diatom is then raised slightly from the slide, and held a little above the stage, while with the left hand the slide is removed, and a clean one drawn from beneath the stand, and after being strongly breathed upon, placed on the stage with the centre in the middle of the field: the microscope is then focussed to the slide, and the operator having again brought the needle under observation, places it in contact with the slide, where the diatom usually remains, being held by the moisture from the breath. If the diatom has any foreign particles clinging to it, it should be moved about on the slide with the needle, when the water will usually separate the objectionable matter, which may then be drawn aside; but if this be unsuccessful in cleaning the diatom, it should be rejected, unless it be a rare form. The slide is then removed from the stage and slid under the stand, till required for the addition of another diatom. If the material does not contain more than five or six species, the search for all of them may be carried on simultaneously, each specimen as found being transferred to its appropriate slide till a sufficient number have been secured, but if the forms are more numerous it will be advisable to collect only four or five species at once, going over the material a second time for the remainder. When as many diatoms are obtained as may be thought requisite, the slide is to be cleaned from the débris of broken valves, etc., which will generally have accumulated round the group of diatoms, and this may be best accomplished by removing the extraneous matter to a safe distance with the needle, and then wiping it off the slide with a soft piece of cork, which, if it be cut with a clean edge, may be passed very close to the group without disturbing it. The covering-glass may now be applied, but unless the diatoms be quite flat, it should not rest directly upon them, but should be supported under one or both edges by fine hairs, single fibres of silk being thick enough in many cases. If this precaution be neglected, the running-in of the balsam will draw the cover down closely to the slide, and, if the diatoms are very convex, or have broad hoops, they will be crushed. With species of *Campylodiscus*, etc., I have found it necessary to use supports of card, as even stout hairs were not thick enough to protect the diatoms from pressure, but it is rarely that anything more is required than a single hair under one edge of the cover. A small drop of soft balsam is next to be placed on the slide at each of two opposite points of the cover, and the slide is to be warmed just enough to cause the balsam to run in with an almost imperceptible motion, the two waves meeting as near the group of diatoms as possible. This is the most critical point in the whole operation, since if the slide be warmed too much, causing the waves of balsam to run in too rapidly, or if the waves do not meet at the proper point, the diatoms will be very liable to be scattered. After the balsam has run in and filled the space beneath the cover, it only remains to clean off the superfluous balsam, and finish the slide.

With the utmost caution it is difficult to mount some diatoms satisfactorily in the above manner, and in no case is this difficulty so marked as in mounting specimens of *Campylodiscus*, for, though of large size, their peculiar shape precludes their having any firm hold of the slide, and the balsam is certain to disperse them. After various futile expedients to overcome this obstacle in mounting the two species common in the West Melbourne swamp deposit, I hit upon the following plan, which proved perfectly effective. A very small drop of balsam is placed in the centre of the slide, and made very thin with carbolic acid—turpentine will not answer, as it spreads all over the slide. The point of the needle is dipped into this and held in readiness while the material is undergoing examination. When a good specimen is found it is removed on the balsamed needle-point, and the prepared slide being placed under the microscope the diatom is deposited in the thin balsam, washed in it, and pushed into the centre of the field. After a sufficient number of diatoms have been arranged in this manner, and any extraneous matter removed with the needle point, the slide is to be heated over the lamp till the balsam, on cooling, becomes hard and firm. A small drop of soft balsam is then let fall on the diatoms and a covering-glass applied, the diatoms not being disturbed, owing to their being firmly imbedded in the solidified balsam. The security from disarrangement afforded by this method is often highly advantageous; for example, we may have only two or three valves of a particular species, and each valve may differ from the others in outline or markings, as in the number of rays in a *Heliopelta* or *Aulacodiscus*, or in the shape of different specimens of *Navicula Smithii* from the West Melbourne deposit, and many other variable species. Or again, they may present the extremes of size found in the species, or various stages of self-division, and in any of these cases it is very desirable that they should be mounted side by side for comparison; but if mounted in the manner first described there is always more or less liability of their being scattered, and the process just mentioned is, I think, the simplest way of avoiding this result. Again, it will sometimes be found difficult to make the diatoms adhere to the needle by simply moistening it, the flat ones especially being often crushed in the attempt; and when they do adhere they are liable to fall off the needle while the slides are being changed, which latter accident is peculiarly annoying, as the largest and finest diatoms are, from their weight, the most likely to be lost. By using a needle dipped in thin balsam they are far more easily taken up, and the danger of dropping them is quite removed. Moreover, by observing the valves in balsam before finally mounting them, it is easier to judge as to whether they are sufficiently clean to be preserved. I have re-mounted old slides which were not satisfactory by lifting the cover and thinning the balsam on both slide and cover with carbolic acid, and then re-arranging the diatoms and proceeding as before described. I have also obtained half-a-dozen slides of distinct species, besides duplicates, from a single purchased slide of mixed material, in a similar manner. The same process is of course equally applicable to any small hard objects, such as *Radiolaria*, plates of the *Holothuridæ*, &c., when different species are so mixed with each other or with sand as to make it undesirable to mount them without selection. I have mounted diatoms in symmetrical groups in this manner, but the valves cannot be relied upon to maintain their exact relative position when the hard balsam in which they are imbedded has become softened by the contact of the soft balsam afterwards added to it. Slides mounted after either of the methods described should always be kept in a horizontal position, otherwise any of the objects that may be free will probably sink by their own weight towards the lowest part of the slide before the balsam has had time to harden.

If a finder is required, the simplest plan is to place a hair or a fibre of coloured silk in the balsam before hardening, in such a way as to extend from near the objects to the edge of the cover. his is easily found under any power, and can be followed along till the end of the thread and the objects come into the field of view.

Notes on Insect Eggs. By W. M. Bale.

[Read 27th November, 1879.]

I have examined the organisms on a piece of bluestone forwarded by Mr. Dawson from Camperdown, and find them to be the eggs of a mite of the family *Trombidina*. The following remarks from Dr. Duncan's "Transformations of Insects" so evidently apply to them, or a closely allied species, that there is little room for further remarks :—

"M. Dugés has given some most interesting details concerning the structures and metamorphoses of the *Tracheary Arachnida* in the *Annales des Sciences Naturelles*, 1834. He found many small eggs sprinkled over stones in shady places, like so many tiny white points, and on examining them with a magnifying glass, he discovered that each resembled a round cupola of a chalky consistence, and that they were shut by a coverlid which was conical in shape, and ornamented with radiating grooves, like the marks on a parasol. When the egg was broken, a red pulp came forth, but when it was allowed to hatch, a small spider partly lifted off the lid with its back, and entered the world. The newly-born creature was red, and was a larva; it had six legs only, and crawled slowly, and did not increase in size. Dugés noticed that, after a while, the larva seeks some crack in the ground near by, and becomes motionless. Then its skin comes off and forms a transparent shelter for the nymph or pupa, just as is the case in many insects. During the nymph condition, the second metamorphosis takes place, and after the lapse of a few days, an eight-legged spider bursts forth. The little *Raphignathus* is not much larger in the adult than in the larval condition, but its long legs enable it to move rapidly. It has an oval-shaped body, with a projecting head, or rather mouth, which looks like the head. There is a small eye of a dark-red colour on either side of the front of the body. The spider lives upon the elder trees, and sucks their sap."

The species before us is probably a *Raphignathus*, judging from the close similarity of the eggs to those described above, but I have not been able to make out the generic characters, and the young mites, when hatched, all congregated on the topmost part of the stone, and died without undergoing further development. The eggs have not a chalky consistence, as may be ascertained by pressing one with a needle, when it will be found that the shell is flexible. When the mite has been hatched, the interior of the shell appears precisely like a smooth basin, with a porcelain-like gloss. The eggs adhere so firmly to the stone, that it is difficult to remove them without breakage.

Atractobolus, described by Tode as a genus of *Nidulariacei* (*Gasteromycetous Fungi*), is said to be the egg of one of these mites. Respecting it, Berkeley has the following:—"*Atractobolus* (Tode) is nothing more than the eggs of a species of *Raphignathus*, unless Fries has something answering to Tode's artificial character.

Some wonderful tales respecting these eggs were told by Dr. Mantell. The inner membrane has precisely the same chemical reaction under iodine and sulphuric acid as cellulose, a circumstance which might in some measure excuse the assignation of such bodies to the vegetable kingdom, though the whole appearance is entirely that of minute eggs."

PROCEEDINGS.

31*st July*, 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed, and Mr. E. L. Chase was elected a member.

Mr. Barnard read extracts from an article in *Science Gossip*, No. 162, *On preparing and mounting leaves and other parts of plants, to show the Crystals in situ*, by W. H. Hammond; and exhibited a series of leaves prepared in accordance therewith. These were beautiful objects.

The President, commenting on the paper, mentioned an old plan of producing artificial crystals of oxalate of lime in plant leaves; and suggested that the members should try experiments by supplying plants with different materials, and note what effects might follow either in the shape or chemical nature of the crystals.

Mr. Goldstein mentioned the variegation in plant leaves as a problem the solving of which would be a most profitable discovery, and instanced how ordinary variegation might be obliterated by feeding the plant on sulphate of iron, which had the effect of making the leaves of a uniform deep green. Variegation might therefore be supposed to be caused by a want of iron in the soil.

28th August, 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed.

The Secretary acknowledged receipt of the last two parts of the *Proceedings of the Linnean Society of New South Wales*, and the last *Decades of Palæontology* and *Natural History of Victoria*.

Mr. H. J. Miller was elected a member.

Mr. Goldstein read a paper, *On the use of Carbolic Acid in preparing and mounting Objects*, to be called *Ralph's Carbolic Acid Process;* Dr. Ralph being the inventor.

Dr. Ralph read a *resumé* of some of the *Proceedings of the Belgian Microscopical Society during* 1878, and promised to continue the same.

25th September, 1879

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed. Rev. Thos. Porter and Mr. J. Bracebridge Wilson, M.A., were elected members.

Mr. Barnard read his paper *On Making Wax Cells*, and exhibited a series of cells of great variety, and practically demonstrated how easily such cells were made.

Mr. J. Bracebridge Wilson then announced that he had lately discovered fossil Polyzoa in great abundance in miocene rocks, near Geelong. Among the forms recognised as new to science he mentioned *Catenicellæ* and *Dimetopia*. Several quotations from competent authorities were given to show the value of the discovery. Mr. Wilson then exhibited a fine series of slides of these fossils, which were much admired, and promised a full paper on the subject, with descriptions and drawings. In the meantime, at the request of the President, he would write out in the form of a paper the notes given this evening.

The Secretary read a paper contributed by Mr. Wm. M. Bale, *On a method of covering and cementing Cells*, wherein the writer maintained that greater security and prevention of "running in" would result from using covers larger than the cells, and then filling up the space thus formed with any cement, thus forming in reality a double cell.

30th October 1879.

ANNUAL GENERAL MEETING.

The President, Dr. Ralph, in the chair.

The minutes of previous meeting were read and confirmed.

Messrs. W. H. Watkeys, Chas. Jenkin, and W. H. Gregson were elected members.

The Treasurer, Dr. Robertson, then read his annual report, showing a balance in hand of £16 11s. 6d.

There being no other nominations for officer-bearers, Dr Ralph was declared duly elected as President, Mr. Haig as Treasurer, and Mr. Goldstein as Secretary, for the ensuing year.

The ballot was then taken to elect two members of Committee, when Dr. Robertson and Mr. Wm. M. Bale were elected.

The President, Dr. Ralph, then read his Annual Address, which was ordered to be printed.

A pleasant *conversazione* terminated the proceedings, during which Dr. Ralph laid upon the table a leaf of the common cauliflower beautifully variegated with white, that had originated in his garden; and Mr. Barnard exhibited slides of Diatoms found at Dight's Falls on the Yarra. These were principally *Synedra.*

27th November, 1879.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The Secretary acknowledged receipt of the following donations: From the Linnean Society of N.S.W., part 4, vol. iii. and parts 1 and 2, vol. iv. of their Proceedings. From Mr. Petterd, his monograph of the Land Shells of Tasmania.

Dr. Bone, Messrs. W. Granger, John Veevers, and T. Warneicke were duly elected members.

Mr. Wm. M. Bale read his paper *On Mounting Diatoms;* also his notes on some insect eggs sent by Mr. Dawson.

Mr. Barnard exhibited a *Science Gossip Section Cutter*, and showed a fine series of wood sections cut by it.

Messrs. Goldstein and Maplestone gave descriptions and figures of two new species of *Catenicella.*

Mr. J. Bracebridge Wilson described a new genus of Polyzoa called *Catenicellopsis*, and furnished descriptions and figures of two species.

29th January, 1880.

Ordinary Meeting.

Rev. J. J. Halley in the chair.

The Secretary acknowledged receipt of the August number of the *Journal of the Royal Microscopical Society of London*, from the Secretary, Mr. Frank Crisp.

The following gentlemen were duly elected members: Dr. P. H. MacGillivray, Dr. John Day, Rev. J. C. Love, Messrs. F. R. Pincott, G. F. Link, W. J. Thomas, Dr. Burke, Dr. Lucas, and Mr. W. Rae.

The Secretary, Mr. Goldstein, read the introduction to a paper, a joint production by himself and Mr. Maplestone, *On the genus Catenicella*, and put in the paper, which was taken as read, it being of too technical a character to be read fully.

28th February, 1880.

Ordinary Meeting.

Rev J. J. Halley in the chair.

Mr. Barnard read some notes on contents of stomach of *Holothuria*, supplied by Mr. J. Bracebridge Wilson, and exhibited slides of Diatoms found therein, two especially being apparently new and very beautiful.

The Secretary reported the result of competition for the prizes given by this Society to the Intercolonial Juvenile Exhibition of Melbourne, and exhibited the slides, upwards of 250, shown by six competitors. The majority of these were astonishingly good, and were much admired.

25th March, 1880.

The President, Dr. Ralph, in the chair.

Mr. C. P. Ogilvie, F.L.S., was present as a visitor.

The Secretary acknowledged receipt, per favour of Dr. Ralph, of a parcel of pamphlets, being Proceedings of the New Zealand Institute, as a donation from that Society. Also from Mr. Petterd, of Tasmania, a parcel of valuable materials for slides, consisting of Diatoms, Foraminifera, &c., &c.

As there were only a few members present, owing to its being Easter week, the meeting was adjourned early.

29th April, 1880.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

Mr. E. Bage was nominated as a new member.

Dr. Ralph continued his *resumé* of the *Proceedings of the Belgian Microscopical Society*, detailing particulars of three interesting papers therein, namely:—*Staining with Picric Acid*, *Preserving Infusoria by means of Osmic Acid*, and *On the Thallus of Diatoms.*

Mr. Goldstein described and figured three new species of Polyzoa, *Serialaria immensa*, *S. intermedia*, and a new *Bicellariad*, for the reception of which he erected a new genus, named *Stirparia*, to include also the *Bicellaria annulata* of Mr. Maplestone, both species having a peculiar stem which separated them from other genera in the same family.

Dr. Ralph read an article from *Nature*, of 11th March, 1880, on the destruction of insect pests, by means of *Isaria* *destructor*, or green muscurdine, a minute fungus, whose action is very injurious to insect life.

A donation of Diatomaceous Earths, from Dr. Hector of New Zealand, were then distributed amongst the members present, and the Secretary acknowledged donations for the Society's cabinet—from the President, Dr. Ralph, five slides of Diatoms from New Zealand gatherings, and from Mr. Bale eight slides of Diatoms, from Tasmanian deposits, lately received through the kindness of Mr. Petterd of Launceston.

Microscopical Society of Victoria.

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Hon. Treasurer:
R. G. HAIG.

Hon. Secretary:
J. R. Y. GOLDSTEIN.

Committee:
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R. ROBERTSON, M.R.C.S. Eng.
W. ALLEN.
F. BARNARD.
WM. M. BALE.

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WOOSTER, W. H.
WOODS, Rev. J. E. T., F.G.S. &c.
WILSON, J. BRACEBRIDGE, M.A.

OFFICE: 117 COLLINS STREET EAST, MELBOURNE.

EXPLANATION OF PLATES.

PLATE IIII.

Fig. 1. Catenicellopsis pusilia. Front view.
,, 2. Catenicellopsis delicatula. Front view.

PLATE V.

Fig. 1.	Catenicella ponderosa.	Front view.
,, 2.	,, ,,	Back of cell.
,, 3.	,,	Back of geminate cells.
,, 4.	Catenicella pulchella.	Front view.

Plate IIII.

Fig. 1 × 22.

Catenicellopsis pusilla

Fig. 2 × 22.

Catenicellopsis delicatula

J. R. Y. Goldstein, Del. Hamel & Ferguson, Litho.

Plate V.

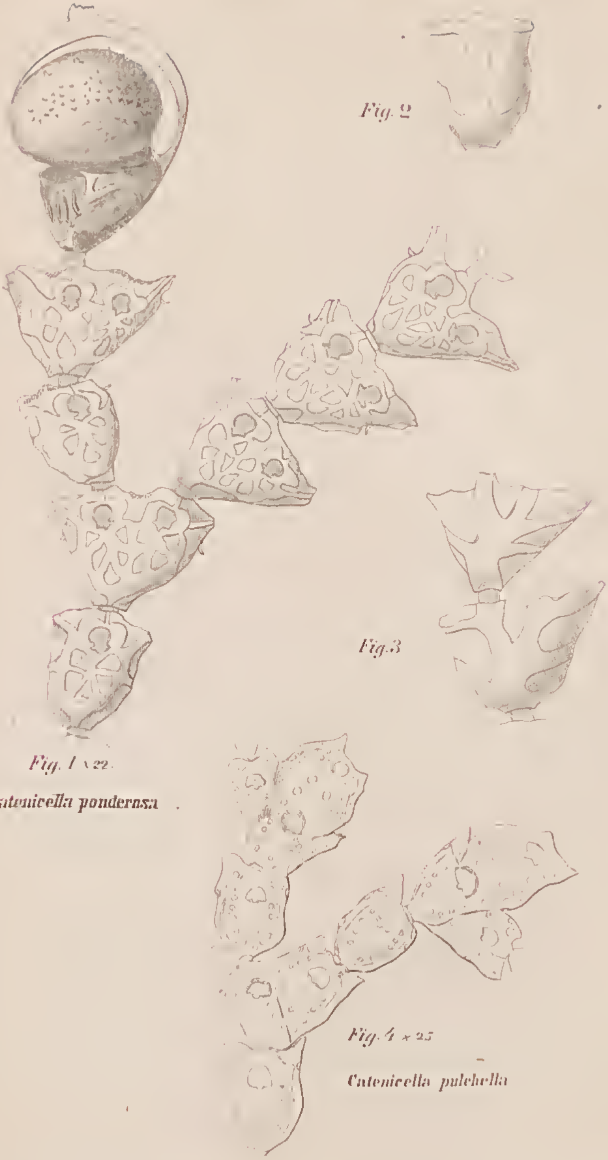


Fig. 1 × 22.

Catenicella ponderosa.

Fig. 2

Fig. 3

Fig. 4 × 25

Catenicella pulchella

J.R.Y. Goldstein, Del.

Hamel & Ferguson, Litho.

JOURNAL

OF THE

Microscopical Society of Victoria.

Notes on the Microscopic Structure of some Igneous Dykes of North Gippsland. By A. W. Howitt, F.G.S.

[*With Plate.*]

[Read 25th Nov. 1875.]

In studying the petrology of North Gippsland many interesting lines of inquiry present themselves, as to the three great classes of rock formations, the sedimentary, the igneous, and the metamorphic. The questions to be asked arrange themselves under various heads, and of these, one includes those which relate to the mineral constitution, the genetic relations and the classificatory position of the intrusive dykes.

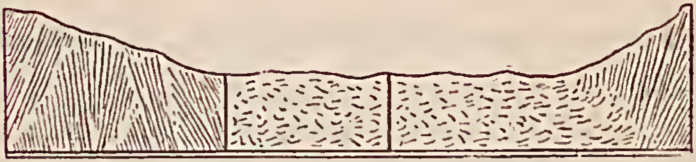
In petrology, as in many other branches of science, the microscope has become a powerful instrument of research. The methods of inquiry have been most admirably worked out, both in England and on tho continent of Europe. It is owing to the labours of Rosenbusch, Sorby, Allport, Zirkel, Streng, and others that micropetrography has almost assumed the dimensions of a separate branch of science.*

The notes which I propose to lay before this Society are the result of my investigations as to one group of igneous dykes in North Gippsland, and will, I hope, prove to be of interest to microscopists as well as to geologists.

Geology of the Locality.—The locality in which these dykes are found is situated on the road from Sale and Bairnsdale to Dargo. It commences at Cobbannah Creek and continues along the road nearly to Squirrel Forest.

* The works of Professor Rosenbusch on the Microscopic "Physiography" of Minerals and of Rocks, are pre-eminent by their thorough mastery of the subject, and tho wide field they cover.

The general geological features of the neighbourhood may be briefly stated, and are illustrated by the subjoined diagram section.



a *c* *b* *c* *b* *a*

DIAGRAM SECTION NEAR BULGOBACK AND GRANITE CREEKS.

(*a*). Lower palæozoic (silurian.)
(*b*). Granites and quartz diorites.
(*c*). Intrusive dykes.

The oldest rocks of the district are the auriferous quartz-bearing slates, and sand-stones of the North Gippsland goldfields. No fossiliferous beds have been met with in this locality, but judging of these rocks by their resemblance to other similar formations in the district of known geological age, by their relations to younger formations in the neighbourhood, whose age is fixed by palæontological evidence, and by the general geological structure of North Gippsland, they may be referred with some confidence to the Silurian age. At any rate, so far as the present evidence goes, they are certainly older than the Middle Devonian formations of Tabberabbera, and I suspect that the latter group may be found to extend to one of the lateral valleys in the west side of Cobbannah Creek.

It is clearly to be seen, in all parts of North Gippsland, that the Silurian formations have either been regionally metamorphosed *in situ*, or that their highly tilted strata have been cut off by intrusive granitoid rocks, most irregularly both in their dip and strike. Where the strata are found to end against these igneous rocks, they not only dip from them, but also end abruptly against them. In examining the planes of contact, evidences of force are to be observed along them in the broken and disjointed or crumpled condition of the sediments. A metamorphosed zone surrounds the surface contacts of these granitic masses. This surface zone is evidently a section of the mantle of metamorphosed rocks which enveloped the whole intrusive mass; a metamorphic envelope which followed the contact of the igneous mass, without regard to the angular position of the sedimentary beds it affected. I have invariably found these effects to lessen gradually in proceeding from any place of greatest metamorphic change, until the formations assume the characteristic appearance of our Silurian series. Finally, veins and dykes are found to pass from the intrusive masses into the broken contact edges of the sediments. It is therefore evident, that the great masses of granites and diorites are younger than and apparently intrusive into the Silurian formations.

The granitic rocks of the locality I am describing form one of those intrusive masses of which I have spoken, and the dykes, which are the subject of these notes, pass through the granite, but not so far as I have observed through the surrounding sediments. The suspicion arises, therefore, that they may be of the same formation and age as the *containing* granitic rocks which contain them.

These dykes are all in the neighbourhood of Mount Budgee Budgee. I have observed that they are usually double, that is, there are generally two dykes running parallel and at but little distance apart. They principally occur near Granite and Bulgoback Creeks, and it is in this order that I shall take them.

Granite Creek Dyke.—The dyke at this place is single, and first shows on the summit of Pretty Boy's Pinch in proceeding northward along the track near the contact of the granite and the sediments. Where it first shows, it is probably not more than twenty-four inches in width, running on a strike of N. 10° W. It continues to show itself in places along the track for about ten chains as subangular grey masses. On examining a fresh fracture, the dyke stone is found to have a dark grey or bluish compact ground mass, showing porphyritic crystals of greyish white translucent felspar, and some plates of shining black mica. The mica can be distinguished as forming rhombic crystals.

A very short distance further on, at the crossing of Granite Creek, the dyke turns to N. 75° W., and crosses the course of the stream. It is here about fifteen feet in width. It weathers in rough angular masses of a grey colour. In the weathered surfaces I have distinguished two felspars. The most frequent are in long, rather translucent, bluish grey prisms, the other in dull white patches. On the fresh surfaces of fracture there may also be distinguished small scattered irregular plates of black mica. The dyke is jointed in the direction of strike.

Microscopic Examination.—I prepared twelve thin slices from samples collected at various places along the course of this dyke. The ground mass is microcrystalline, and its composition is as follows :—

(*a*). A small amount of yellowish glassy basis which is, of course, isotropic.

(*b*). Very numerous minute prisms of colourless felspar, some of which are twinned.

The angle formed in these prisms by the plane of vibration, as against the composition face, I found to be small, but I was not able, owing to the minute size of the crystals, to obtain any reliable measurements. I regard these felspars as triclinic, and the small angles point to one of the soda-lime varieties. Very frequently these felspars form radiating groups.

(*c*). Very numerous minute prismatic crystals having inclined terminations, they vary individually from mere fibres up to dimensions of ·005 by ·0005 inch. They are green in colour, and are dichroic. I have observed cross sections of the larger individuals which showed me the angle of hornblende. Such an instance I give in Fig. 1. I could not observe the characteristic prismatic cleavage in these microliths. Some of the longitudinal sections show divisions at a somewhat acute angle to the axis *c*, similar to such divisions as seen in actinolite. These microliths are, I doubt not, some form of amphibole.

They lie in the ground mass at all angles to each other, and often form a perfect network. In slices taken from the northern end of the dyke, these microliths have a somewhat different appearance. Besides the long prismatic forms having inclined terminal planes, there are also groups of irregular plates; both of these forms are brownish in colour and dichroic. The plates somewhat resemble mica, but there are no cross sections which support such a view, and the dichroism of the plates is incompatible with their being mica, as they would then be seen in the direction of the axis *c*.

These microliths clearly show the flow structure of the groundmass, as they are in places arranged in streams having their longer diameters parallel. These streams divide at some of the larger minerals, and again reunite beyond them.

(*a*). Small rhombic plates of brown magnesia mica, which is strongly dichroic.

There are traces of alteration and decomposition in some parts of the ground-mass. It becomes dim and turbid, owing to the presence of a grey, cloudy substance, which is also specially seen in the felspars. This is probably kaolin. In other places, the base is made cloudy by a light brown pigment, which follows the minute cracks in the contacts of the felspar crystals with the ground-mass, and is also connected with groups of the amphibole microliths. This is, no doubt, ferric hydrate.

In this ground-mass are porphyritic crystals of:

(*a*). *Felspar.*—Porphyritic crystals of felspar are predominant in most parts of the dyke. Their sections, seen in the thin slices which I have prepared, differ in character. In one kind, the outlines indicative of the crystalline form are sharply defined against the ground-mass, as is shown in Fig. 3, and some of these sections have cleavage planes perpendicular to each other. Occasionally, there are irregular groups of simple crystals. Whenever sections occur which can be referred to the zone *o*—*ii*, the plane of vibration is found to be parallel to the edge *o*—*i*. It is of the utmost rarity that any intergrowth with albite can be suspected from the occurrence of minute lamillæ, interpolated parallel to the place *ii*.

The felspar substance is clear, translucent, and colourless, and much resembles in its translucency, its homogeneous character and its mode of twinning the potass felspar adularia. A qualitative examination of one of these porphyritic crystals confirmed the belief that it is a potass felspar.

It is not unfrequently the case that these orthoclase crystals are twinned, according to the Carlsbad law, and I have observed one instance of a Baveno twin.

Besides these larger orthoclase felspars, there are more rarely other smaller crystals, which aro certainly triclinic. They are usually of less well-defined outlines, and are more affected by alteration than the former. They are frequently bordered by a dark-coloured (blackish-green) choritic substance, which also extends into the cleavage planes and fissures traversing the crystal. Portions of the ground-mass, together with amphibole microliths found in it, are included in the triclinic felspars. I observed also, as rare inclusions, more or less regularly formed, minute plates of yellowish-brown mica. Magnetite and a few exceedingly minute acicular colourless microliths complete the list of inclusions.

(*b*). *Mica.*—Mica is frequent in occurrence, both as completely-formed crystals or as irregular flakes. Its size varies down from porphyritic crystals to the minutest flakes visible with a power of 600 linear. These microliths are in the ground-mass.

Its colour is light brown, and it is strongly dichroic, in shades of light yellow to nearly black. Substances included in the mica are of great rarity. The only instance I met with was a small portion of the ground-mass, and a few minute apatite needles.

(*c*). *Magnetite.*—Magnetite is rare, unless the minute black specks and opaque black dust-like particles in the ground-mass may be referred to this species.

The Bulgoback Dykes.—All the dykes in this neighbourhood have a strong resemblance to each other, and, so far as their microscopic features are concerned, may be described as a whole. Before doing so, I must, however, give a few particulars as to the physical features of these dykes, which I extract from notes I made at Bulgoback.

In crossing the low watershed at the source of Granite Creek, dykes are to be seen in different places traversing the granite. The strike of these dykes varies from N. 25° W. to N. 35° E. From the appearances I observed, where one of them crosses a gully, its dip is probably to N. 60° W. at about 70°, and its width, so far as can be estimated from surface indications, 10 to 15 feet. On the weathered surfaces are irregular patches of whitish felspar, and more or less irregularly formed crystals of black hornblende. The dyke stone is somewhat tougher than that at Granite Creek.

Other similar dykes occur in the hills along which the road ascends, and again descends, after crossing Bulgoback Creek. One of these stands out of the ground for some chains, in a strike of N. 30° E., and may be, perhaps, 10 to 15 feet in width. It weathers into rounded blocks of a grey colour. When freshly broken, the surfaces show a compact dark grey ground-mass, with irregular crystals of translucent colourless to opaque white felspars. I also observed small masses of ordinary pyrites; some of these were surrounded by a "halo" of oxidation. A variation of texture occurs in some parts of the dyke, as patches of fine grained rock, which, under the lens, is a network of white felspar and greenish hornblende crystals. It then resembles some of the diorites.

Microscopic Examination.—The ground-mass of twenty slices which were prepared from these dykes is usually microcrystalline, and more rarely cryptocrystalline. It is composed of—

(*a*). Granules or minute prisms of felspar, which seem to be all triclinic.

(*b*). Small flakes and prisms of amphibole, which are placed without order, and lie, as a rule, without any common direction. Their appearance is peculiar. The colour is dull yellowish green. In carefully passing under review the whole of the slices prepared from these dykes, the following points become worthy of notice: The flakes are in places of exceedingly minute size, and have a rounded outline. In other places, where they are less numerous, they occur as isolated irregular lamellæ, or as groups of lamellæ superposed on each other, or as minute prisms, having a tendency to arrange themselves in radiating groups. I have observed the minute prismatic forms to be bifurcated, or in groups of three, in which the length of the middle one is less than that of the two others.

(*c*). Grains or imperfect crystals of magnetite or titanic iron.

(*d*). Prisms and needles of apatite, which lie in all directions in the ground-mass.

(*e*). Chlorite (viridite.)

In rare instances this ground-mass becomes microporphyritic by some one constituent preponderating in dimension, and this is usually felspar. In the ground-mass are porphyritically situated—

(*a*). *Felspars.*—These are, without exception, triclinic. They are highly compound in structure, and also frequently show zonal growth in a beautiful manner. In an example taken from a large dyke in the hill above the Bulgoback Post Office, I found the angles formed by the plane of vibration in sections in the zone *o*—*ũ* to be 18°, 21°, 25°, 34°, 30′. The angles, I think, point to a felspar of the labradorite class. In addition to these, I observed also, in the same example, numerous simple crystals, in none of which the plane of vibration was in accord with the edge, $o-\ddot{\imath}$, but formed low angles up to 11°; nor were any of these crystals rectangular in outline. Some showed zonal growth, in which the zones were marked by minute inclusions of ground-mass, or of devitrified basis. Inclusions in theso felspars are rare, and are principally confined to apatite. Flakes of greenish chlorite are numerous, but these are rather alteration products than inclusions.

In slices from another dyke I observed sections of felspars in which the angle formed by the plane of vibration with the composition face in the zone, $o-\ddot{\imath}$ were 11°, 14°, 17°, 27°. The crystals in this case were compounded according to the Albite and Carlsbad law, and also grouped irregularly together. Almost the only inclusions in these felspars are very small, long and colourless prisms, probably apatite. They aro, in some cases, arranged according to the planes of growth in the crystal—(Fig. 5.) I have also observed a fow instances of minute colourless microliths in the felspars, having an apparently monoclinic habit, and finally also a few rare cases of inclusions of magnetite.

Many of tho triclinic felspars have undergone alteration. This, it seems, commences by the production of a groy cloudy substance, either in the centre of the crystal, or extending into it from without, and connected with similar grey cloudy patches in the ground-mass. The ultimate result of this process is that the felspar, although still polarising as a doubly refracting substanco, quite loses the bright chromatic effects which characterise its fresh state; this I believo to be kaolinization. In almost in all cases, however, I have observed some few shreds of the original felspar substance remaining, in which the banded structure is still perfect; these portions are frequently round the exterior of the crystal.

Another frequent chango is caused by the presence of a dark, blackish green granular or flaky substance, which is, I do not doubt, a chlorite, and which, in some cases, surrounds the margin while in other cases, it follows the line of cleavage and fissures. (Figs. 5 and 6.)

Another process of alteration consists in tho production of minute scales of some mica which, in many cases, almost replaceo the whole of the original crystal. This alteration of felspar into mica is well known, and as the felspars in this case are of the soda-lime varieties, the mica would, in all probability, were it possible to examine it chemically, prove to have soda or lime as its mineral base.

(*b*). *Hornblende.*—The hornblende seen in the thin slices bears out the inference to be drawn from the fragments standing out in relief on the weathered rock surfaces. It usually occurs in ill-defined prisms or lamellæ, but in some few cases perfectly formed in crystalline outline. Its colour in the slice varies from dark blackish green to greenish yellow. The section is generally strongly dichroic. The crystals are frequently twinned according to the usual hornblende law. (Fig. 7.)

In samples taken from a large dyke near the Bulgoback Post Office I found the hornblende in more or less well-formed crystals of the ordinary form ; the sections became translucent in shades of yellowish brown, and the crystals had a somewhat glassy appearance. In other slices from this dyke I found the hornblende in long and rather bladed crystals of a greenish or yellowish colour. All this hornblende is strongly polychroic, the angles formed by the plane of vibration, with the prismatic cleavage in sections, approximately parallel to the axis *c*, I found to be 12° 30′ in two of the most satisfactory measurements, and 14° 30′ in a third. In some instances, when the hornblende occurred as greenish rather fibrous lamellæ the angle was unusually high, two instances giving 28° 30′ and 32° 30′ respectively. Such angles are suggestive of pyroxene, were it not that the slices of this mineral are strongly dichroic. The many observations which I have now made as to the analogous groups, pyroxene and amphibole, lead me to see that there are apparently varieties in the latter, which represent diallage in the former, and that their occurrence, together with triclinic felspar (anorthite or labradorite), produces a rock which may be well termed amphibole gabbro.

Where the hornblende has a crystalline form the characteristic prismatic cleavage is well-marked in sections perpendicular to the prism.

The amount of included substance (ground-mass), is large. It is either in rounded grains, or where central, often has the form of the hornblende crystal. It would seem that the central neucleus of the hornblende crystal has been a portion of the ground-mass round which the crystal has formed, and it must have been plastic for the crystallisation of the hornblendo to have impressed its own form upon it. (Fig. No. 9.)

The hornblende includes, or is accompanied by grains or masses of magnetite, which constantly show rectangular sections or forms compounded of rectangular outlines. With the exception of the granules of ground-mass which I have mentioned, there are no inclusions which I have observed in the hornblende.

The alteration to which the hornblende is liable is the production of chlorite. What this form of chlorite is I am unable to say. Its character is more that of flakes than of fibres. It is slightly dichroic, and so far as I could observe, identical with the minute flakes of chlorite, which are of very frequent occurrence in the mass of dykestone.

As I have before stated, a gradation of forms may be observed from the unmistakable hornblende down to microliths in the ground-mass. But the two extremes are distinguished by the generally fibrous aspect and polychroic properties of the former being doubtful, if not absent, in the latter.

The finely crystalline portion of dyke in the hill north of Bulgoback Creek I found to consist of crystals of triclinic felspar and hornblende, with a little magnetite. As might be expected from the crystalline texture of the stone the hornblende is here much more perfectly crystallized than is usually the case. It occurs in long thin prisms, cross sections of which show the characteristic prismatic cleavage of hornblende.

The constant occurrence of magnetite with and in the hornblende suggests that it may represent the excess of iron beyond the amount required in the composition of that silicate.

(*c*). *Magnetite.*—From previous statements it will be seen that magnetite is of frequent occurrence. It is found not only closely connected with the hornblende but also plentifully scattered through the ground-mass, and more rarely it occurs in the felspars. It is of least frequent occurrence in the minute flakes of brown mica. Some of the black opaque rectangular substances may, however, belong to titanic iron, or to pyrite.

(*d*). *Mica.*—Mica is raro as minute brown flakes, and is quite subordinate to the other constituents. Its form, colour, and optical properties indicate it as being a magnesia mica.

(*e*). *Apatite.*—The colourless prisms, withplain terminations, as well as the colourless acicular crystals, which are plentiful in the ground-mass, and also occur in all the porphyritic crystals are probably all apatite.

(*f*). *Pyrite.*—Ordinary iron pyrites occurs in grains and masses of grains throughout the dykes, but is nowhere plentiful.

(*g*). *Chlorite.*—I have mentioned a variety of chlorite as occurring constantly, associated with the triclinic felspars. Some variety of this group also occurs throughout the samples, often as no more than a green pigment, and is an alterative product of the hornblende.

I may, in conclusion, say a few words on the granitic rocks in which these dykes occur. I prepared slices from samples collected near where the large dyke crosses Granite Creek, and others from the adit of the Mt. Budgee Gold Mining Co. The rock is a crystalline granular compound of :—

(*a*). *Felspar.*—Of this mineral there are two varieties; one monoclinic, and the other triclinic. Usually the former is larger in dimensions than the latter. It in fact fills in large spaces, and thus conforms to the outlines of other minerals. These felspars are not twinned, and intergrowth with other felspar is rare, and confined to isolated lamellæ. I have observed, however, that where the crystals had suffered from alteration there often remained margins of perfectly clear and perfect substance, while the interior was extensively kaolinised. The margin, in one instance, was partially banded, and I regard this as a case of envelopment of orthoclase, by some triclinic form. In addition, there are always more or less of smaller and well-crystallised triclinic felspars, which from the angles formed in them by the planes of vibration, I judge to be probably of the group albite and oligoclase. I observed in a slice from a sample from the Mt. Budgee adit that the felspar was entirely triclinic, and of the above character.

The alterations of these felspars are all more micaceous than kaolinic. Many of the crystals and crystalline masses are almost wholly converted into micaceous substances, composed of very minute flakes; in fact, mere scales, but locally larger, and these are either arranged side by side or divergently. Their clear and colourless condition, and their bright chromatic polarization and optical characters, are those of muscovite. As, however, they arise from the alteration of triclinic felspar, they should be micas analagous to the potass felspar, but containing, instead of that alkali, soda or lime.

(*b*). Hornblende in irregular crystalline masses, showing the usual prismatic cleavage and polychroism.

(*c*). Brown, highly-dichroic magnesia-iron mica.

(*d*). Quartz filling in interspaces.

(*e*). One of the most interesting constituents is, however, chlorite, which I observed especially in a slice taken from a sample from the Mt. Budgee mine. In this slice, while the general structure and composition were such as I have described, there was no hornblende, this constituent being represented by chlorite.

It occupies just those situations which are in other samples filled by hornblende. It is in masses of fibrous plates, having ragged edges. When seen perpendicularly to the cleavage, it is almost colourless; seen in the direction of the cleavage, it is slightly dichroic. With polarised light and crossed nicols, it behaves precisely as does the chlorite of the diorites of Swift's Creek. There are here, however, no cases where any passage through alteration can be observed from hornblende to chlorite; the alteration must be held to have been here completed, unless we conclude that the chlorite is an origiual constituent. I doubt this, more especially as this sample formed part of the "footwall" of the quartz lode.

(*f*). In addition to the above, I note in these samples the occurrence of magnetite and pyrite, and, less frequently, of apatite.

Conclusion.—The inferences to be drawn from the preceding statements are, I think, the following:—The dyke at Pretty Boy's Pinch and Granite Creek consists of orthoclase and magnesia mica, and with amphibole and very subordinate triclinic felspars in the ground-mass. Its main feature is potass felspar in its monoclinic form, amphibole and magnesia mica, and its structure is strongly porphyritic. It is therefore, according to the present classification, a porphyritic syenite, having affinities with a mica syenite (minette).

The other dykes in the neighbourhood of Bulgoback are similar to each other; they consist of triclinic felspars, hornblende, and a little magnesia mica, porphyritically dispersed in a microcrystalline ground-mass. Their mineral composition is that of the diorites; their structure, however, being markedly porphyritic, places them among the hornblende porphyrites.

As these dykes do not, so far as I can ascertain, occur out of the granite area, it is, I think, most probable that they are, in fact, adherents to the granitic rocks. These latter have locally either the character of an orthoclase and hornblende, or of a plagioclase and hornblende, rock, and it is these two classes of rocks which the dykes at Granite Creek and Bulgoback Creek respectively represent. The granitic rocks in these two varieties belong to the amphibole granites and the quartz diorites.*

According to these views, the dykes would belong to the same great age as the granites, but at its later period. This age is not, I think, older than Upper Silurian, and not younger than Upper Devonian.

How the Lerp Crystal Palace is Built.

By W. H. Wooster.

[*With Plate.*]

[Read 29th July, 1880.]

Many of our Eucalypts are infested with scale insects, commonly called Lerp, but which belong to the family *Psyllidæ*, of the order *Homoptera*. These insects in the larval state protect themselves from the sun and their enemies by building over themselves little tents, or rather crystal palaces, composed of a gummy and sugary secretion, which is exuded in a semi-liquid state from a tube at the hinder end of the body. I have taken at least three species, one of which makes its scale almost exactly like a minute oyster shell, slightly convex, the rings of enlargement being added to the edge in such a way as to leave the starting point of the scale still at one edge, as at the hinge of the oyster shell. This species leaves its scale plain; nothing is added on the outside for ornament or defence. A second species constructs its house like a basin, the increase being added round the edge equally, thus keeping the starting point in the centre. This kind of scale is covered all over with curved silky hairs or loops, often longer than its diameter, which are so

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* The samples examined of the variety characterised by orthoclase felspar showed also strong affinities with the granitites, magnesia mica being present. This rock may, therefore, be even regarded as standing between amphibole granite and granitite.

numerous that they almost hide the dome. The third, and to me most interesting species, is found on one of the peppermints, which I take to be the *Eucalyptus meliodora*, and builds tents that are conical when full sized, and when twenty or forty are together on one leaf, they make it look like a veritable soldiers' camp in miniature. These tents have the starting point at the apex, the additions being made pretty evenly all round the edge. When full sized, they are rather plain, with the appearance of a series of flounces round the lower half; but when first formed, and very small, they have a few or many glassy loops or threads round the edge, often longer than the diameter of the tent. The scales of those first mentioned are from a quarter to half an inch wide; those of the last two seldom exceed an eighth of an inch in diameter.

During last February, I noticed several young broods of the last species appearing on the leaves above-named; and placing some under the binocular with the 1-inch objective, I found they presented a charming sight, much more beautiful and interesting than the old ones. Many of the tents were clear as crystal (the old ones being opaque white), generally with four to six strong ribs, and several of the before-mentioned loops; and where some were near each other, these long loops crossed and recrossed, and became soldered together in a fantastic style. Many were decidedly as beautiful as anything the Bohemian glass-blowers ever turned out of colourless glass, and often reminded me of their work.

But while passing from one to another, I had the good fortune to find one that had just begun to build, and was then hard at work. I watched him for hours, my wife and daughter also taking many a peep at the little architect; and as it gave to us intense pleasure to see "how the crystal palace was built," I thought an account of the same might be interesting to the Society.

Fig. 1, Plate VII., represents the larva when quite young. It is about one-fiftieth of an inch long, very flat, reddish yellow, with eyes redder still, and the spots and legs brown. Fig. 2 shows his house as seen from above, and Fig. 3 the same in section. He begins by sticking one drop of his crystal cement on the leaf, as the foundation-stone of one of the pillars or ribs, and then adds successive drops on it till high enough. Then he strengthens it by further deposits in the form of buttresses from the bottom upwards, and lengthens it, making it curve over as seen in Fig. 3, till long enough, and again he strengthens it. One rib or self-standing rafter being finished, he builds the others in like manner (marked *a* in the figures). These form the skeleton, and took about fifteen minutes each to build. He is so much master of his business that he makes his beginnings, additions, endings, and measurements, without ever *turning round* to look at his work, doing everything apparently by feel, with his back to it. Then follows the plastering or roofing, which is done inside, beginning at the top, beads of glass being stuck to the underside of the ribs, and other beads to them, edge to edge, till the whole top is covered in, leaving open spaces at the bottom. (This plastering is marked *b* in the figures.) The building thus far occupied about four hours, and then my builder rested, I presumed, from want of material. One could scarcely credit that the whole substance of the house was in his own body a few hours before, especially when told (stranger still) that the difference in his size before and after the operation was hardly noticeable; and yet the house was twice as wide as the owner was long, and as high as he could raise his tail to reach. That one built no more, I suppose because as the leaf was drying he could get no sap to make more of the secretion.

I was still in the dark as to how the loops (marked *c* in the figures) were made, as many of them were far higher than the makers could possibly reach, and I had never found one on the outside of his house as if making them. Further investigation settled this point, as I found another specimen in the act of spinning them. The plan was this: he stayed inside, head to centre, protruded his spinneret under the edge at an open place, stuck the beginning of a thread to the leaf or a rib, and then kept spinning and pushing backwards his thread which thus made a loop, the first half of which was very slender, the last much stouter. When long enough, the thick end was fastened to the house. These loops took from five to fifteen minutes each to spin, and now and then fell over, or met with others that altered their direction, for though the semi-fluid sets almost immediately enough to keep its shape, it is pliable and sticky for some time.

But I had not yet seen how the infant palace was enlarged; fortune, however, favours the persevering as well as the brave, and this point also was cleared up. I had concluded that the additions must be made at the lower edge, but how they got them there was the puzzle. It was like enlarging a circular house by putting fresh stones under the foundation, and thus forcing up the walls and roof; but this is what is actually done. A certain house that struck my attention by its beauty was repeatedly noticed as being in the usual horizontal position, and giving no sign of life or alteration. But an hour or two after it was found to be tilted up on one side, as in Fig. 4, and new struts (marked *d* in the figure) built under the edge to keep it up, one of which the occupant was then strengthening at the base. The leaf now began to dry up, and no further work was done on the building; but it is easy to see how the same process repeated on the other side (and the attachment to the leaf is but slight), and the plastering being continued down between the ribs, would be all that was required to preserve the symmetry, increase the size, and yet do it all from below.

Fig. 5 is a sectional view of a full-sized house, the line *a b* showing the part that is first built, and described above, and seen in Figs. 2, 3, and 4. The loops seem to be seldom made on the lower series of additions, and to be often worn, broken, or eaten off by flies, ants, &c., from above.

Line and Pattern Mounting.

By W. H. Wooster.

[Read 29th July, 1880.]

The directions for "Line and Pattern Mounting" contained in the following pages were given to me by Mr. Henry Sharp, of New South Wales, whose slides, thus prepared, are exquisite examples of manipulative skill, and it is with his sanction that I now lay them before the Society.

Requisites: (1) One or two cat's or mouse's whiskers fastened on match-like sticks or fine rushes, with shellac rather than gum, with about ¼ inch free. I prefer to have one with the natural point, and another with the point cut back to where it is somewhat stiffer. (2) A good simple microscope of some kind, either attached to a roomy stageplate, with a mirror below and revolving plate above, or detached on some stand, but capable of being brought over a mounting table with mirror and rotating plate as above. My own is home-made, extremely simple, costing nothing but the trouble, and such as any one with a little ingenuity could make for himself. It consists of a piece of pine 9 in. long, 5 in. wide, and 1 in. thick, on three legs, with a hole in the centre into which a wooden matchbox (with the bottom cut out) fits tightly, projecting a little above; over this fits a piece of slate just tight enough to rotate easily; beneath, a peg receives the mirror of the microscope. This forms the detached mounting table. For the simple microscope, I take the foot and tube pillar of the condenser, fit a piece of cane in this tube, drive a pickle-bottle cork stiffly on it, and fasten on this a horizontal wooden bar with a hole in the middle to fit on the cane, and another at each end in which to fit the lenses, which are just the 1½ in. and ½ in. objectives, which give far better definition than common pocket lenses. (3) A steady hand. (4) Patience and perseverance.

Dry Mounts.—All diatoms and scales should be mounted on the cover, not the slide. Lay a clean cover on a slide and keep it in place by a drop of water between. As scales are larger than diatoms, it is well to begin with them. Put several on a slide in the ordinary way, pick out the ones wanted with the bristle under the simple microscope, one at a time; keep the cover flooded with moisture from the breath, and deposit the scales picked up wherever wanted in lines or patterns. They will readily leave the bristle for the wet glass, and can be pushed about quite easily. When the moisture dries off no stain is left, and the objects will adhere with sufficient firmness to resist anything short of a sharp jar. When the line or pattern is finished, mount in a shallow cement cell.

Balsam Mounts.—The cover must have a film of a gelatinous nature which is insoluble in balsam and its solvents. A *thin* aqueous solution of isinglass carefully filtered serves well. A single drop is placed on a clean cover, and spread out as thin as possible with a clean needle. It dries almost instantly in warm weather, and in a few seconds in winter. A diatom placed on this film and *gently breathed on* is securely sealed, and cannot be dislodged without moisture. Care must be taken to place the diatom in position while the film is *quite dry*; then breathe on it; allow the film to dry again; then place another diatom, and so on till the line or pattern is finished. If any of the diatoms are thick or likely to be crushed, stick three bits of cover glass under the edge of the cover with gum, and place a dot of gum on each before placing the cover in position on the slide. This, when dry, will keep the cover in its place while introducing the balsam, before doing which allow a little benzine to run under by capillary attraction, which soon displaces the air from the diatoms. Then apply a little balsam to the edge of the cover and a bit of blotting paper to the opposite edge. This draws away the benzine, and the balsam follows and takes its place. Another plan is to gum a piece of good cream-laid paper on the slide, centre on the turn-table, and make two cuts through the paper, removing the middle and outer portions and leaving a ring of paper to form a cell as large as the cover; then cut two small openings in opposite sides of the ring, gum the top of the cell and insert the prepared cover on the gummed surface. When dry apply benzine to one of the small "sluice gates," and then balsam as before. Put the slide in a warm place for several days, and finish off with white, black or coloured varnish to fancy.

Winter is the best time for the dry mounts, as the breath dries off too soon in hot weather; and summer is the best for the balsam mounts, as it is difficult in winter to keep the breath from moistening the isinglass at the wrong time. The cement cells should be quite dry and hard before mounting, or a dewiness will appear and ruin the object. Soften the cement over the lamp, press the cover down till it sticks all round, let stand a day or two and finish off. No doubt the diatoms would be more secure if burnt on the cover in the dry mounts, and possibly that process would be sufficient for the balsam mounts without the film of isinglass, as stated on p. 68 of Davies' Manual of Mounting.

Mr. Sharp has tried several kinds of mechanical finger, but declares he "can do the work quite as well and in less than half the time" by the method described above. He has sent specimens of scales and diatoms mounted according to the above directions, and although he says they are a long way from his best, they are certainly all that could be desired as proof of the efficacy of the plan.

On Mounting Diatoms in Symmetrical Groups.

By W. M. Bale.

[Read 26th August, 1880.]

As the subject of mounting diatoms in symmetrical groups has been recently before the Society, a few further remarks in reference thereto may be acceptable to any members who may intend trying their hands at this particular branch of microscopy. Perhaps no objects (with the exception of microscopic writing and engraving) cause so much surprise to the beginner as those slides in which a spot so small that its exact shape can scarcely be distinguished with the naked eye, is found to consist of a number of minute diatoms arranged in a design of perfect symmetry. Yet there is no special difficulty in the process, and all that is requisite is a firm hand, a good stock of patience, and a little practice, without which no great amount of success is likely to be attained in any branch of microscopic art.

In the first part of my paper read in November, 1879, I have described in detail the mode of arranging the diatoms on the slide, and if the valves are very small and flat, and are to be mounted dry, it will be sufficient to follow the directions there given, afterwards surrounding them with a thin cell and applying a cover; but large or uneven diatoms mounted thus are liable to leave the slide at the least jar, and must therefore be attached with some cement; while *any* diatoms which are to be mounted in balsam must be fixed to the slide or cover with a cement not soluble in the turpentine contained therein. In these cases, a minute drop of clear gum may be deposited near the centre of a clean slide, and thinned with a drop or two of water, the whole being spread backwards and forwards over the slide with the blade of a knife till none appears to be left in the centre where the objects are to be placed. The diatoms are then arranged on the slide in the usual manner after breathing on it, and when dry they will adhere to its surface, after which they may be covered in the ordinary way. With dry mounts especial care must be taken that the merest invisible film of gum remains on the slide, the appearance of the diatoms being spoiled if they are saturated with gum or any similar material.

For transferring the valves from one slide to another the best implements are mounted bristles, of which two should be at hand, one rather stout for large diatoms, the other not thicker than a human hair, and preferably somewhat curved, for lifting small valves, and also for removing particles of dust which frequently settle on or among the diatoms during the process of mounting; but for moving the diatoms into the exact position which they are to occupy on the slide a fine needle is almost indispensable, bristles being too elastic. If, however, it should be necessary to draw a diatom towards the operator's hand a bristle or hair must be used.

When the objects are to be mounted in balsam, the slide should be allowed to dry, and a small drop of carbolic acid placed on the diatoms, which are then to be examined with the microscope, as it frequently happens that the gum, if not thin enough, seals up the minute cells in the valve, or even the whole cavity beneath it, preventing the entrance of the acid. In this case a drop of spirits of wine placed on the diatoms will usually find speedy entrance and dispel all bubbles, and while the diatoms are still wet with the spirit the carbolic acid may be placed upon them. Gentle warmth will then evaporate the spirit, leaving the acid, and it only remains to apply a small drop of balsam and a cover, taking care, if any of the valves are very convex, to provide rests to prevent the cover from crushing them. It is better to let the balsam fall on the diatoms than to apply the cover first and let it run in, as it very often carries in with it particles of dust, cotton fibres, &c., which may be on the slide or the edge of the cover, and which are apt to come in contact with the diatoms and remain there. The running-in process is only necessary when the valves are not cemented to the slide, and when, consequently, balsam let fall on them would be almost certain to disperse them.

In most cases it is advantageous to mount the diatoms on the cover, which is easily done by first fastening it to a slide with a drop of glycerine, which will not evaporate during the process of mounting, and is easily removed afterwards. I have found that large diatoms, such as *Arachnoidiscus*, when mounted on the slide and examined by reflected light, are apt to show a slight haze surrounding the group, instead of the intense black ground which should be presented when all light is shut off from below the stage. This is caused by reflection from the under surface of the slide, and can be avoided by mounting on the cover and placing some dead-black material at the bottom of the cell. It is also advisable to mount the diatoms on the cover whenever they require a high power to resolve them; and if this be done, and if covers are used which have been all gauged to a particular thickness, the adjustment of the screw-collar of the objective will be the same for every object so mounted, and the trouble of making this adjustment for each slide will be obviated.

If *Polycistina* or *Foraminifera* are to be mounted, a thicker layer of gum should be placed on the slide than for diatoms, as these objects, from their peculiar forms, have usually a very small part of their surface in contact with the slide.

It is of course open to question whether these slides are worth the time bestowed upon them, but as it is comparatively rare to obtain gatherings consisting of one species and free from foreign matters, it becomes necessary to select the diatoms, and when this has to be done it is not much more trouble to arrange them symmetrically. As the pleasure which an artistic eye finds in orderly arrangement may be obtained at so small an additional expense of time and trouble, I think we may consider this branch of microscopic art as quite legitimate, provided, of course, that scientific value is not sacrificed to mere prettiness. For instance, when a pure gathering containing one predominant species can be obtained, it should be mounted in the mass, as there are almost certain to be variations of form, marking, or development, some of which would probably be passed over if a few specimens were selected and the rest thrown aside.

For some months past I have used the gum process with all balsam-mounted diatoms, even when they are not arranged symmetrically, for the sake of the security it affords against the valves being displaced by slight pressure on the cover-glass, or by the slide being kept in other than a horizontal position, also for the advantage of being able to mount the valves in different positions, so often necessary in order to get an exact idea of their true form.

I make use of the binocular microscope with a 1-inch objective for work of this kind, and I do not think a much lower power would be effective; indeed, for small diatoms, a $\frac{1}{2}$-inch would be preferable, provided that it had sufficient working distance to permit a hair or needle to be moved freely under it.

On an Impromptu Bramhall Reflector.

By W. H. Wooster.

[Read 30th September, 1880.]

As, notwithstanding all that can be said against *diatomaniacs*, the resolution of diatom lines and dots will always have charms for a great number of microscopists; and as it is most certainly an excellent species of "microscopic gymnastics;" and as, moreover, many other objects have fine lines and other markings, any method that will show these easily and well cannot be too widely known. Mr. Bramhall discovered a plan (which, however, seems to have been discovered before) of bringing out these lines and dots with remarkable ease and beauty. It consists of a piece of silvered glass or speculum metal sunk an eighth of an inch below the surface of a wooden slide 3 in. by 1¼ in., with a ledge at the lower edge for the object slide to rest against. In use it is placed on the microscope stage, the object slide placed on it, and the light condensed on it at *any* suitable angle by the condenser, so as to be thrown back from the reflector on to the object, *any* degree of obliquity being given by the position of the lamp.

Some may not be able, others may not care, to make this, and still fewer are likely to have one made to order without first seeing the effects. I had long promised myself one when I could get the bit of silvered glass with which to make it, but it never turned up; when one day it occurred to me that I might try the effect of unslinging the *mirror* of the microscope and placing *that* on the stage with the object slide on it, condensing the light as above. The result was a decided success. Whether I used the French ¼ of 50°, or the Crouch ⅛ of 90°, lines or dots formerly resolved by either with great difficulty were brought out with greater distinctness, and with little or no trouble or loss of time, and either objective easily resolved the lines or dots on certain diatoms that it never showed before or since by any other method. No doubt many members like myself had heard of the Bramhall reflector without making one or getting one made. Here is a simple plan of testing it, and ready to the hand of every microscopist, after which he may make one or get it made as he thinks best; but I feel pretty sure that for fine lined objects, when once tried, he will not let the method fall into disuse. It is suited equally well for dry, balsam, or fluid mounts, provided they be transparent, with a sufficient space round the object not covered by paper. Those objects that are *well* resolved without it receive little or no benefit from it; but it is a most valuable accessory in the case of those objects that are resolved with difficulty, or only *almost* resolved without it.

Notes on Dry and Balsam Mounting.

By W. M. Bale.

[Read 24th February, 1881.]

(1.) *Dew or Moisture in Dry Mounts.*—The last number of the *Journal of the Royal Microscopical Society* contains some remarks on the subject of the moisture or dew which frequently settles on the inner surface of the cover-glass of cells in which objects have been dry-mounted. My attention was attracted to this article owing to the fact that this particular difficulty has always confronted me in mounting objects dry; indeed, in my own experience, it has proved (rather than Canada balsam) the true *pons asinorum* in the art of mounting, since I have never yet succeeded in finding a plan by which objects can be mounted dry with any certainty that the covering-glass will not soon become covered with a fine dew, which may be sufficiently dense to injure the definition of the object, and which will be particularly objectionable when delicate specimens, such as diatoms or insect scales, are mounted on the cover. From the slight attention paid to this subject in works on mounting, I at one time imagined that I was singular in finding this difficulty, but the appendix to Dr. Carpenter's work on the Microscope (fifth edition) shows that the author recognised the difficulty without apparently being able to suggest a proventive, as he merely proposes to use cells of a mixture of wax and balsam, in order that the cover may at any time be easily detached and cleaned from the moisture. The remarks above alluded to were elicited by some articles which have appeared in the American microscopical journals. Dr. H. L. Smith advises the abandonment of wax cells, of which he is said to be the inventor, on the ground of their tendency to encourage the deposition of moisture, while Mr. Cox, in reply, says that all cells in use are liable to the same fault, and wax cells not more than any others. He considers that the mistiness may sometimes be caused by emanations from the wax, "but that it more frequently results from the use of cements containing resinous or oily solvents, like turpentine or benzole;" while, of course, if the object be not quite dry when mounted, the water contained in it will be liable to condense upon the cover; and he says that, "if a cement is used composed of shellac dissolved in alcohol, plenty of time allowed for the completion of each step, and the specimen thoroughly dry, the cell will be free from vapour and condensations;" and he thinks, therefore, that the wax cell is "the best cell for dry objects that has ever been used." Mr. Stidham "has found no trouble since covering the whole cell with a thin film of shellac, and using shellac to fix the cover, *provided the day was a dry one*," and the cover is held for a moment over the lamp flame. He thinks Mr. C. C. Merriman's suggestion of leaving a small opening so that moisture may get out would be of practical advantage if it could be done.

It seems to be the general opinion that shellac is the best cement for dry cells, and Dr. H. L. Smith strongly recommends the use of cells made of paper saturated with it, and allowed to dry, and having the covers fixed by passing a hot wire round the margin. He remarks that this process is so simple that it is strange no one has thought of it before, but there are probably few microscopists who have not made use of paper cells saturated with cement; but in common with many others, I have used balsam or gold-size for the purpose, which, it now appears, has been to a great extent tho cause of the dew on the cover. If shellac is less liable than other cements to give off emanations, it matters little what substance the cell is composed of, provided that it is completely coated inside with a film of shellac. It is to be noted, on the other hand, that Dr. Phin finds that shellac, in all its pure forms, is very apt to leave the slide after some time. The above-quoted suggestion, that a small opening should be left for the escape of moisture, can be carried out without any difficulty. I have often affixed the cover to the cell by touches of cement in two or three places only, with good results as long as the cell remained in this condition; but when, fancying that the cell was sufficiently dry, I have allowed a fluid cement to run into the intervening spaces, to thoroughly secure the cover, a deposit of dew has almost invariably made its appearance in a short time, due, as I afterwards found, to the cement itself.

Since reading the article above quoted, I have adopted the following very simple plan of mounting objects to allow of the circulation of air through the cell: Take an ebonite cell, and if necessary trim the edge neatly with a file, then with a file or knife cut two opposite broad shallow notches on that side of the cell which is to be underneath; then cement the cell to the slide, taking care not to allow the cement to fill the notches, which, being shallow, are quite unnoticed unless looked for. The object may be placed in the cell, and the cover cemented on at leisure. If a bright edge be required to the cell, it is only necessary to paint it with a thin solution of balsam or dammar, and no varnish ring on the cell is requisite (unless some other color than black be desired), as the ebonite cell supplies in itself a sufficiently neat finish.

Those who are in the habit of using the excellent slides made by gluing perforated wooden slips to strips of card, can easily provide for the circulation of air by making one or two small slits in the card bottom of the cell.

To obtain the freest circulation of air through the cells it will be advisable to leave the slides in an open rack box till the cement has hardened, rather than to close them up at once in a cabinet.

(2.) *Vacuum-bubbles in Canada Balsam.*—One of the first difficulties which a novice in mounting meets with arises from the formation of air-bubbles in Canada balsam, but experience soon shows him that if the balsam be used in not too thick a state, any bubbles that may form in it will, unless they are excessively large, gradually disappear in the course of a few days at most, and henceforth air-bubbles in the balsam cease to be a source of trouble. It is otherwise, however, with vacuum-bubbles, which are apt to appear in any closed cavities of an object at the moment of applying the balsam, even though every cell may have previously been perfectly filled with turpentine or carbolic acid. The cause appears to lie in the different densities of the fluid and the balsam, the former finding its way out of the cell to mix with the balsam, while the latter, owing to its greater density, is unable to enter the cell and supply its place. A vacuum is therefore left, which has all the appearance of an air-bubble, and which may either take a globular form or expand till it completely fills the cell. In the former case it is evident that the balsam is finding its way into the cell, though slowly, and if it is thin enough to retain its soft condition for a few days, the bubbles will probably disappear; but when they completely fill the cell it is a sign that the balsam cannot find entrance, and the object can then only be cleared by again soaking it in the fluid solvent. Among the objects most liable to this inconvenience may be mentioned sections of some woods, also such *Bryozoa* as some of the common *Catenicellæ*, the avicularian processes of which usually contain perfectly closed-in chambers. In the closed gonothecæ of some of the most delicate Hydroids the same cause is followed by different results—the escape of the fluid and the inability of the balsam to enter, causing the collapse of the thin chitinous investment, instead of the formation of a vacuum-bubble, as is the case where the wall of the closed cavity is strong enough to resist the pressure of the balsam. Precisely the same phenomenon is observed when delicate vegetable tissues are placed in glycerine, and the means used to prevent it, viz. thickening the medium very gradually, suggested to me the idea of applying the same principle to balsam mounts. An easy method of doing this is to place the object in turpentine on the slide under a large cover-glass, and with a glass rod, deposit round the margin an embankment of soft balsam, then lay the slide aside till the balsam and turpentine are thoroughly mixed, which will be a slow and gradual process. It is not advisable to use carbolic acid for this work, at least if there be any considerable depth between the cover and the slide, as the mixture of acid and balsam assumes a rather deep colour. A slight modification of this plan may be used with advantage to prevent delay in the drying of the slide, as follows: Place the object (saturated with carbolic acid) in the middle of the slide, and make a little embankment of balsam at some distance all round it, then fill the space within the balsam with a pool of the acid, and place the slide under a cover till the acid and the balsam are sufficiently mixed (ten minutes or a quarter of an hour), then drop fresh balsam on the object and cover as usual. Turpentine is not suitable for this purpose, as it runs all over the slide.

(3.) *Mounting Moist Objects in Balsam.*—In a note read before this Society by Dr. Johnson some years ago, it was recommended as a means to mount Sertularians, Bryozoa, &c., that the objects should be boiled in water till all the air is removed, then drained, placed for a few hours in carbolic acid, and thence transferred to the slide and mounted in balsam. It will be found, however, that the water contained in the interior of the specimens being taken up by the acid will, unless a large quantity of the latter be employed, or the objects be placed in two successive baths of it, be sufficient to cause a cloudiness in the balsam. Moreover, it is frequently undesirable to lose time by putting the object aside till the water and acid have completely mixed; and to remedy these inconveniences, the object, after removal from the water, should be placed in methylated spirits, which will take the place of the water in a very few minutes, thence it may be transferred to carbolic acid and boiled in it for fifteen or twenty seconds, when the object will be ready for mounting at once. I use this method with all moist specimens, and find it of great advantage in enabling me to mount them without delay, besides which, the quantity of acid used or spoiled is comparatively small, its place being partially filled by the inexpensive methylated spirit.

(4.) *Dust in Canada Balsam.*—I have often found it difficult to obtain balsam perfectly free from foreign particles, and now always keep two bottles. One is filled with balsam made quite fluid by the addition of benzine or chloroform, which is well stirred up with it. This stands undisturbed while the other bottle is in use, a period of several months, during which all particles sink to the bottom. When the other bottle is finished this is brought into use, the first bottle being cleaned out, filled with thinned balsam and stood aside in its turn to settle. This mixture will usually require to be somewhat thickened by evaporation before using. When balsam thus prepared has stood for some months, the bottom of the bottle will be seen on holding it up to the light to be covered with a very fine dust which has settled from the balsam, and if it be compared under the microscope with most fresh samples its superior clearness will be at once apparent.

On Cleaning Used Slides and Covers.

By F. Barnard.

[Read 24th February, 1881.]

I think many members may be surprised at my reading a paper upon such a subject as the above, but as we have many among us who are young beginners, I think I may be excused.

We have all made unsatisfactory slides. Some perhaps have been put into our collections because of the trouble it takes to clean the slides and covers. Also, we often have slides smeared with Canada balsam in our failures to mount.

In an English periodical I have seen the question asked more than once, "How to clean old slides." One answer particularly struck me—"to heat the slides in sulphuric acid;" another, rather more comfortable to the fingers—"to boil them in a pipkin with a little soap three hours," and if that did not remove the balsam to repeat the operation. Another says there is nothing like benzine; and I believe every one has a plan of his own which makes it rather puzzling to offer another way.

My plan of proceeding is this: To warm the slide over a spirit lamp and remove the cover, which I at once drop into a bottle containing methylated spirit of wine, to which has been added 25 per cent. of liquor potassæ. I then scrape off what balsam I can with an old knife, and with a rag wetted with the above mixture clean the slide. Afterwards, a second rag wetted with the same liquid is used if necessary; then, *while wet*, the slides are dropped into a basin of water; it will then only be necessary to thoroughly wipe them with a clean cloth. Breathing on them will show at once whether they are clean or not.

During the time I have been cleaning the slides the cover glasses have been soaking in spirit and potash. They may now be removed one by one and wiped on a rag. If necessary they can be so treated a second time; but in either case they are to be dropped while wet into clean water.

In removing the covers it will be found that the spirit and potash has decomposed the balsam and any gold size, black varnish, &c., upon them, and the dropping them while wet into the water prevents the adherence of any particles by the decomposition caused by it.

I have tried benzine, turpentine and many other things, but nothing seems so expeditious and cleanly as the mixture recommended, as it frees the slides from grease, which has to be done after using benzine or turpentine.

I think perhaps I might say there is a risk in leaving the covers in the bottle of spirit and potash too long. I should fear an injurious effect of the potash on the glass, but this has not happened to me, though I have left them uncleaned for a long time after being removed from the slides.

*** Several papers with the rest of the Proceedings are unavoidably held over. These will appear with the illustrative plates in a fifth part, concluding the first volume, and which it is expected will be issued almost immediately.

PROCEEDINGS.

27*th May*, 1880.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

The Rev. J. Spaven, F.R.M.S., was present as a visitor.

Mr. E. Bage was duly elected a member.

Professor Ralph Tate, of Adelaide, and Dr. Hector, of New Zealand, were nominated as honorary members.

The President gave an interesting lecture on *Lichens and their Development*, illustrated by lithographs of New Zealand species, and by a choice collection of specimens obtained in the vicinity of Melbourne.

Some discussion ensued, and the President, at the unanimous request of the members, undertook to continue the subject at the next practice meeting, with practical instruction in the manipulation and mounting of lichens.

The Secretary read a paper contributed by Mr. Maplestone, describing a new genus of Polyzoa, which he named *Dikista*, with a figure and description of the only species *D. purpura*.

24th June, 1880.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

Professor Ralph Tate and Dr. Hector were duly elected as honorary members.

Dr. Ralph read a paper on the *Blood of Equine Animals*, in which he maintained that the red corpuscles in the Mammalia are globular while in the living animal, only becoming discoid when exposed to the atmosphere. He described a remarkable peculiarity in the condition of some of the colourless corpuscles of the blood of the horse, which contained many nuclei quite filling the corpuscle, instead of one or two nuclei as is usual in mammalian blood.

The Secretary read a paper by Mr. Maplestone, describing three new species of Polyzoa, viz., *Bugula rufa*, *B. globosa* and *Calwellia gracilis*; and enumerating several species not previously recorded from Victoria. These were *Beania Australis*, *Farciminaria aculeata*, *Fasciculipora ramosa*, *Diachoris crotali*, *Idmonea contorta* and *Frondipora reticulata*.

29th July, 1880.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

Mr. C. Elliott was duly elected a member.

The Secretary read two papers by Mr. W. H. Wooster, one on *Mounting in Lines and Patterns*, the other on *How the Lerp Crystal Palace is Built*. The former paper recommended that a very thin coat of isinglass should be spread over a covering-glass and allowed to dry, the diatoms or other small objects being arranged upon it and fixed by breathing upon the cover after each one is placed in position. Both papers were illustrated by specimen slides.

26th August, 1880.

ORDINARY MEETING.

In the absence of the President, Mr. Barnard occupied the chair.

The Secretary acknowledged receipt from the Royal Microscopical Society of three parts of their *Journal*.

Dr. J. Couper Johnston and Mr. Anderson were duly elected as members.

The Secretary read a paper by Mr. Bale on *Mounting Diatoms in Symmetrical Groups*, and exhibited a series of slides in illustration.

The Secretary also read from the "Journal of the Royal Microscopical Society" a paper by Mr. Frank Crisp *On the State of Microscopy in England.*

30*th September*, 1880.

ORDINARY MEETING.

The President, Dr. Ralph, in the chair.

Mr. Frank Crisp was duly elected an honorary member, and Mr. W. T. Moffatt a country member.

Dr. Ralph described an easy method of constructing growing-slides by cutting cells of various forms out of glass of different thicknesses, and using wax to cement the various parts together. Several specimens were exhibited.

The Secretary read a note by Mr. Wooster *On an Impromptu Bramhall Illuminator*, consisting of the ordinary mirror removed from the microscope and laid upon the stage below the slide, the light being thrown upon it and reflected upwards through the slide.

EXPLANATION OF PLATES.

PLATE VI.

The illustrations were drawn under tho microscope, by means of the camera lucida. In every instance polarisod light was used.

1. Portion of the ground-mass of the dyke at Granite Creek, magnified by about 200 linear, showing hornblende microliths.

2. Portion of the same dyke, showing flow structuro of the microliths in the ground-mass—magnesia mica.

3. Portion of tho same dyke, showing crystal of orthoclase.

4. Portion of dyke at Granite Creek, showing hornblende and triclinic felspars.

5 and 6. Triclinic felspars from the dyke at Bulgoback, showing apatito needles marking lines of growth of crystal, and also the chloritic alterations.

7. Hornblende from dyke at Bulgoback.

8 and 9. Hornblende, with nucleus of ground-mass, from dyke at Bulgoback.

PLATE VII.

1. Young larva of Lerp insect.
2. "House" of do. (seen from above.)
3. Do. in section.
4. Do. in process of enlargement.
5. Sectional view of a full-sized "house."

A.W. Howitt del.

Fig. 1. ×50

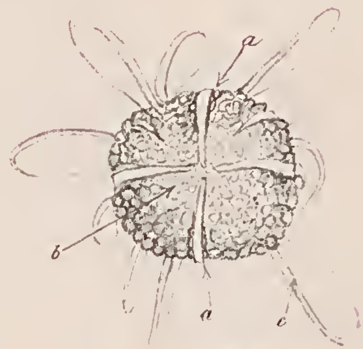


Fig. 2. ×25.

Fig. 3.

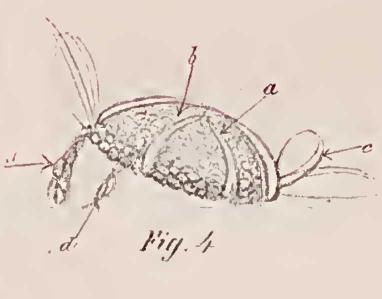


Fig. 4

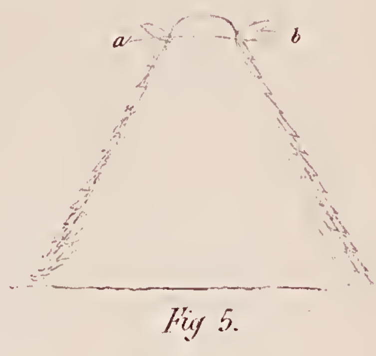


Fig 5.

JOURNAL

OF THE

Microscopical Society of Victoria.

Micro-Chemical Experiments and Observations on the Structure of Human Blood.

By Thomas Shearman Ralph, M.R.C.S. Eng. &c.,
Pres. Mic. Soc. Victoria.

[Read 30th June, 1881.]

While it is true much has been written on the subject of the blood and its investigation by means of the microscope, and also chemical agents applied, yet at this hour it seems to me that our knowledge regarding the structure of the blood, not to say its composition, is by no means exact, and that, moreover, some incorrect statements are still promulgated in text-books for students, who thus obtaining their impressions on this subject seldom undertake for themselves any extended inquiry as to their absolute correctness.

It may seem to be a bold and presumptuous action for any one to come forward and challenge the correctness of points on this subject, which are generally admitted and quoted as fixed and certain; but seeing that what I have already advanced and published has received no notice or comment, I again invite attention and discussion thereon by re-stating them, with considerable additions, in this our local Journal. As the subject is involved in a special use of the microscope, I deem it more needful to avail myself of such a publication as will circulate freely among workers with that instrument; and perhaps a want of this kind has delayed that inquiry which I now desire to stir up, and finding moreover, that an approach to the method of examination I adopted some fifteen years ago has made its appearance in the Journal of the Royal Microscopical Society of May and July, 1878, I am induced again to appear in print in order to push the subject still more vigorously.

(2.) In order, therefore, that I may the more clearly and positively draw attention to what I know to be important points to be recognised in the structure of the blood, I will at once state the views I have adopted, and having formulated them, will proceed to illustrate them by detailing my experiments, leaving the reader to draw his own conclusions, and to dispel by counter *observations* any error I may have advanced.

(3.) The blood is universally admitted to consist of a fluid or plasma, in which certain corpuscles varying as to size and form in different animals, are seen to exist.

The mammalian blood generally, and the blood of the human species, is known to be composed of two principal corpuscular forms, *i.e.*, a white and a red corpuscle.

The red corpuscles of the human blood, and most of the mammalia, are decidedly *globular* or *spherical* in form, and only bi-concave or discoid when they have passed out of the circulation; hence to describe them as bi-concave is incorrect and misleading in various directions.

The other element of the blood, which is known as the white corpuscle, appears as a cell with a nucleus and a contained fluid. This corpuscle, I believe, is in part the incipient or early form of the red corpuscle, which, when fully developed, may be regarded as possessing a double covering to a contained amorphous mass, which then possesses the property of passing out of the *quasi* cell covering, exhibiting this last as an empty cell.

Lastly, a recognisable amount of change can be distinctly made out as occurring in these corpuscles when subjected to the action of certain chemicals; and reasoning on these changes, we may be led by induction to apprehend the nature of some morbid changes occurring in the tissues.

There are then three important points to which I desire to direct attention and investigation, and in so doing, I do not intend it to be understood that any of these views, except the last, are quite new; only that the two prior positions have been speculatively advanced by some and rejected by others, but which, I believe, can be subjected to proof or demonstration of some kind; and this is a part purpose of this communication.

(4.) Thus I would put the matter briefly—

(*a.*) The red corpuscle is a spherical body.

(*b.*) The white corpuscle is a nucleated cell.

(*c.*) That changes produced in these two organisms by means of chemical substances, tend to show that the white passes to the condition of the red corpuscle or more perfect form.

(5.) We must now, for a moment, engage in a theoretical view of the change of the white corpuscle into the red, and afterwards revert to the experiments supposed to illustrate these changes. The cell wall of the white corpuscle, it appears to me, gradually condenses and contracts upon the nucleus, and the interspace is thus destroyed. When this has proceeded to a certain extent, the cell wall becomes adherent to the nucleus, and the whole constitutes a solid spherule, the red corpuscle. In process of time the solid material of this red corpuscle, or former nucleus of the white, acquires the property of passing out and thus renders the corpuscle flaccid, and in this condition it is ready to assume the bi-concave form on escaping from the vessel in which it has been circulating; and according to the amount of solid material retained will the corpuscle measure a greater or lesser diameter. When the corpuscle is quite emptied, there remains only a *ghost* of a corpuscle, represented under the microscope by a clear fine ring, without any contents.

(6) Thus far the theory. We now proceed to test our position by experiments—

Firstly—Withdraw a specimen or specimens of blood on a slide and prepare them for exhibition under the microscope, premising that the blood is healthy and no alcoholic or vinous fluids have been recently imbibed. These specimens will then be standards for comparison during the experiment. With the same blood drawn at the same time on a slide, add either directly (or by means of vapour) some prussic acid (about nearly equal bulk.) If the vapour is employed, the slide should be held over a bottle of the acid for about a minute or more, and then the covering glass placed on.

The first thing to be noticed, after the lapse of a short time, is that such specimens of blood exhibit a larger amount of white corpuscles than those which have not been so treated. This experiment should not be confined to one slide only, but extended to three or more, or repeated on a further occasion. Having noted this feature, the next, which is a very delicate experiment to be carried out, may be tried, *i.e.*, the use of magenta, diluted considerably from the strength usually sold in a fluid state, so as to tinge the nuclei of the white corpuscles. This result may not be always readily brought about, perhaps requiring time and manipulation according as the blood itself may vary in quality.

When it is apparent the nuclei have received colouration, every white corpuscle should be carefully examined with a view to the following results:—That one or more will be found to have, besides the colouration of the nucleus, a minute coloured spot, magenta stained, situate on the periphery of the white corpuscle wall. This fact, if once recognised, should be diligently sought for in any specimens of blood which have been subjected to the prussic acid process. In addition to this change, another condition of the blood acted on by the acid can be noted—of course, without the magenta action—that, by carefully and gradually lessening the light under the object, the nuclei of the white corpuscles present a decided greenish blue or bluish tinge; and in addition to this, in some part of the specimen of blood, there will be found, in all probability, some solid fibrinous or other mass, with a decided deep blue tinge, a cyanide of iron, or Prussian blue re-action, due to the iron in the blood engaged by the prussic acid. Careful manipulation of the light in reducing it to a very low ebb is absolutely needful in order to display the blue tinge of the nuclei, and perhaps less care in finding the blue amorphous particles, as they exhibit a denser colour. Without a condenser to modify the light this experiment is not likely to succeed.

(7.) We come now to the examination of the blood in another way, with a view to carry out the same inquiry. Mix magenta solution with prussic acid. The white corpuscles will be attacked as before, and the colouration of the nuclei will be readily shown, as also the colouration of a macula on the periphery of the cell wall. The number of these white corpuscles will be found to be increased. In conducting the experiment in this way, we do not obtain the blue re-action of the prussic acid, as that is covered by the magenta staining. The above experiments, to my mind, serve to illustrate this point in the history of the red corpuscle, that the action of the prussic acid has caused the newly formed red corpuscles to retrograde to the condition of the white by the dilatation of the cell covering, which, not having permanently adhered to the nucleus, sometimes carries away with it a small adhering portion of the nucleus, which takes colour, and is seen as a coloured macula on the distended cell wall. The increased number of white corpuscles in the field of the microscope also points in the same direction, *i.e.*, that their presence is due to the newly-formed red corpuscles retrograding to the white corpuscular stage, thus in a degree justifying us in referring the origin of the red from the white corpuscle.

(8) We will now experiment more particularly on the red corpuscle. A solution of sulphate of copper must be made in ammonia, termed cupreate of ammonia. Place about a drachm of this solution in a test tube, and allow some fresh blood to flow into it to about the same amount, and agitate, and then examine the corpuscles under the microscope. Another method is to add a drop of blood as quickly as possible to a drop of the cupreate solution on the slide, and then proceed to examine it. Few white corpuscles will be seen; in all likelihood they will have been dissolved, but the red will be noticed under two or three forms. Some will be decidedly spherical, others plano-convex or bi-concave, and some few quite empty. Now, by cautiously adding magenta, all these corpuscles will take the dye and much more clearly exhibit their condition; those which are half empty and bi-concave will show their contents, beautifully coloured, in a thick marginal ring, the central portion being quite clear, so that the light can be seen through it. The spherical ones also take colour and roll about, beautifully exhibiting their distinctly globular form.

This experiment gives us a very different result to the former, in which the magenta coloured the *extruded* material of the red corpuscles; but here the cupreate prevents the outflow of their contents, and allows the ingress of the dye. If now water be gradually added, the cupreate is washed away, and with it the contained corpuscular matter is extruded, coloured. This experiment shows that when the blood is added directly from a vein to the cupreate solution, the corpuscles are arrested in their normal state; some of them, having parted with their contents in their transit through the blood vessels, are found half empty, while others being fully formed and having undergone no change, are preserved in their spherular form. By carefully drying off the fluid from the slide, the corpuscles can be preserved in oil for a time.

(9.) From a consideration of the action of the several chemical elements used on the blood, I think we can fairly arrive at a conclusion of this kind, that the red corpuscles respond to their action, seeing they present us with the same or similar phenomena, *i.e.*, that some are spherical, while others exhibit a partial empty condition and assume a discoid form; and others are merely empty cells, represented by very delicate circular forms; that another class of agents appear to disintegrate the corpuscles in such a manner as to exhibit what seems to indicate an external envelope, and possibly an internal one as well. It is true some observers refer all such changes to chemical action, and regard the appearances as due to coagulation, and that there is no true cell wall. All that is contended for in answer to such a view is, that a differentiation has been effected by the chemical agent used, and that this implies a difference in the chemical composition between the external and internal portions of a corpuscle; and again, the action of prussic acid on the white corpuscles will sometimes exhibit them with a second envelope, or vesicle attached to the nucleus (see diagram); and this bears out the view that such a corpuscle is a retrograde red corpuscle, *i.e.*, exhibiting not only the cell wall of the white corpuscle, but also one which has commenced to invest the nucleus. But, in as much as the blood varies from time to time in its composition, such a result is not invariably obtained; nevertheless, if we do obtain definite results under several experiments, we should be prepared to attach some value to such changes.

The operation of delicate tests, such as the above, must be liable to be interfered with by what may seem to be trivial circumstances, and the more delicate and more readily decomposable the test, or agent is, the more readily will it give evidence of change of composition, and so perhaps give rise to uncertainty. When however, the experiment succeeds a given number of times, some value should be attached to such results in testing the blood. Thus we find the action of wine on the blood may prevent the blue re-action of the prussic acid, and this is explicable on the ground that the iron has been pre-occupied by a stronger agent derived from the wine, and the blue re-action is suspended for a time.

(10.) It will be seen by reference to the papers already published that the major portion of this essay is contained in them ; but in justice to the subject, and to the present Journal, I have undertaken to experiment anew, and have also extended my observations to the action of other agents, and have recast all my materials and collected and condensed them into one whole, and have also refigured and added to the former microscopical appearances. All the experiments adduced can be readily undertaken by a fair working microscopist, and will, I am certain, if no other result be obtained, yield good practical training as a reward, similar to the manipulation of diatoms, an investigation which leads to skill in the use of the microscope and its accessories, and is a pursuit which should not be subjected to such wholesale reprobation as insisted on by some observers.

(11.) Being aware that great changes in the views regarding cells and cell-formation have taken place, and that the white corpuscle of the blood is not regarded now as a cell proper, with a nucleus, I wish to explain that in using the term cell and cell wall in considering the structure of the blood, I do so only with a view to mark out and establish appearances, without involving the subject in any question of the cell theory ; and while doing this I am quite willing to accept the term that the white corpuscle is not a nucleated cell, if one does not go so far as to deny what appears self-evident, that there is a nucleus present, and a limiting protoplasm, and between these an interspace filled with some fluid, but not, in all probability, of a gaseous nature, as refraction does not indicate such a condition.

(12.) But we have not done with all the changes which can be noticed as occurring in the blood under the chemical substances which have been quoted, viz., prussic acid and cupreate of ammonia. I have noticed that whenever a distinct blue re-action follows the application of prussic acid to the blood, a further and a more interesting change takes place. The fluid under the microscope should be carefully searched for the presence of *starch-like* bodies, corpuscles assuming the form and appearance of *starch* grains, exhibiting at times a concentric arrangement of the interior, with a rounded or reniform shape. These bodies assume a purple and then a black tint under iodine re-action, and also exhibit a cruciform polariscopic appearance. If carefully looked for in a slide of blood treated with prussic acid, the observer may perhaps, at first, note a minute oil-like point, and watching it, he will find it increase to the size of a rice starch grain and larger, and then suddenly assume a decided starchy form, and appearance, and then the above re-action by iodine can be brought out; or the observer, after having applied prussic acid to the blood, can lay it aside for fifteen or twenty minutes, and then carefully apply the iodine test, and he will, by the darkened change of colour, readily make out an object which he may have passed over, because of its unusual appearance, and he can then revert to the gradual formation of such corpuscle by long and careful examination of a slide, and be rewarded with the view of a starch body forming in the plasma, as I have done many a time. Similar results can be obtained when the blood is acted upon by the cupreate solution.*

(13.) This formation of starch-like grains resulting from the action of chemicals (prussic acid, cupreate of ammonia) is well worthy of note; and it is likely the above list may be more extended.

There are other chemical agents which affect the blood in a remarkable manner, but require to be examined more carefully as to their action, in order fully to elicit the nature of the changes brought about; and it is to this line of observation and experiment I desire to direct attention; at the same time, I must say that experiments made with prussic acid should be first carried out and fully recognised before going into any others, as the results I have obtained have been the means of conveying to me a better mode of experimenting than could be obtained by starting first with those substances which have not been so constantly and frequently employed by me, and have come into use long after.

It would take a great deal more space than I can afford to go into details regarding the many substances which have been experimented with, but I will enumerate the principal ones.

* Note.—The action of chloral hydrate on the blood, induced by injecting it subcutaneously, and the further action of formic acid, applied in the same way, will exhibit abundance of such bodies; and even the urine will be found to exhibit them; so also these changes can be exhibited in the urine if freshly past, by adding the above reagent to the secretion while under the microscope.

(14.) The following substances have been experimented with to a small amount compared with the fore-mentioned, hence the effects cannot be spoken of so decidedly :

The action of carbolic acid, combined with an equal bulk of glycerine, and a small portion of blood added on the slide, presents remarbable changes. The red corpuscles take various forms, some appear solid, some appear quite empty, or with a small portion of solid matter, the cell wall being in all cases thickened ; some appear as if they had a luminous centre, this being due to the contraction of the contents leaving the centre empty when the light passes freely through it ; others lose their consistence and become smeary, and exhibit one or more clear spaces or spots. This experiment can be varied by mixing magenta solution with carbolic acid, and then dropping on the covering glass with a small portion of blood on it—the magenta will colour the corpuscles in a pleasing way.

(15.) The action of hydrobromic acid is peculiar ; the red corpuscles appear as if their contents were solidified, and are seen in all conditions ; the half empty ones with a depression on one side, or deeply bi-concave, and some are seen to be solid, all presenting a decided pale bluish tint under feeble light.

(16.) The action of bromal hydrate is very remarkable, differing from anything yet seen. All the red corpuscles are corrugated as to their contents, while the cell wall stands out thicker than usual ; this corrugation of the corpuscles gives them an appearance of minute coscinodisci, or as if each had received the impress of a thimble marking. Magenta colours this very well. The addition of prussic acid causes a curious action; every corpuscle by degrees, as the acid reaches it, ceases from the corrugation of the contents, becomes smooth and softened in appearance. Some corpuscles are quite empty, presenting a decided marked cell border, very different from that yielded by the action of water or prussic acid on the globules.

(17.) The application of nitro-glycerine solution in alcohol (10 per cent.) gives extraordinary results. The red corpuscles, if not too much acted on, appear to give up their contents and look emptied, and usually a nuclear like body of minute size is seen in them, occasionally two ; these I consider to be the solid material of the corpuscle, undissolved by the agent. The cell wall appears wrinkled.

(18.) Judging from a comparison of all these results, it seems evident that the substance of the red corpuscle differs from the peripheral portion, as it will take colour, will shrivel up and separate from it, and exhibit itself as a separate mass in the centre, while the cell-like portion will not colour; in other instances, the contents exude through the cell wall and leave the cell quite empty. Again, this can be provented by the action of ammonia cupreate, so as to allow magenta to pass in and tinge the contents; while the magenta, if used alone, causes the contents to issue forth, and become coloured like a fine granular mass outside the cell covering. The blue re-action of prussic acid points to its action on the iron in the corpuscles, and also in the fluid or plasma, in as much as amorphous masses are formed, chiefly tinged blue; also starchy bodies are formed through some decomposition between the agent used and the corpusclo contents. The noticeable change effected with the white corpuscles, *i.e.*, enlarging their cell wall, and sometimes exhibiting a double condition, and the increased number of the white bodies, indicates a change effected in them.

In conclusion, I will tabulate and condense the results I have obtained, hoping further experiments will be made to illustrate the interesting matters relating to the blood corpuscles.

(19.) *Prussic Acid.*—Action on both corpuscles; extrusion of red corpuscular contents; dilatation of cell of white corpuscles; blue re-action and starchy matters formed.

Ammonia Cupreate.—Red corpuscular contents retained; corpuscles seen in all conditions; solid and spherular; bi-concave, or empty; ablo to receive magenta dye; cupreate washed away by water added; contents then extruded; white corpuscles dissolved; starchy bodies formed.

Carbolic Acid.—Contents of red corpuscle altered, ultimately becoming dissolved.

Hydrobromic Acid.—Action much resembling ammonia cupreate; corpuscles bluish.

Bromal Hydrate.—Contents of red corpuscles corrugated and separated from cell wall, which appears thickened; all this altered by action of prussic acid.

Strong Nitric Acid.—The red corpuscles assume an *oval* form, and exhibit their contents condensed; able to take magenta, each corpusclo showing a clear space.

Tincture of Hammamelis.—With and without dilution; red corpuscles emptied of contonts according to their condition; somo exhibiting granular contents, some corrugated; some with one or more molecules, which are seen sometimes to move about within the cell cover; wall of cover thickened; some cells glued together.

(20.) Results arrived at—

White corpuscle a nucleated cell; eell wall dilateablo; supposed to condonse into nucleus and become thickened; able at early stage to separate by action of chemicals or poisons; red corpuscle is the white corpuscle with its envelopo firmly adherent; contents able to exude, or made to remain in cell covering; globular* during circulation, and becoming bi-concave when removed therefrom by loss of watery or gaseous fluid; hence the discoid form may vary as to diameter, according as the cell covering is fully or partially empty; hence measurements of corpuscles aro uncertain standards as to nature of tho blood, that is to a certain degree.

With regard to the modo of using tho different chemical agents, no positive rule as to quantity can bo laid down. The use of tho magenta should bo moderate, as strong magenta darkens the field, and too much of a weak solution is apt to make a change from tho large amount of water added to the blood. Note also, much difficulty attends the use of substances dissolved in rectified spirit, as this agent is apt to interfero with tho proper action of the chemical experimented with.

Some of these observations now dato back more than sixteen years, as the leading points in this paper were published in 1866. The following papers can be consulted, in which some of my experiments have been detailed—"Observations and Experiments on the Effects of Prussic Acid on the Animal

* NOTE.—Tho spherical form of the red corpuscles can be seen in the mosentery of the mouse, and as soon as they escape take on the discoid form.

Economy," in the *Australian Medical Journal*, 1866, and reprinted in full in the quarterly journal of *Microscopical Science*, Oct. 1866; "Observations and Experiments with the Microscope on the Effects of various Chemical Agents on the Blood," *Australian Medical Journal*, Aug. 1866; "Observations and Experiments with the Microscope on the Chemical Effects of Chloral Hydrate, Chloroform, Prussic Acid, and other Agents on the Blood," *Australian Medical Journal*, Feb. 1871.

In the foregoing paper, submitted to the Microscopical Society of Victoria, reference has been made merely to the changes which have been noticed in the blood under the action of chemical substances, and notably that of hydrocyanic acid; but there is another and a most important aspect of the subject bearing on pathology, to which I now allude, separate from the interests of the above society.

It will be borne in mind that the action of hydrocyanic acid resulted in the production of blue particles in the blood, and also that of starchy matter in the form of starch-like grains. I have, in administering the acid to patients, distinctly recognised the presence of the blue particles, and have found that these have diminished in quantity as soon as the remedy has been withdrawn, *i.e.*, after two or three days' discontinuance. I have also noticed, in two cases of epilepsy, the presence of blue particles in the blood when examined by *itself* under the microscope, and apart from any employment of remedial agents, leading me to this idea —that these cases may have originated in a toxic state of the blood, analogous to that produced by the action of hydrocyanic poison, how generated in the system, or from what exciting cause, it is impossible at present to determine; and that the blood in these cases was in such a condition of change as probably to induce an accompanying deposit of starchy material in the line of some nerve structures. One of these cases was affected with hemiplegia, but ultimately recovered; the blood was examined within an hour after the attack. The other case has been a subject of epilepsy in a moderate form for years, and when noticeably worse, exhibits blue particles in the blood. Under such circumstances of a disturbed chemical state of the blood, starch-like material may be formed in it, and perhaps deposited as starch in those parts where stasis of the blood may occur, and thus give rise to epileptiform symptoms; or perhaps the first action of the altered condition of the blood may be indicated by severe syncope, which being promptly met by the use of ammonia, may cause a cessation of further toxic effects for a time. Be this as it may, I will now conclude these remarks by an extract from my paper on the "Effects of Prussic Acid on the Animal Economy," published in 1866:

"The interest which attaches to the facts I have brought forward is not limited to chemical theories, or to our use of prussic acid as a remedial agent, but the facts observed may also serve to explain important points in physiology and pathology. I here briefly allude to some discoveries in pathological science which relate to amyloid substances discovered in the animal tissue, and about which so much has been written during late years. That the so-called *corpora amylacea*, or starch-grains, found in different organs of the human subject, and referable to some morbid condition of the blood, may take their origin from some similar chemical changes as those to which I have drawn attention, and that perhaps, in many instances, these have only been formed at the time of death, and are referable to *post mortem* changes, except in such cases as resemble the one of epilepsy recorded in the *Microscopical Journal* (Eng.) of 1855 by Mr. Stratford, of Toronto, who speaks of having noticed starch-grains in the blood drawn from an epileptic patient during life."

Connected with this subject of changes in the blood from toxic materials, I would point to the observations of Professor Halford, of this city, on the effects of snake poison on the blood, and which observations are to this day denied or ignored, but I consider to be quite in accord with the action of hydrocyanic acid as a *quasi-organic* poison.

Kew, August 1881.

Description of Plate.

Fig. 1. Action of prussic acid on blood—(*a.*) Two red corpuscles, one empty and the other full. (*b.*) White corpuscles, right fig. exhibiting a macula or spot on its wall. (*c.*) White corpuscles with nuclei in different forms. (*d.*) Left fig. exhibiting a double envelope. (*e.*) Starch bodies. (*f.*) A mass of blood corpuscles after the full action of prussic acid; the red have parted with their molecular contents, and some bluo particles are also seen; all the nuclei exhibit a blue tint re-action. Par. 6, 12, 19.

Fig. 2. Red corpuscles subjected to the combined action of prussic and nitric acids—the principal feature being the oval form assumed by the red; the colourless spaces are empty portions in each corpuscle; all exhibit a bluo tint.

Fig. 3. Tho action of tincture of hammamelis on the red corpuscles—some showing granular contents, others tho same, crumpled up; one quite empty, with thickened walls; another with three nuclei, which exhibited motion for some time. Par. 19.

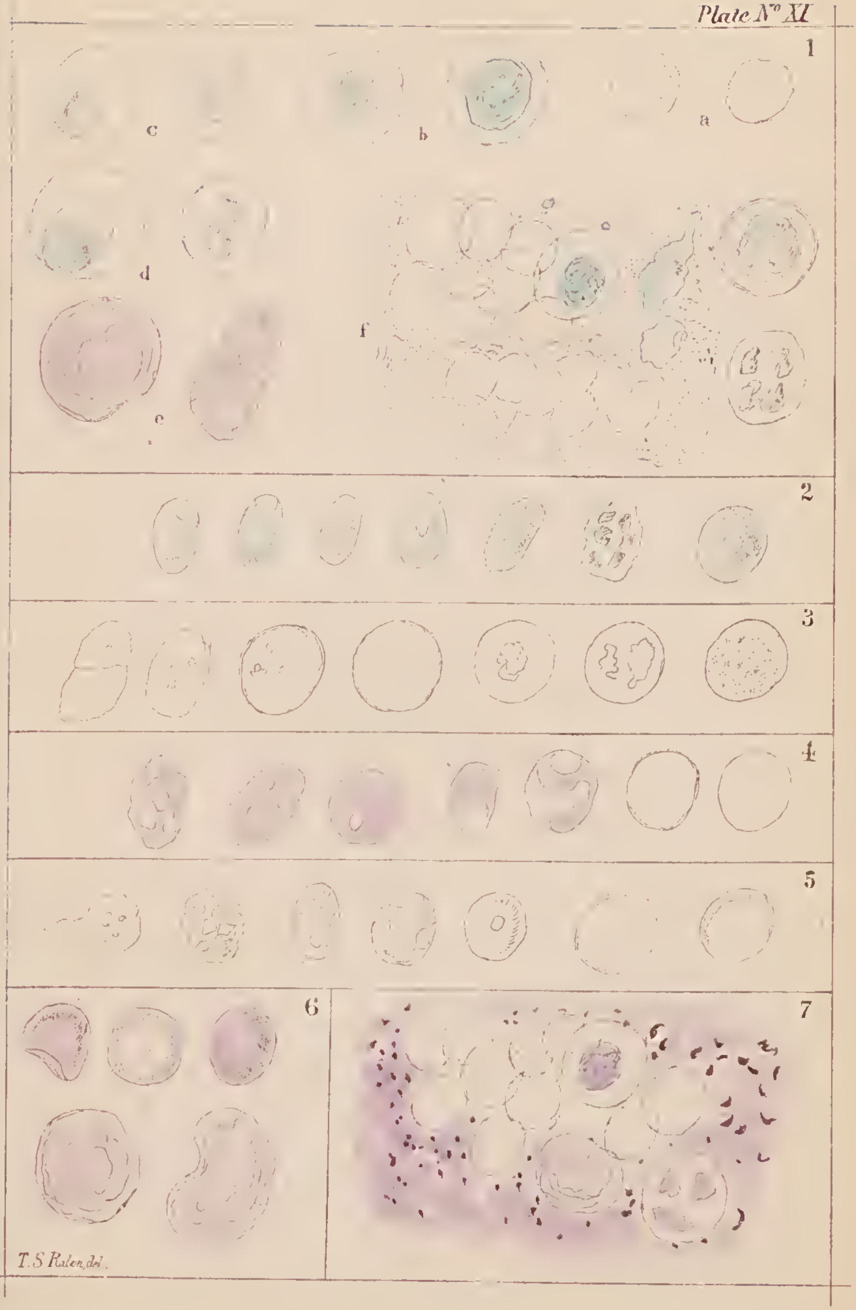
Fig. 4. The action of nitric acid on red corpuscles—some are oval, and their contents variously corrugated; these have been coloured by magenta; the next are extremely dilated and coloured also; the three remaining are softened, exhibiting nuclear forms. Par. 19.

Fig. 5. Action of carbolic acid—the red corpuscles exhibit colourless spaces; the two right hand figures are the result of carbolic acid and glycerine; one is nearly empty. Par. 14.

Fig. 6. The action of cupreate of ammonia on tho red corpuscles, coloured by magenta—one solid and spherical, the next flattened and empty in the centre; the next concavo-convex. The two figures below are starch bodies, measuring about $\frac{1}{1000}$ to $\frac{1}{500}$ of an inch. These havo been tinged by iodine. Par. 8, 19.

Fig. 7. Blood after the action of prussic acid tinged with magenta—empty red corpuscles, with molecules coloured by the dye; white corpuscles, with tinted nuclei and starch body. Par. 6, 12.

Plate Nº XI



On the Hydroida of South-Eastern Australia, with Descriptions of Supposed New Species, and Notes on the Genus Aglaophenia.

By W. M. Bale.

(Read 30th June, 1881.)

The South-Eastern portion of Australia possesses a hydroid fauna, differing so much from that of any other region as to have induced Professor Allman, when dealing with the general distribution of the order, to rank it as a distinct province. At the time of the publication of the "Monograph of the Gymnoblastic Hydroids," in which his remarks on distribution occur, only a small number of species had been recorded as common to this province. and any other part of the world; and these consisted principally of two or three widely-distributed forms, such as *Sertularia operculata*; but several have since been added to the list, most of which occur in Australia and New Zealand. So far as I am aware, not a single species is known to be common to the north and south coasts of Australia, but this may be owing, in some measure, to the want of fuller investigation, especially among the smaller members of the order.

Though the profusion in which some zoophytes are cast on the British coasts, as depicted by Mr. Hincks and other authors, is almost without parallel in this country, and few of our species usually occur in large quantities, our seas are by no means deficient in number and variety of forms, as compared with those of Britain. In Mr. Hincks's "British Hydroid Zoophytes" ther are described about twenty-four species of *Sertulariidæ*, and fourteen of *Plumulariidæ*; while from South-Eastern Australia and Tasmania there are already recorded, of the same two families respectively, at least thirty-six and twenty-one species, including those in the present paper, and I have recently obtained four or five additional ones, while doubtless many still remain to be discovered. A number of Australian species are included in the works of Lamouroux, Lamarck, and others of the older naturalists, but as it is, in most cases, impossible to identify them with any certainty, owing to the insufficiency of their descriptions, and as it is not usually stated whether they occur on the north or south coasts, I have not taken them into account; neither have I included eight or nine species of Kirchenpauer's, which are merely described as coming from Australia. It is somewhat remarkable that so few *Plumulariidæ* have been previously recorded from this province by recent authors, though these beautiful forms are by no means rare. Only two or three Campanularians and no *Athecata* have been described, which is, however, easily accounted for by the delicacy of the polypary in the former, and its rudimentary condition in the latter, rendering the study of them difficult, except to those who have facilities for observing them in the fresh state. If these groups bear anything like the same proportion to the Sertularians that they do on the British coasts, any observer living at the sea-side, especially if provided with facilities for dredging, will find an extensive and almost untrodden field open to him in the study of these perishable forms and their development.

With the object of facilitating the labours of any who may be disposed to enter upon the study of our *Hydrozoa*, I subjoin a list of species already described by recent authors, so far as they are known to me, with their synonyms and localities, and references to the books or papers in which they are described; and I trust to give, in future papers, descriptions and figures of such of these species as I have obtained, especially those which, like Mr. Busk's species, have been briefly described but never figured.

The following is a list of the principal authors who have published descriptions of Australian and New Zealand *Hydroida*:—

Lamouroux. Histoire des Polypiers Corallines Flexibles, 1816.
Lamarck. Histoire Naturelle des Animaux sans Vertèbres.
Krauss. Beiträge zur Kentniss der Zoophyten der Sudsee, 1832.
Gray. Dieffenbach's "New Zealand."
Busk. Voyage of the "Rattlesnake," vol. I. App.
Busk. Sertularians and Zoophytes of South Africa. British Association Reports, 1850.
Hincks. On New Australian *Hydrozoa*. Annals and Magazine of Natural History, 3rd series, vol. VII.
Allman. New Genera and species of *Hydroida*. Journal of the Linnean Society, Zoology, vol. XII.
Hutton. New Zealand Sertularians. Transactions of the New Zealand Institute, vol. V.
Coughtrey. New Zealand *Hydroideæ*. Transactions of the New Zealand Institute, vols. VII. and VIII.

Coughtrey. Critical Notes on the New Zealand *Hydroida.* Annals and Magazine of Natural History, 4th series, vol. XVII.

D'Arcy W. Thompson. New and rare Hydroids from Australia and New Zealand. Annals and Magazine of Natural History, 5th series, vol. III.

Kirchenpauer, Neue Sertulariden, &c. Verhandlung der Kaiserlichen Leopoldino-Carolinischen deutschen Akademie der Naturforscher, 1864.

Kirchenpauer. Ueber die Hydroidenfamilie *Plumularidæ*, &c. Abhandlungen herausgegeben von dem naturwissenschaftlichen Verein zu Hamburg.

Aglaophenia—V., 1872.

Plumularia and *Nemertesia*—VI., 1876.

To these may be added Johnston's "British Zoophytes" and Hincks's "British Hydroid Zoophytes," for the five or six British species which have been found in Australia.

The species mentioned below have all been recorded from South-Eastern Australia or Tasmania by recent authors; those of Lamouroux and Lamarck not being usually described minutely enough for certain recognition, I have not inserted them; and I have, unfortunately, been unable to obtain Krauss' work on the "Zoophytes of the South Sea." The localities now given for the first time are printed between brackets. For the synonymy, &c., of the British species, see Hincks's "British Hydroid Zoophytes."

Sertularia operculata. Lin. Europe; South Africa; Australia; New Zealand; &c. &c., Johnston, Brit. Zooph.; Hincks, Brit. Hyd. Zooph., &c.

Sertularia bispinosa. Australia and New Zealand; (Brighton, South Australia.)

Dynamene bispinosa, Gray. Dieffenbach's "New Zealand."

Sertularia bispinosa, Coughtrey. Trans. N.Z. Inst., VII.

Sertularia operculata? D'A. W. Thompson. An. Nat. Hist., 5th series, III.

Sertularia trispinosa, Coughtrey. New Zealand; (Victoria). Trans. N.Z. Inst., VII.

Sertularia minima. Adelaide; Gulf of St. Vincent; New Zealand; (Williamstown, profusely investing sea-weed.)

Synthecium gracilis, Coughtrey. Trans. N.Z. Inst., VII.
Sertularia pumila, Coughtrey. Trans. N.Z. Inst., VIII.
Sertularia minima, D'A. W. Thompson. An. Nat. Hist., 5th series, III.

Sertularia australis. Sealer's Cove; George Town; Cape Lefebvre; Port Phillip.
Dynamena australis, Kirchenpauer. Verhand. Akad. der Naturforscher, 1864.
Sertularia australis, D'A. W. Thompson. An. Nat. Hist., 5th series, III.

Sertularia penna. Bass's Straits, Tasmania.
Dynamena penna, Kirchenpauer. Loc. cit.

Sertularia elongata. George Town; Bass's Straits; Cape Wilson; Port Phillip; New Zealand; &c.
Sertularia elongata, Lamouroux. Hist. Polyp. Flex.
Sertularia lycopodium, Lamarck. An. sans Vert.
Dynamena abietinoides, Gray. Dieffenbach's "New Zealand."
Sertularia abietinoides, Coughtrey. Trans. N.Z. Inst., VII.

Sertularia flexilis, D'A. W. Thompson. Sealer's Cove.
Sertularia flosculus, D'A. W. Thompson. Near Adelaide; (Williamstown).
Sertularia pulchella, D'A. W. Thompson. George Town; (Williamstown).
Sertularia insignis, D'A. W. Thompson. George Town.
Sertularia sp., D'A. W. Thompson. Gulf of St. Vincent.
} An. Nat. Hist., 5th series, III.

Sertularia (Diphasia ?) sub-carinata, Busk. Bass's Straits; (Griffiths' Point; Williamstown).
Sertularia patula, Busk. Bass's Straits; (Williamstown).
Sertularia loculosa, Busk. Bass's Straits: (Queenscliff).
Sertularia tridentata, Busk. Bass's Straits.
Sertularia (Sertularella ?) divaricata, Busk. Bass's Sts.; Patagonia; Magellan's Sts.
} Voyage of the "Rattlesnake."

Sertularella ramosa, D'A. W. Thompson. New Zealand; Bass's Straits? } An. Nat. Hist., 5th series, III.
Sertularella sp., D'A. W. Thompson. Brown's River. } An. Nat. Hist., 5th series, III.
Sertularella neglecta, D'A. W. Thompson. Australia, probably Bass's Sts.; (Queenscliff). } An. Nat. Hist., 5th series, III.

Sertularella simplex. New Zealand; (Williamstown).
Sertularia simplex, Hutton. Trans. N.Z. Inst., V.
Sertularia simplex, Coughtrey. Trans. N.Z. Inst., VII.

Sertularella Johnstoni. Tasmania; New Zealand; (Queenscliff.)
Sertularia Johnstoni, Gray. Dieffenbach's "N. Zealand."
Sertularia Johnstoni, Hutton. Trans. N.Z. Inst., V.
Sertularia Johnstoni, Coughtrey. Trans. N.Z. Inst., VII.
Sertularella Johnstoni, Allman. Jnl. Lin. Soc. Zoology, XII.

Diphasia attenuata, Hincks. Port Adelaide; England; &c. Brit. Hyd. Zoophytes.

Diphasia pinnata (*Sertularia pinnata*), Pallas. Europe; South Africa; Sydney; &c. Hincks, Brit. Hyd. Zoophytes.

Thuiaria ambigua, D'A. W. Thompson. New Zealand; Sealer's Cove; (Queenscliff; Griffiths' Point.) An. Nat. Hist., 5th series, III.
Sertularia sp.? Coughtrey. An. Nat. Hist., 4th ser., XVII.

Plumularia obliqua, (*Laomedea obliqua*), Saunders. England; Tasmania. Hincks, Brit. Hyd. Zoophytes.

Plumularia campanula, Busk. Bass's Straits; (Griffiths' Point), Voyage of the "Rattlesnake."

Aglaophenia divaricata, (*Plumularia divaricata*), Busk. Bass's Straits; (Queenscliff; Griffiths' Point; Williamstown; Brighton, S.A.), Voyage of the "Rattlesnake."

Obelia geniculata, (*Sertularia geniculata*), Lin. Europe; New Zealand; Port Phillip; Glenelg; King George's Sound. Coughtrey, An. Nat. Hist., 4th series, XVII. Hincks, Brit. Hyd. Zoophytes.

Lafoëa fruticosa, Sars. Bass's Straits. Hincks, Brit. Hyd. Zoophytes.

Campanularia tincta, Hincks. Port Phillip. An. Nat. Hist., 3rd series, VII.

Lineolaria spinulosa, Hincks. Port Phillip. An. Nat. Hist., 3rd series, VII.

The following species are only described as from "Australia," and I cannot ascertain which of them, if any, are from this province, and which belong to the very dissimilar fauna of the tropical seas to the north of the continent. I have not succeeded in obtaining Kirchenpauer's papers on *Aglaophenia* and *Plumularia*, and the species of the former genus described in the following pages must be considered as provisionally named till it can be ascertained whether any of them are identical with those of Kirchenpauer. The difficulty of obtaining isolated papers which have appeared in various journals, frequently of small circulation, especially when such journals are issued in foreign countries, forms the most serious obstacle which the student of nature in these colonies has to encounter.

Sertularia (Dynamena) grosse-dentata, Australia, Kirchenpauer. Verhand. Akad. der Naturforscher, 1864.

Aglaophenia avicularis
" *ramulosa*
" *brevicaulis*
" *longirostris*
" *longicornis*
" *squarrosa*
" *rubens*
} Australia, Kirchenpauer. Abh. ver. Hamb., V.

Plumularia badia, East Australia; Singapore.
" *obconica*, Australia.
" *obliqua, var. Australis*, Australia.
} Kirchenpauer. Abh. ver. Hamb., VI.

Antennularia cymodocea, Busk. Australia and S. Africa. Brit. Ass. Report, 1850.

Of the species described in this paper, those from Queenscliff were obtained by me during a few days' stay at that place; those from Williamstown have also been collected by me at various times; while the species from Griffiths' Point were all collected and given to me by Mr. J. R. Y. Goldstein, whom I have also to thank for much valuable assistance in other ways. *Sertularia acanthostoma*, *S. recta*, and *Plumularia compressa* are described from specimens in a collection of South Australian species, forwarded to Mr. Goldstein by Mr. T. B. Smeaton, of Adelaide. This collection also contained specimens of several of the other species here described, which are noted in their respective places.

Family, SERTULARIIDÆ, Hincks.

SERTULARIA, Linnæus.

The gonothecæ of some of the species are unfortunately absent; it is therefore possible that they may belong to the genus *Diphasia*. From the general aspect of the polyparies, however, it appears most probable that they are true *Sertulariæ*.

S. MINUTA. *n. sp.* Plate XII, fig. 1.

Shoots simple, minute, divided by constricted joints into internodes, each bearing a pair of opposite hydrothecæ. Hydrothecæ tubular, those of a pair adnate to each other in front, slightly separated behind; base expanded outwards, forming a somewhat angular projection; upper part abruptly divergent horizontally, with a fold or crease in the angle; divergent part short, free; aperture directed outward, and slightly forward, somewhat expanded, with three teeth, one superior, and two lateral; emarginate below.

Gonotheeæ large, thick, oblong, springing from behind the basal part of the proximal internode, about equal in height to four internodes of the stem, operculate, mouth surrounded by minute, scattered denticles.

Colour, brown. *Hab.* Sorrento (Mr. J. B. Wilson).

Though the sea-weed on which these species occurred bore a considerable number of shoots, several with gonothecæ, I failed to find any exceeding one-twenty-fourth of an inch in height, or consisting of more than four internodes.

S. PUMILOIDES. *n. sp.* Plate XII, fig. 2.

Hydrorhiza reticulate, with the margins irregularly scalloped or zig-zag, shoots simple, about one-fourth of an inch in height, con sisting of from ten to sixteen internodes, each springing by a narrow base from the one below, the summit of which is continued upwards into a point behind it, forming, with the part between the divergent hydrothecæ, a rhomboidal figure. Hydrothecæ opposite, a pair on each internode, tubular, adnate nearly to the aperture; those of a pair adnate or closely approximate for half their height in front, slightly separated behind; upper part divergent, ascending; aperture directed upwards and outwards, and a little forwards, with two prominent lateral teeth, the outer larger.

Gonothecæ large, pyriform or sub-globular, about five times as long as the internodes of the stem; aperture operculate, surrounded by small irregular denticles; only one on a stem, springing from behind the basal part of the proximal internode.

Colour, yellowish brown. *Hab.* Queenscliff.

This species closely resembles *S. minima*, D'A. W. Thompson, (which occurs plentifully at Williamstown), but is larger, and differs in the hydrorhiza, which in *S. minima* is nearly uniform in width, with a series of short transverse markings along each margin, of which there is no trace in the present species. Both differ from *S. pumila* in having only one gonotheca on a stem, the position of which is constant; in the close approximation or adnate condition of each pair of calycles; in the cell-apertures being directed more upwards and furnished with longer teeth; and in never having more than two calycles in an internode, while *S pumila* often has four.

S. BICORNIS. *n. sp.* Plate XII, fig. 3.

Hydrorhiza slender, shoots pinnate, about one-fourth of an inch in height, stem somewhat zig-zag. Pinnæ alternate, each jointed obliquely to a process given off at right angles from the base of one of the long, slender internodes of the stem; each internode of the stem and pinnæ springing by a slender base from the summit of the one below, which is continued upwards into a point behind it; internodes of the pinnæ of a broad triangular form below the hydrothecæ, slender above; the proximal one on each pinna short, without hydrothecæ. Hydrothecæ short and broad, opposite, one pair on each internode, and a single one in each axil; those of a pair adnate to each other, divergent, adnate by the base only to the hydrocaulus, from which they project forward almost horizontally; aperture tubular, transversely oval, with two small lateral teeth; directed forwards and outwards and a little upwards; a large, erect, tubular process at each side of the mouth.

Gonotheeæ? Colour, yellowish. *Hab.* Queenscliff.

S. ACANTHOSTOMA. *n. sp.* Plate XII, fig. 4.

Stem pinnate, pinnæ opposite, not jointed to the stem, distant, each pair separated from the next by three pairs of hydrothecæ. Hydrothecæ on the stem opposite, on the pinnæ sub-alternate; one pair to each internode, except the proximal internodes of the pinnæ, which bear a single one on the lower side; divergent, ascending, sinuated on the inner side, expanding upwards. Aperture wide, with three large and four small teeth on each side, two of the latter rising from within the margin, and two small teeth springing from the inner side of a small chamber or invagination of the wall of the hydrotheca at the front (outer) margin. A small process projecting horizontally into the hydrotheca from about the middle of the inner side, with a double line continued from it across the cell; a second process projecting into the cell from the outer side, near the base.

Gonothecæ? Colour, light yellowish. *Hab.* Robe, S.A.? (Mr. Smeaton).

S. RECTA. *n. sp.* Plate XII, fig. 5.

Stem flexuous, alternately pinnate, each internode bearing near its base a pinna with an axillary hydrotheca, and above, a pair of hydrothecæ. Hydrothecæ sub-alternate, one pair to each internode, large, smooth, flask-shaped, upper side projecting at right angles to the hydrocaulus; aperture small, directed upwards and outwards, with two rounded lateral teeth, one of which almost or quite conceals the other in a front or back view of the polypidom.

Gonothecæ? Colour, brownish-red, hydrothecæ pale, except towards the mouth. *Hab.*, Brighton, S.A.? (Mr. Smeaton).

SERTULARELLA. Gray.

The *Sertularellæ* described below are all small, simple species, with three marginal teeth to the hydrothcea, in which latter characteristic they resemblo our other species, *S. Johnstoni*, *S. neglecta*, &c. I have found only one four-toothed species, which seems identical with *S. simplex*, Hutton, a native of New Zealand.

S. LÆVIS. *n. sp.* Plate XII, fig. 6.

Shoots simple, twisted at the base, about one-third of an inch in height, divided by narrow twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ divergent, long, smooth, slightly narrowed towards the aperture, each forming, with its internode, a sub-fusiform body; aperture with three marginal teeth, one superior and two lateral.

Gonothecæ about twice as long as the hydrothecæ, borne on the stem or on the hydrorhiza, ovate, with a few large, tranverse rugæ, and a short, tubular neck, with three teeth on the summit.

Almost colourless. *Hab.* Williamstown.

S. INDIVISA. *n. sp.* Plate XII, fig. 7.

Hydrorhiza slender, shoots simple, twisted at the base, about one-third of an inch in height, divided by narrow twisted joints into intornodes, each bearing a hydrotheca on its upper part. Hydrothecæ divergent, with two or three faint transverse rugæ, sometimes nearly smooth; narrowed upwards and contracted near the aperture, which is furnished with three marginal teeth, ono superior and two lateral; also with three internal, compressed, vertical teeth, alternate with the marginal ones.

Gonothecæ three to four times the length of the hydrothecæ, borne on the hydrorhiza or near the base of the hydrocaulus, usually not moro than one on a stem; ovate, with distinct, not close, transverse rugæ, and a tubular neck; summit with from three to six teeth (generally four).

Colour, yellowish-brown. *Hab.* Williamstown; St. Kilda.

S. SOLIDULA. *n. sp.* Plate XII, fig. 8.

Hydrorhiza matted, sometimes so closely as to form a continuous expansion in parts; shoots simple, about half an inch in height, twisted at the base, and divided by slightly-twisted joints into swollen internodes, each bearing a hydrotheca on its upper part. Hydrothecæ divergent, smooth, contracted near the aperture, swollen below; aperture with three marginal teeth, one superior and two lateral, also with three internal, compressed, vertical teeth, alternating with those on the margin.

Gonothecæ borne on the stems, frequently three or four in a row, twice or three times the length of the hydrothecæ; ovate, with strong transverse rugæ and a tubular neck, with three indistinct teeth on the summit.

Colour, light brown; the polypidom thick and solid. *Hab.* Williamstown.

The gonothecæ vary much in the number and distinctness of the transverse rugæ, sometimes bearing a strong resemblance to those of the last species.

S. PYGMÆA. *n. sp.* Plate XII, fig. 9.

Hydrorhiza delicate, shoots simple, twisted at the base, about one-fourth of an inch in height; divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ divergent, tubular, or sub-conical, smooth; aperture not contracted, with three teeth, one superior and two lateral.

Gonothecæ about three times the length of the hydrothecæ, borne two or three on a stem; with close, strong, double transverse rugæ their whole length, and a short, tubular neck, with entire margin, rising from within the uppermost of the transverse rugæ; the narrow interspace between the double costæ closely striated.

Colour, yellowish-brown. *Hab.* Queenscliff; Griffiths' Point, (Mr. Goldstein).

This species closely resembles *S. Johnstoni*, Gray, in the form of the calycles, but differs in its minute size and simple habit.

S. MACROTHECA. *n. sp.* Plate XIII, fig. 1.

Shoots simple, about half an inch in height, twisted at the base, divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ very large, close, smooth, slightly divergent, both series directed towards the front; aperture contracted, with three inconspicuous marginal teeth; three internal, compressed vertical teeth within the front margin, extending about one-third across the cell, the central one largest;

similar teeth, but single and narrower, within each of the other two sides of the aperture.

Gonothecæ sub-globular, between two and three times as long as the hydrothecæ, with a few distant, transverse rugæ; summit truncate.

Colour, brown, very dark and opaque before preparation. *Hab.* Griffiths' Point (Mr. Goldstein.)

Each gonotheca was surmounted by a globular body about equal to it in size, which is probably an external marsupium, but which could not be seen distinctly, owing to its being coated with sand and other foreign matter.

THUIARIA, Fleming. T. LATA. *n. sp.* Plate XIII, fig. 2.

Shoots pinnate, sometimes branched, one or two inches in height; stem fascicled towards the base, divided into internodes, each of which bears a single hydrotheca on one side, and a pinna between two hydrothecæ on the other. Pinnæ alternate, not close, long, straight, narrow at point of junction with the stem; divided into internodes of various lengths. Hydrothecæ tubular, adnate their whole length; base not divided off from the cavity of the hydrocaulus; aperture oblique, with two lateral teeth, sometimes nearly obsolete.

Gonothecæ? Colour, whitish. *Hab.* Griffiths' Point (Mr. Goldstein).

Family, PLUMULARIIDÆ, Hincks.

HALICORNOPSIS. *n. gen.*

Hydrothecæ unilateral, uniserial, with a single sarcotheca attached to the front of each; no other sarcothecæ on the polypidom.

Gonothecæ without corbulæ.

H. AVICULARIS. *n. sp.* Plate XIII, fig. 3.

Polypidom irregularly branched, five or six inches in height, pinnate; pinnæ alternate, nearly straight, ascending; one or two on an internode. Hydrothecæ cup-shaped, shallow, set at an angle of about 45°, the margin expanding, with three spine-like teeth, two lateral and one anterior; the latter long, beak-like in lateral view, tubular, with the front produced downwards into the hydrotheca, forming an intrathecal ridge. Sarcothecæ short, bract-like, situated about the middle of tho front of the hydrotheca, and subtending an aperture in it; completely open on the inner side.

Gonothecæ entire, ovate, borne in long rows on the stem at the bases of tho pinnæ, directed slightly towards opposite sides alternately.

Colour, light or dark brown. *Hab.* Griffiths' Point (Mr. Goldstein); Robe and Point Elliott, S.A.? (Mr. Smeaton).

Tho sarcotheca in this species differs from those of some *Aglaopheniæ*, in which a wido opening is formed by the confluence of the lateral and terminal apertures. It is not an incomplete tube, but a mere bract, placed opposite tho orifice in the hydrotheca, and is attached by its base only. It may sometimes be seen projecting at right angles from the hydrotheca, having been accidentally pushed out of its proper position. Tho long anterior tooth of the hydrotheca somewhat resembles the anterior sarcotheca of *Aglaophenia*. I have seen a true *Aglaophenia* in which the anterior tooth was similarly elongated, while the sarcotheca was quite small.

Aglaophenia, Lamouroux.

The different species of *Aglaophenia* which I have obtained on our shores have all many characteristics in common. They are mostly furnished with a long mesial sarcotheca, often double the length of the calycle; and whether long or short, this sarcotheca has, except in *A. parvula*, two distinct external apertures; besides which, in some species, there is a third aperture, communicating with the cavity of the calycle. Kirchenpauer's sub-genus *Macrorhynchia* was formed to include those species distinguished by a long mesial sarcotheca, with two external apertures, and also by having tho gonothecæ unprotected by corbulæ. Professor Allman has pointed out that these characteristics are not always combined, as his *A. acanthocarpa* possesses the long sarcotheca, with two apertures, but has the gonothecæ protected by well-developed corbulæ. *A. plumosa* and *A. McCoyi*, described in this paper, agree in both these points with *A. acanthocarpa*. Moreover, some of our species are furnished with sarcothecæ only about as long as the calycle, which, nevertheless, have two apertures, and one of these—*A. divaricata*, Busk—has open corbulæ resembling those of *A. McCoyi.* An interesting form from Port Darwin has a lenticular gonotheca on every third pinna of each series, borne near the base; the pinna, which bears, instead of hydrothecæ, two series of sarcothecæ, being recurved and directed forwards in such a manner as to generally overarch the next gonotheca in front, the separate elements of the corbula being thus scattered along the stem, instead of being combined on a single branch. This species also is provided with sarcothecæ with two orifices. *A. parvula* usually has the mesial sarcotheca channelled in front; in other words, the lateral and terminal apertures are united by an opening more or less wide. Sometimes, however, this opening is represented by a mere crack in the chitinous tube. The transition to this form from those with two distinct apertures is well shown in *A. prolifera.* In that species the mesial sarcothecæ are normally somewhat longer than the hydrothecæ, and have two distinct orifices; but when, as often happens, they are considerably shortened, the two apertures become completely confluent, forming the so-called canaliculate nematophore. In those of intermediate length, the two orifices are connected by a crack or slit.

I am not aware whether any author has alluded to the presence of more than one aperture in the lateral sarcothecæ, but nearly all the species that I have been able to examine are furnished with two, or in some cases with three. Usually there is a subtubular terminal orifice, with a lateral one less distinct, which in *A. parvula* and *A. Thompsoni* is continued forward till it unites with the terminal one, the circular outline of which is interrupted at the point of junction. A small species, parasitic on *A. divaricata*, shows the transition in the laterals exactly as *A. prolifera* does in the mesial sarcothecæ. The laterals in *A. superba* and *A. ascidioides* are provided with two sub-tubular orifices, in addition to which, the whole front of the sarcotheca is completely free, forming a wide aperture, extending even beneath the part of the margin which bears the tubular ones. *A. prolifera* is similarly formed, except that in the laterals there is only one tubular aperture instead of two; but in the cauline sarcothecæ of this species as many as three of these sub-tubular orifices are found bordering the free margin. In forms like these the wide opening in front appears to represent the ordinary lateral aperture, and the repetition of the terminals is similar to what occurs in *A. plumosa*, where the proximal sarcothecæ of the gonangial pinnules frequently bifurcate about the middle, thus presenting two terminal orifices.

Altogether, I have ten species from our own shores and two from Port Darwin, and in all, except *A. parvula*, the lateral and terminal apertures are separate in tho mesial sarcothecæ, while in the laterals they are separate in all except *A. parvula* and *A. Thompsoni*; and in both these species the form of the aperture shows plainly that they are the result of the union of the ordinary terminal and lateral orifices. I have seen only one species in which the sarcothecæ show no indication of the lateral aperture—a species closely allied to *A. myriophyllum*, if not identical with it. Its locality is unknown, but it probably came from the seas to the north of Australia. Tho absence of lateral orifices in this form is explained by the fact that the sarcothecæ are all truncated so far down that tho terminal orifices are below the point at which the laterals are usually found. On tho whole, it would appear that the species with lateral and terminal openings to each sarcotheca represent tho typical aspect of tho genus, and that the lateral apertures aro only wanting when the shortness of the sarcotheca causes them to be completely merged in the terminal ones. Even in species which have usually more than one orifice to the sarcothecæ it frequently happens, when these are short, that the orifices are united by a fracture-like opening. The lateral apertures appear to be the more constant of the two, as, in several of our species, the sarcothecæ of both kinds near the distal ends of the pinnæ are frequently found with tho ends closed and entire, while the latoral orifices are open. In these cases, the mesial sarcotheca is usually shorter than the ordinary open-pointed ones on the other portions of the polypidom, but the laterals, on the contrary, are apt to be much longer and stouter, either with or without the suppression of the terminal orifice.

The form which I have described as *A. parvula* is peculiarly interesting from the structure of the corbula, which, in some cases, is formed on the type of *A. pluma*, or rather *A. tubulifera*, and in others consists of free leaflets or broad pinnules, with a series of sarcothecæ fringing each margin. Theso different modifications, which form the bases of Mr. Hincks' sections of the genus, are found in shoots of the same cluster, which in all other points of structure are identical, and they enable us to trace with ease tho transition from one type to the other, though I can see no indication to show whether development has proceeded from the closed to the open corbulæ, or *vice versa.* The closed forms consist of two series of pinnules, or leaflets, which bear a row of sarcothecæ on their distal edges only, and which are completely united to each other throughout their whole length, forming a pod-like receptacle. When, however, each leaflet is separate and free, the sarcothecæ are developed on both edges, though not always to the same extent, the proximal margin often being nearly free from them towards the base, while the pinnules occasionally appear to be slightly attached to each other at one or two points in the same part, though free throughout the rest of their length. It is noticeable that the pinnules in the open corbulæ of *A. plumosa* and *A. McCoyi*, also of *A. divaricata*, Busk, are always devoid of sarcothecæ on the proximal side, near the base.*

Another point which I have not seen mentioned is the existence in certain species of minute, claw-shaped denticles, projecting into the cavity of the hydrotheca at or near the base, and forming two small groups or series. They appear to partly surround the opening which connects the cavity of the hydrotheca with that of the pinna, and may possibly serve as points of attachment for the hydranth. To distinguish them, it is sometimes necessary to heat

* I have recently received from Mr. Goldstein a beautiful little *Aglaophenia* from Fiji, which I mention principally on account of its peculiar corbula. The species is about an inch in height, light brown, branched, with straight, approximate, alternate pinnæ; the stems without distinct joints, though towards the summit there are faint indications of them. The calycles are peculiar in form, lying along the pinnæ, and deeply constricted in the middle of the upper side, the constriction representing the intrathecal ridge, which in some species occupies the same position, and which is simply a constriction with its walls coalescent, forming a partial septum. The anterior sarcotheca is rather long, rising principally from the calycle, and directed forwards and slightly upwards; the laterals are tubular, pointing forwards, and springing from under the calycle, so that their position is further towards the back of the pinna than is usually the case; in both kinds the terminal and lateral orifices are united by a narrow slit. The aperture is somewhat expanding, with three teeth on each side and an incurved one in front, and

the polypidom for a few minutes in diluted liquor potassæ, afterwards agitating it in pure water to get rid of the remains of animal matter.

Every species of *Aglaophenia* which I have seen has two sarcothecæ on the stem, near the base of each pinna, and *A. parvula* and an English species differing little from it (*A. pluma ?*) have, in addition, a single small one on the pinnæ, near the base. These cauline sarcothecæ, which are similar to the laterals, caused me considerable perplexity on my first examination of these forms, as, in Mr. Hincks' "British Hydroid Zoophytes," it is repeatedly stated that in *Aglaophenia* the nematophores are appendages of the hydrotheca *only*, this being the principal characteristic by which the genus is there distinguished from *Plumularia*.

The name "*Aglaophenia*" is applied in this paper to all such forms as would be included under it in Mr. Hincks' classification. *A. Thompsoni*, and probably several other species here described, would come under the genus *Halicornia*, Busk, as modified by Mr. Allman; but as the gonangia are in most cases absent, it is more convenient to follow the older system, and class them as *Aglaopheniæ*.

A. SUPERBA. *n. sp.* Plate XIII, fig. 4.

Polypidom irregularly branched, pinnate, about six or eight inches in height; pinnæ close, long, straight, ascending, subalternate, a pair to each internode. Hydrothecæ set at an angle of of about 60°, upper part somewhat bent upwards from the pinna;

is separated from the anterior nematophore by the constriction mentioned above. There is also a slight constriction on the under side of the calycle, near the proximal end, with wrinkles proceeding from it partly across the cell and the pinna. The corbula, however, is the most remarkable feature of the hydrosoma. It consists of four or five pairs of broad leaflets, lobed at the margins, those adjacent being united to each other by the lobes, leaving the interstices open; a very large lobe is near the base of each leaflet, on the distal side. The edges of the leaflets may be serrated with nematophores or free from them, and on the upper part the nematophores are not confined to the margins, but are scattered over the surface, usually, however, being arranged in two or three short linear series. Below the large lobe of each leaflet there is a deep sinus, in which is seated a hydrotheca, resembling those on the ordinary pinnæ, except in the absence of the anterior sarcotheca. The gonangial pinna bears a single hydrotheca below the corbula.

If undescribed, I would propose for this species the name of *A. heterocarpa*.

a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture with three everted teeth on each side, a broad, rounded tooth or lobe behind, and usually a minute tooth in front; a group of several minute denticles within the front of the cell near the base, directed upwards, and a similar group a little above, pointing downwards. Mesial sarcotheca stout, rising from the pinna, about twice the height of the hydrotheca, to which it is adnate up to the margin, upper part curved and generally produced forwards parallel with the pinna, with terminal and lateral apertures, the latter sub-tubular. Lateral sarcothecæ short and broad, with two sub-tubular orifices, one directed forwards, the other upwards; front margin completely free, forming a wide aperture. Cauline sarcothecæ similar to the laterals, two on the stem at the base of each pinna.

Gonothecæ? Colour, brown. *Hab.* Griffiths' Point (Mr. Goldstein).

The anterior sarcothecæ are generally produced as in the next species, but not quite to the same extent. Those resembling the figure are mostly found near the ends of the pinna, the transition being gradual. The teeth of the calycle vary somewhat in size and relative position.

A. ascidioides. *n. sp.* Plate XIII, fig. 5.

Shoots from one inch and a half to two inches in height, pinnate; pinnæ close, opposite, straight, ascending, a pair to each internode. Hydrothecæ set at an angle of about 60°, a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture with two everted teeth on each side, a small incurved one in front, and a long upright one behind; a group of several minute denticles within the front of the cell near the base, directed upwards, and a similar group a little above, pointing downwards. Mesial sarcotheca stout, rising from the pinna, adnate to the hydrotheca up to its margin, rising considerably above it, and then continued forward parallel with the pinna till it nearly reaches the next sarcotheca in front; slightly tapering, with terminal and lateral apertures, the latter subtubular. Lateral sarcothecæ short and broad, with two subtubular orifices, one directed downwards, at right angles to the hydrothecæ, the other pointing upwards in a line with it; front margin completely free, forming a wide aperture. Cauline sarcothecæ similar to the laterals, two on the stem at the base of each pinna.

Gonothecæ? Colour, bright reddish-brown. *Hab.* Queenscliff.

This form is closely allied to *A. superba*, but is much smaller, and differs in the number and arrangement of the teeth of the calycle, &c. I have met with but few specimens, and do not know whether it occurs with a branching habit. The name was suggested by the ascidian-like form of the lateral sarcothecæ.

A. ILICISTOMA. *n. sp.* Plate XIV, fig. 4.

Shoots in clusters, one to two inches in height, pinnate; pinnæ curved towards the tips, close, sub-alternate, two on each internode. Hydrothecæ cup-shaped, set at an angle of about 55°; aperture with six teeth on each side; the first, fourth and fifth from the front everted, the second, third and sixth incurved; the sixth on each side placed towards the back of the hydrotheca, and curved forwards, so that the two appear in lateral view like one median tooth; a single broad, incurved tooth in front: a group of two or three minute denticles within the front of the hydrotheca near the base, and a smaller group just below. Mesial sarcotheca stout, slightly tapering, rising from the pinna, adnate to the hydrotheca up to its margin, rising vertically above it, then curved forward and continued parallel with the pinna till it nearly reaches the next sarcotheca in front; with terminal and lateral orifices, the latter sub-tubular. Lateral sarcothecæ short, ovate, with a sub-tubular orifice directed forwards, and a lateral one on the inner side. Cauline sarcothecæ similar to the laterals, two on the stem at the base of each pinna.

Gonothecæ? Colour, light brown. *Hab.* Queenscliff; Robe, S. A.? (Mr. Smeaton).

The teeth of the calycle, pointing in different directions, and somewhat resembling holly-spines, suggested the specific name.

A. THOMPSONI. *n. sp.* Plate XIV, fig. 1.

Shoots in dense tufts, about two inches in height, pinnate, usually branched, stems with short internodes, each bearing a pair of close opposite or sub-alternate pinnæ, curved towards the tips. Hydrothecæ cup-shaped, tapering towards the base, set at an angle of about 50°; aperture with three slightly everted teeth on each side, and a slender incurved tooth in front: three or four minute denticles in a group at the base of the hydrotheca, and a similar group a little above. Mesial sarcotheca, a long slender tube, not tapering, rising from the pinna to double the height of the hydrotheca, to which it is adnate up to the margin; upper part curved and generally produced forwards parallel with the pinna; two orifices, lateral and terminal. Lateral sarcothecæ short, ovate, pointed behind, truncate or sub-tubular in front, canaliculate. Cauline sarcothecæ similar to the laterals, two on the stem at the base of each pinna.

Gonothecæ, borne in rows at the bases of the pinnæ, small, membranous, somewhat pyriform, truncated above.

Colour, light brown. *Hab.* Griffiths' Point (Mr. Goldstein); S. Australia (Mr. Smeaton).

I have named this species after Mr. D'Arcy W. Thompson, who has described a number of Sertularians from Australia and New Zealand. The mesial sarcothecæ are rather variable in length, often being produced forwards like those of the last two species. The gonothecæ resemble those of *A. pennatula.*

A. PROLIFERA. *n. sp.* Plate XIV, fig. 5.

Stems thick, six or seven inches in height, pinnate, sometimes giving off small branches, especially near the summit; pinnæ close, straight, ascending, alternate or sub-alternate, two on each internode. Hydrothecæ deep, cup-shaped, tapering towards the base, set at an angle of about 35°; aperture with a nearly erect tooth in front, and three on each side, the first and second from the front everted; two series of minute denticles in the basal part of the cell. Mesial sarcotheca generally somewhat longer than the hydrotheca, rising mainly from it, but continuous with the pinna by a small part of its base; adnate to the hydrothecæ up to its margin, and projecting from it, tapering, with lateral and terminal apertures, which are sometimes united. Lateral sarcothecæ flask-shaped, adnate by their base to the hydrotheca, with a tubular orifice directed downwards at right angles to it; the front margin completely free from the pinna, forming a wide aperture. Cauline sarcothecæ, two on the stem at the base of each pinna, similar in structure to the laterals, the upper one larger; the lower usually with two, and the upper with three small sub-tubular orifices close to the upper margin, which is completely free, as in the laterals.

Gonothecæ? Colour, brown. *Hab.* Queenscliff.

(See the remarks on this species in the preliminary note on the genus.)

A. PARVULA. *n. sp.* Plate XIV, fig. 3.

Hydrorhiza stout, shoots attaining a height of nearly an inch, pinnate; pinnæ close, alternate, straight, ascending, each springing from the lower part of an internode, and both series borne towards the front of the stem. Hydrothecæ urceolate, narrowed towards the base, set at an angle of about 35°; a fold or constriction crossing the back part of the cell in a direction vertical to the pinna; aperture sub-plicate, with five teeth on each side, the first from the front everted, and an incurved slender one in front. Hydrothecal internodes narrowest at the proximal end, with two folds or constrictions partly surrounding them; one transverse, opposite the fold in the hydrotheca, the other directed obliquely forward from the base of the lateral sarcothecæ. Mesial sarcotheca about as long as the hydrotheca, and projecting from it, adnate to the hydrotheca to within a short distance from the aperture, and mainly rising from it, but continuous with the pinna by a small part of its base; obliquely truncate, canaliculate, with an orifice communicating with the hydrotheca immediately below the external aperture. Lateral sarcothecæ short, canaliculate, directed forwards, the teeth of the hydrotheca projecting beyond them. Cauline sarcothecæ, two on the stem at the base of each pinna resembling the laterals; one on the basal part of each pinna, small, tubular, not open at the side.

Gonangial pinna bearing a single hydrotheca below the corbula, with a joint above and below it, the rest of the pinna not jointed. Corbulæ of two kinds—(*a*), with six or seven pairs of broad leaflets completely united and forming a closed pod, as in *A. pluma*, the distal edge of each leaflet fringed with short, stout, tubular, canaliculate sarcothecæ; a free pinnule springing from the proximal rib of the corbula on one side, directed forward parallel with the pinna, and near it, with a series of sarcothecæ on each side; (*b*), with all the leaflets free, bordered with sarcothecæ on both edges, forming an open corbula.

Colour, yellowish brown, upper part very pale. *Hab.* Queenscliff (W. M. B., Mr. Goldstein).

This species very closely resembles a British one sent to me by Mr. Barnard, and said to be *A. pluma*, though I cannot identify it with Mr. Hincks' figures of either that species or *A. tubulifera.* It agrees with *A. parvula* in the form and size of the lateral sarcothecæ, in the two constrictions of the hydrothecal internode, and in the opening from the calycle to the mesial sarcotheca; and in all these points they differ from Mr. Hincks' figures of *A. pluma*, especially in the lateral sarcothecæ, which he shows very minute. In both species these organs appear in front view like those of *A. tubulifera* in form, but they are almost entirely concealed beneath the hydrotheca, and can only be seen by focussing down through it; while in *A. tubulifera*, as represented by Mr. Hincks, they are free from the calycle, and project in advance of it. In the English species referred to, the front of the calycle is incurved between the mesial sarcotheca and the aperture, and all the marginal teeth of the latter are much everted; in *A. parvula* the median tooth is incurved, and the two next to it are the only ones noticeably everted; in the English species there are four teeth on each side, in *A. parvula* five; in the latter, the two posterior teeth on each side are large, generally projecting considerably in advance of the lateral sarcothecæ; in the former, these teeth are much smaller than those near the front, the last one usually proceeding parallel with the sarcotheca, and close to it, and not projecting beyond it. The lateral sarcothecæ seem a trifle more erect in the English species, and being opposite to the incurved front, the calycle appears in lateral view more narrowed below the aperture than in *A. parvula.* Both species agree in the cauline sarcothecæ. *A. parvula* is usually about half an inch in height, and principally remarkable for the different modifications of the corbula which it presents.

A. McCoyi. *n. sp.* Plate XIV, fig. 2.

Shoots nearly an inch in height, pinnate; pinnæ approximate, nearly straight, ascending, alternate, one to each internode, both series borne towards the front of the stem. Hydrothecæ set at an angle of about 35°; urceolate, with an intrathecal ridge rising from a little below the centre of the lower side, and extending nearly half across its cavity, parallel with the aperture, and continuous with an incomplete septum extending into the hydrothecal internode; the part of the hydrotheca behind the intrathecal ridge not separated from the pinna; aperture with four teeth on each side, the first and second from the front more everted than the others; a slightly incurved tooth in front with a delicate, compressed, secondary tooth rising erect from it. Mesial sarcotheca rising from the pinna and hydrotheca to nearly double the height of the latter, to which it is adnate up to the margin; free part curved slightly forwards, the summit widened transversely, with the extremities curved forwards in a crescentic form; two orifices, lateral and terminal, and a third communicating with the cavity of the hydrotheca immediately below the external lateral aperture. Lateral sarcothecæ tubular, rising as far as the margin of the hydrotheca, directed forwards and upwards, those at the distal ends of the pinnæ usually much enlarged; two orifices, lateral and terminal. Cauline sarcothecæ similar to the laterals, large, two on the stem at the base of each pinna.

Gonangial pinnæ, with ten or fifteen pairs of alternate pinnules, each borne on a short internode, and furnished with two lateral series of sarcothecæ, resembling the laterals on the hydrothecæ, but much larger; sarcothecæ opposite, the two proximal ones on the distal side of each pinnule without corresponding ones on the opposite side; pinnules with obscure joints, plainer above the first and second sarcothecæ; two sarcothecæ on the pinna at the base of each pinnule. The two series of pinnules much arched, meeting at the tips, and forming an open corbula. A single hydrotheca on each gonangial pinna below the corbula.

Colour, brown. *Hab.*, Queenscliff: Robe, S.A.? (Mr. Smeaton.)

This species is dedicated to Professor McCoy. It does not usually exceed three-quarters of an inch in height, but I have seen a branched variety attaining a height of an inch and a half.

A. PLUMOSA. *n. sp.* Plate XIV, fig. 6.

Shoots in clusters, pinnate, about an inch in height; pinnæ alternate, recurved, approximate, one on each internode. Hydrothecæ parallel with the pinna in their longest diameter, crossed in in the back part by a fold or constriction vertical to the pinna; aperture nearly parallel with the pinna, each side forming a broad sub-angular lobe, everted; a long, nearly erect tooth in front. Hydrothecal internodes smaller at the proximal end, with two deep constrictions extending almost round them, one transverse, opposite the constriction of the hydrotheca, the other directed obliquely forwards from the base of the lateral sarcothecæ, generally a third midway between them. Mesial sarcotheca rising partly from the pinna, but mainly from the arched front of the hydrotheca, to which its base is adnate as far forward as the aperture; projecting forward at an angle of about 70° with the pinna, the free part about equal in length to the shorter diameter of the hydrotheca; narrowed near the lateral orifice, and somewhat swollen between that and the terminal one, with an orifice communicating with the cavity of the hydrotheca immediately below the external lateral aperture; base in front produced downwards into a short septum or ridge in the hydrotheca. Lateral sarcothecæ somewhat similar to the mesial in form, rising considerably above the margin of the hydrotheca, to which they are adnate; divergent, directed upwards and slightly forwards, with two apertures, lateral and terminal. Cauline sarcothecæ, two on the stem at the base of each pinna, conical, with lateral and terminal apertures united.

Gonangial pinnæ usually two or three on a shoot, recurved, bearing about fifteen or twenty pairs of alternate pinnules, each springing from a short internode, and furnished with two lateral series of sarcothecæ, resembling the mesial ones of the hydrothecæ; sarcothecæ opposite or sub-alternate, the two proximal ones on the distal side of each pinnule without corresponding ones on the opposite side; pinnules jointed above the proximal sarcotheca, which is larger than the others and often bifid. Two conical sarcothecæ on the pinna at the base of each pinnule. The two series of pinnules slightly arched, meeting at the points, and forming an open corbula, surrounding the delicate ovate gonothecæ. A single hydrotheca on each gonangial pinna below the corbula.

Colour, light brown. *Hab.*, Queenscliff; Aldinga, S.A.? (Mr. Smeaton).

PLUMULARIA. Lamarck.

Our native species of *Plumularia* differ considerably from the British. One is simple in habit, two or three possess more or less developed intrathecal ridges, and several belong to that section of the genus which is distinguished by bearing only one calycle on each pinna, and which is represented by *P. obliqua* only among British species. Another form which I have found at Williamstown appears not to be specifically distinct from *P. obliqua*. Its stem is nearly half an inch in height, and is often produced upwards into long thick tendrils, having a similar structure to that of the hydrorhiza.

P. INDIVISA. *n. sp.* Plate XV, fig. 1.

Shoots flaccid, simple, rising from a dense network of filiform radical fibres, and obtaining a height of one-half or three-fourths of an inch; proximal part naked, upper part divided by oblique joints into long internodes, each bearing a hydrotheca near its lower extremity. Hydrothecæ distant, cup-shaped, set at an angle of about 40°, base wide and rounded, aperture entire. Sarcothecæ bithalamic, one at each side of the hydrotheca, pedunculate; one in front, and one about midway between every two hydrothecæ, on the same internode as the lower.

Gonothecæ: female, ovate, nearly three times as long as the hydrothecæ; male, as broad as the female, but shorter, flabelliform; both kinds with two lateral sarcothecæ near the pedicle.

Hydrorhiza and proximal part of the shoots brown, upper part transparent and nearly colourless. *Hab.*, Williamstown.

P. PRODUCTA. *n. sp.* Plate XV, fig. 3.

Hydrorhiza stout, shoots about one-third of an inch in height, pinnate; pinnæ alternate, one borne about the middle of each internode. Hydrothecæ set at an angle of about 30°, cup-shaped, but with the back part much produced upwards; front wall of the cell doubled inwards just below the aperture, and continued into a transverse septum or intrathecal ridge, which extends more than half across the cavity of the cell; aperture entire, expanded in front. Sarcothecæ bithalamic, one in front of each hydrotheca only.

Gonothecæ? Transparent, almost colourless, shrivels when dry. *Hab.* Queenscliff.

P. SETACEOIDES. *n. sp.* Plate XV,, fig. 4.

Hydrorhiza stout, with waved margins, shoots pinnate, from one to three inches in height. Pinnæ recurved, alternate, borne near the summits of the internodes, and transversely wrinkled. Hydrothecæ distant, set at an angle of about 40°, cup-shaped, with entire margins. Sarcothecæ bithalamic, with slender pedicles, two abreast behind and one in front of each hydrotheca, one on a separate short internode between every two hydrothecæ, one at the base of each pinna, and one on the lower part of each stem-internode. A short proximal internode on each pinna without appendages.

Gonothecæ large (eight or nine times as long as the hydrothecæ), obliquely truncated a little above the broadest part, transversely rugose, borne at the bases of the pinnæ, often forming two rows extending half-way up the stem.

Pale yellowish brown, or colourless and transparent. *Hab.* Williamstown, Queenscliff.

There appear to be two varieties of this species, one very lax and delicate, two or three inches in height, and resembling Mr. Hincks' figure of *P. setacea*, the other not more than an inch in height, with setaceous pinnæ, equal all up the stem, and only about one-twenty-fourth of an inch in length. This small form was from Queenscliff, and so closely resembles the other in minute structure that I do not think they can be separated, unless the gonothecæ, which I have not yet seen, should prove different from those of the larger form. The trophosome of this species seems scarcely to differ from that of *P. setacea*, except that the nematophores of the latter are more slender, and the laterals are raised higher above the margin of the calycle. The gonothecæ somewhat resemble those of *P. halecioides*.

P. DELICATULA. *n. sp.* Plate XV, fig. 2.

Hydrorhiza with waved margins, stems slender, pinnate, about an inch in height; pinnæ alternate, one borne near the summit of each internode, transversely wrinkled. Hydrothecæ nearly parallel with the pinna, urceolate, contracted towards the oblique entire aperture. Sarcothecæ bithalamic, with slender pedicles, two abreast behind and one in front of each hydrotheca, one on a separate short internode between every two hydrothecæ, one on the lower part of each stem-internode, two in each axil, and a few slender, tubular ones on the hydrorhiza. A short proximal internode on each pinna without appendages.

Gonothecæ? Colour, yellowish brown, pale, transparent. *Hab.* Griffiths' Point (Mr. Goldstein).

P. Goldsteini. *n. sp.* Plate XV, fig. 7.

Hydrorhiza delicate, flat, with transverse markings at short intervals along the margins; shoots pinnate, about one-sixth of an inch in height; pinnæ alternate, gracefully recurved, one borne near the summit of each internode. Hydrothecæ, three or four on a pinna, rather distant, the base raised on a vertical process of the pinna, and the body of the cell thence directed downwards to the pinna, where it is recurved and terminates in an aperture looking directly upwards; the base of the hydrotheca separated from the process of the pinna by an oblique septum, which is continued for a short distance into the cell, forming a rudimentary intrathecal ridge; three or four slight constrictions in the pinna, radiating from the hydrotheca. Sarcothecæ bithalamic, with slender pedicles, one slightly below the middle of each stem-internode, one in each axil, two abreast behind, and one in front of each hydrotheca, and one between every two hydrothecæ, on a separate short internode. A short proximal internode on each pinna without appendages.

Gonothecæ? Colour, pale yellowish, transparent. *Hab.* Queenscliff.

A very beautiful species, the back part of the calycle, with the process from the pinna, forming together an erect, nearly conical body, with a rounded summit.

P. hyalina. *n. sp.* Plate XV, fig. 9.

Hydrorhiza delicate, stems flexuous, pinnate, from one-third to one-half an inch in height; each internode usually with from one to four transverse wrinkles; pinnæ rather distant, alternate, one borne close to the summit of each internode, wrinkled transversely, and bearing each a single hydrotheca; distal part curving from under the hydrotheca, smooth; proximal internode short, without appendages. Hydrothecæ ventricose, the back bent inwards at the summit of the pinna, forming a cavity which is occupied by the sarcotheeæ; aperture at right angles to the hydrotheca and pinna, broadly notched behind. Sarcothecæ bithalamic, with slender pedicles, two abreast behind each hydrotheca, and one in front, the latter often obsolete.

Gonothecæ? Almost colourless, transparent. *Hab.* Queenscliff.

P. SPINULOSA. *n. sp.* Plate XV, fig. 8.

Hydrorhiza delicate, flat, with transverse markings at short intervals along the margins; shoots pinnate, about one-fifth of an inch in height; pinnæ alternate, each springing from about the middle of an internode, and bearing a single hydrotheca; distal portion curved, and abruptly contracted behind the hydrotheca to half the thickness of the lower part, contracted portion slightly constricted at two or three points on the inner side, and prolonged upwards into an incurved spine above the margin of the hydrotheca; proximal internode short, without appendages. Hydrothecæ compressed laterally, attached to the pinna by the back and part of the base; aperture at right angles to the cell and pinna; an intrathecal ridge springing from the back of the cell near the aperture, curved forwards and downwards nearly to the base of the cell. Sarcothecæ bithalamic, with slender pedicles, two abreast above the hydrotheca, one in front, one in each axil, and one on the lower part of each stem-internode; those in the axils and above the hydrothecæ with the upper chamber compressed, flabelliform.

Gonotheca? Colour, pale yellowish, transparent. *Hab.* Queenscliff.

P. PULCHELLA. *n. sp.* Plate XV, fig. 6.

Hydrorhiza dense, shoots crowded, pinnate, about one-fourth of an inch in height, transversely wrinkled; pinnæ alternate, each rising from about the middle of an internode, and bearing a single hydrotheca; distal part curving abruptly from under the hydrotheca, and widening towards the summit, with from one to three constrictions on the inner side; proximal internode short, without appendages. Hydrothecæ campanulate; margin entire, slightly everted, rising a little above the summit of the pinna, at right angles to it and the hydrotheca. Sarcothecæ bithalamic, with slender pedicles, two abreast above and one in front of each hydrotheca, and two in each axil.

Gonothecæ six or seven times the length of the hydrothecæ, ovate, obliquely truncate, the orifice surrounded by large, smooth internal teeth.

Colour, pale yellowish, transparent. *Hab.* Queenscliff.

P. COMPRESSA. *n. sp.* Plate XV, fig. 5.

Shoots pinnate, stem smooth, about one-fourth of an inch in height, pinnæ alternate, wrinkled transversely, each borne close to the summit of an internode, and bearing a single hydrotheca; distal part curved from under the base of the hydrotheca, smooth; proximal internode short, without appendages. Hydrothecæ much compressed laterally; aperture at right angles to the pinna and hydrotheca, sinuated behind down to the summit of the pinna. Sarcothecæ, two above and one in front of each hydrotheca, bithalamic, with slender pedicles; one in each axil, tubular, slender, very inconspicuous.

Gonothecæ about four times the length of the hydrothecæ, very convex behind, slightly concave in front; aperture in a line with the front, margin everted.

Colour, pale yellowish, transparent. *Hab.* Robe, S.A.? (Mr. Smeaton).

Since the publication of the preceding paper in a separate form I have added a few notes, which, owing to the delay in issuing the present number, I am enabled to include in it. I have obtained a quantity of fresh material collected at Queenscliff, severe gales having thrown ashore an unusually rich harvest of zoophytes and Bryozoa; these additions consist mainly of the more conspicuous forms, and their examination necessitates some slight modifications in a few of the specific descriptions. There are among them four or five *Sertulariæ* which appear to me to be new.

Having sent Mr. Busk some of our species for identification, he has very kindly forwarded me drawings of the species described in the "Voyage of the Rattlesnake," with mounted specimens of a number of them, thereby assisting me very materially.

I have to thank Mr. Haswell for a collection of Hydroids from various places on the east and north-east coasts of Australia, comprising fifteen or sixteen of those described by Mr. Busk, three of those in the preceding paper, and nine or ten others, most of which are probably new. Eight species common to the southern coast are included in this collection; of these one is from Botany Bay, one from Port Jackson, five from Port Stephens, and one—*Idia pristis* (Lamx.)—which is common on the north-east coast, is recorded (on the authority of Mr. Haswell) from Griffiths' Point.

I hope to furnish full descriptions of the species contained in this collection, also of the new *Sertulariæ* from Queenscliff, in future papers; at present I shall deal only with those species which are mentioned in the foregoing paper.

I have received from Mr. Smeaton some sea-weed covered with a luxuriant growth of *Plumularia compressa*, by which I am enabled to correct the somewhat erroneous description taken from mounted specimens; also a branch of *Idia pristis* from Port Darwin, with the curious campanularian parasite, formerly described as its gonotheca. I had previously noticed this hydroid (which strongly resembles the pyriform, transversely ribbed gonotheca of certain *Plumulariæ*) on one of Mr. Haswell's specimens of Idia, and ascertained its parasitic nature, and it appears from Mr. Busk's drawings that he had also noticed it.

I regret that I am still unable to ascertain whether any of the *Aglaopheniæ* which I have described are identical with those of Kirchenpauer, Mr. Halley having kindly endeavoured when in London to procure that author's papers on the Hydroida, but without avail.

Sertularia operculata, Lin. This species is common in Victoria, and Mr. Haswell's collection contains specimens from Port Stephens.

Sertularia flosculus, D'A. W. Thompson. Mr. Thompson suggests that this may be *S. divergens*, Lamx., and as it is the same as the species identified by Mr. Busk with *S. divergens* it will be advisable to retain that name for it. Mr. Busk's specimen is from Swan Island, Banks Strait.

Sertularia pulchella, D'A. W. Thompson. This is described as a minute species with one gonotheca to each hydrocaulus. The specimen erroneously (?) assigned by me to this species was small and barren, but a larger one since obtained from Queenscliff is five or six inches in height, with several gonothecæ.

Diphasia sub-carinata, Busk. Port Stephens (Mr. Haswell).

Sertularella divaricata, Busk. Port Stephens (Mr. Haswell).

Sertularella simplex, Hutton. Though the specimens found are simple in habit, I doubt whether it is distinct from *S. polyzonias.*

Thuiaria ambigua, D'A. W. Thompson. This name must be abandoned, as the species is no doubt the same as Mr. Busk's *Sertularia unguiculata.* His specimens were from Swan Island, Banks Strait, but it is one of our commonest species.

Aglaophenia divaricata, Busk. Port Jackson (Mr. Haswell).

Plumularia campanula, Busk. Port Stephens (Mr. Haswell), Williamstown.

Sertularia pumiloides, Bale. I am now inclined to consider this a variety of *S. minima*, D'A. W. Thompson, specimens from New Zealand appearing to be intermediate, but further examination will be necessary.

Thuiaria lata, Bale. Specimens recently obtained at Queenscliff are six to eight inches in height, with stems fully $\frac{1}{8}$ of an inch in diameter at the base. Port Stephens (Mr. Haswell).

Aglaophenia superba, Bale. The pinnæ are sub-alternate, sometimes nearly opposite. The calycle has normally three teeth on each side, but the pair next the back are sometimes obsolete, or nearly so. The circular apertures of the lateral sarcothecæ are often united with the wide opening in front, the upper one especially being sometimes quite merged in it. Fine tufts found at Queenscliff.

Aglaophenia ascidioides, Bale. This species, like the last, has three teeth on each side of the calycle, but the pair next the back are often obsolete, and the description was taken from such a specimen. The tubular orifices of the lateral sarcothecæ are sometimes united to the wide front aperture, but I have not found them entirely merged in it. The cauline sarcothecæ have sometimes three or four circular orifices.

Aglaophenia ilicistoma, Bale. The pinnæ are alternate or subalternate.

Aglaophenia Thompsoni, Bale. The pinnæ vary from alternate to nearly opposite, according to the length of the internodes from which they spring. Found at Queenscliff.

Aglaophenia prolifera, Bale. As in the last species the pinnæ vary from alternate to nearly opposite, a variation which will probably be found in most species which bear more than one pinna on an internode. Robust specimens from Queenscliff have the mesial sarcotheca fully double the length of the calycle, projecting from it and curved gracefully forwards. The cauline sarcothecæ may have either two or three circular orifices.

Aglaophenia parvula, Bale. The second tooth on each side of the calycle is often folded behind the third, so that under a low power they appear as one tooth.

Aglaophenia McCoyi, Bale. The calycle of this species is distinguished from that of *A. divaricata*, Busk, by the longer mesial sarcotheca expanded at the summit, and by the secondary tooth on the median tooth of the calycle. In the front view as figured, though the summit of the anterior sarcotheca is shown, the remainder of it, which should be continued down the front of the cell, is accidentally omitted.

Plumularia indivisa, Bale. This is identical with the stemless variety of *P. campanula*, Busk. Mr. Haswell's collection contains specimens from Port Stephens and Holborn Island, which are pinnate and five or six inches in height. The hydroid from Griffiths' Point, which I had supposed to be *P. campanula*, was considered by Mr. Busk to belong to that species, but the discovery of specimens with gonothecæ shows it to be distinct. Those of *P. campanula* are as shown under *P. indivisa*, while the large ones of the Griffiths' Point species are three-sided, or like a right-angled triangle in section, with a row of four or five sarcothecæ running down each of the narrower sides. Besides this there are differences in the trophosome which appear to be constant, the most patent being the thick stem with short internodes and both sets of pinnæ borne on the front, while the stem of the true *P. campanula* is much slenderer, with longer internodes and more distant pinnæ and calycles. I have found no gonothecæ on the pinnate form of *P. campanula*, but cannot hesitate to identify it with the stemless variety described as *P. indivisa*.

Plumularia setaceoides, Bale. Found at Botany Bay (Mr. Haswell).

Plumularia compressa, Bale. The calycles are only slightly compressed, and the anterior sarcotheca is larger than in the figure and not so projecting. The calycles are set on the pinnæ at right angles to the plane of the hydrocaulus, so that when it is laid flat on a slide they are seen in back or front view instead of laterally. Specimens received from Mr. Smeaton are half-an-inch in height.

EXPLANATION OF PLATES.

(The figures on these plates are from camera drawings of specimens mounted in Canada balsam.)

Plate XII.

Fig. 1. Sertularia minuta.
,, 2. ,, pumiloides.
,, 3. ,, bicornis.
,, 4. ,, acanthostoma, a pair of calycles from the main stem.
,, 5. ,, recta, part of pinna.
,, 6. Sertularella lævis.
,, 7—7a. ,, indivisa.
,, 8. ,, solidula.
,, 9. ,, pygmæa.

Plate XIII.

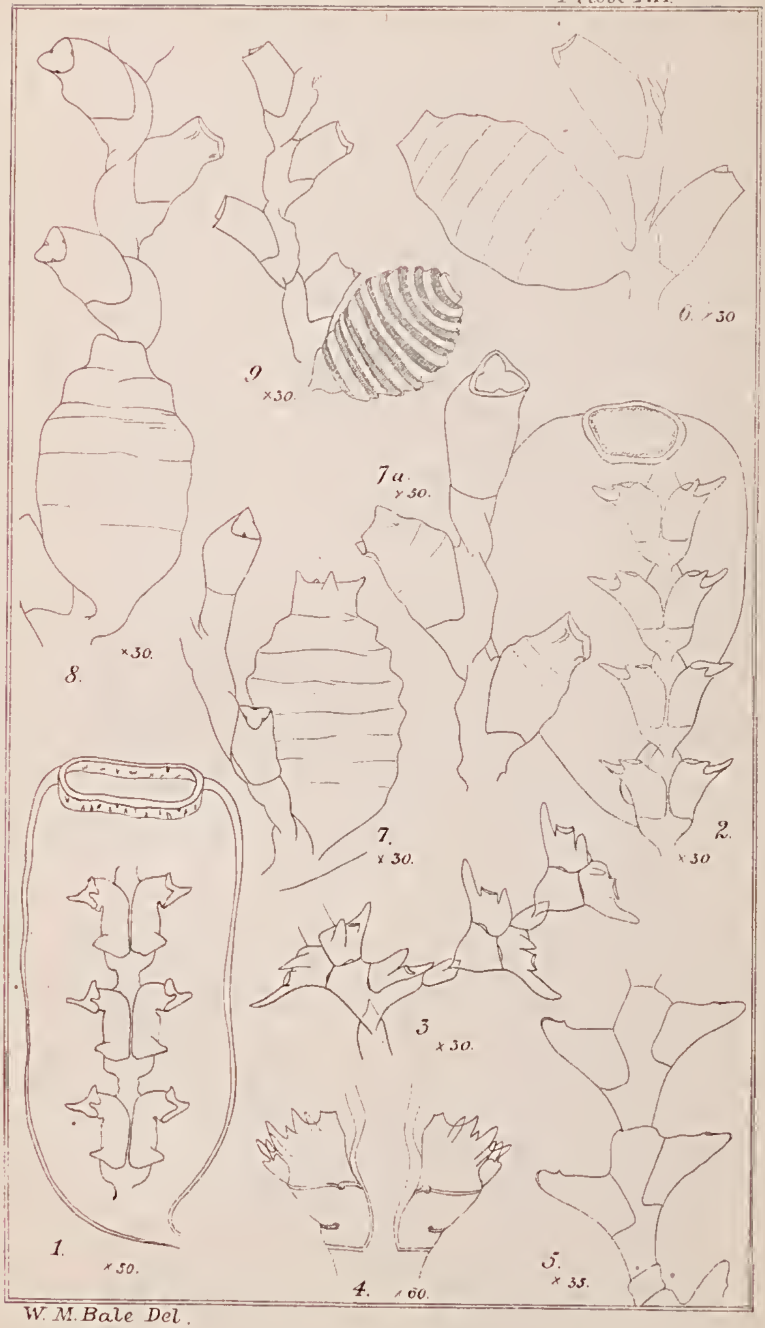
Fig. 1. Sertularella macrotheca.
,, 2. Thuiaria lata, part of pinna.
,, 3—3b. Halicornopsis avicularis (3b, gonotheca).
,, 4—4b. Aglaophenia superba.
,, 5—5b. ,, ascidioides.

Plate XIV.

Fig. 1—1a. Aglaophenia Thompsoni.
,, 2—2c. ,, McCoyi (2c, a pair of sarcothecæ of the corbula).
,, 3—3b. ,, parvula.
,, 4—4b. ,, ilicistoma.
,, 5—5a. ,, prolifera.
,, 6—6b. ,, plumosa (6b, sarcothecæ of the corbula).

Plate XV.

Fig. 1—1b. Plumularia indivisa (1a, female gonotheca; 1b, male do.)
,, 2—2a. ,, delicatula.
,, 3. ,, producta.
,, 4—4b. ,, setaceoides (4b, gonotheca).
,, 5—5a. ,, compressa (5a, gonotheca).
,, 6—6a. ,, pulchella (6a, gonotheca).
,, 7—7a. ,, Goldsteini.
,, 8—8a. ,, spinulosa.
,, 9. ,, hyalina.



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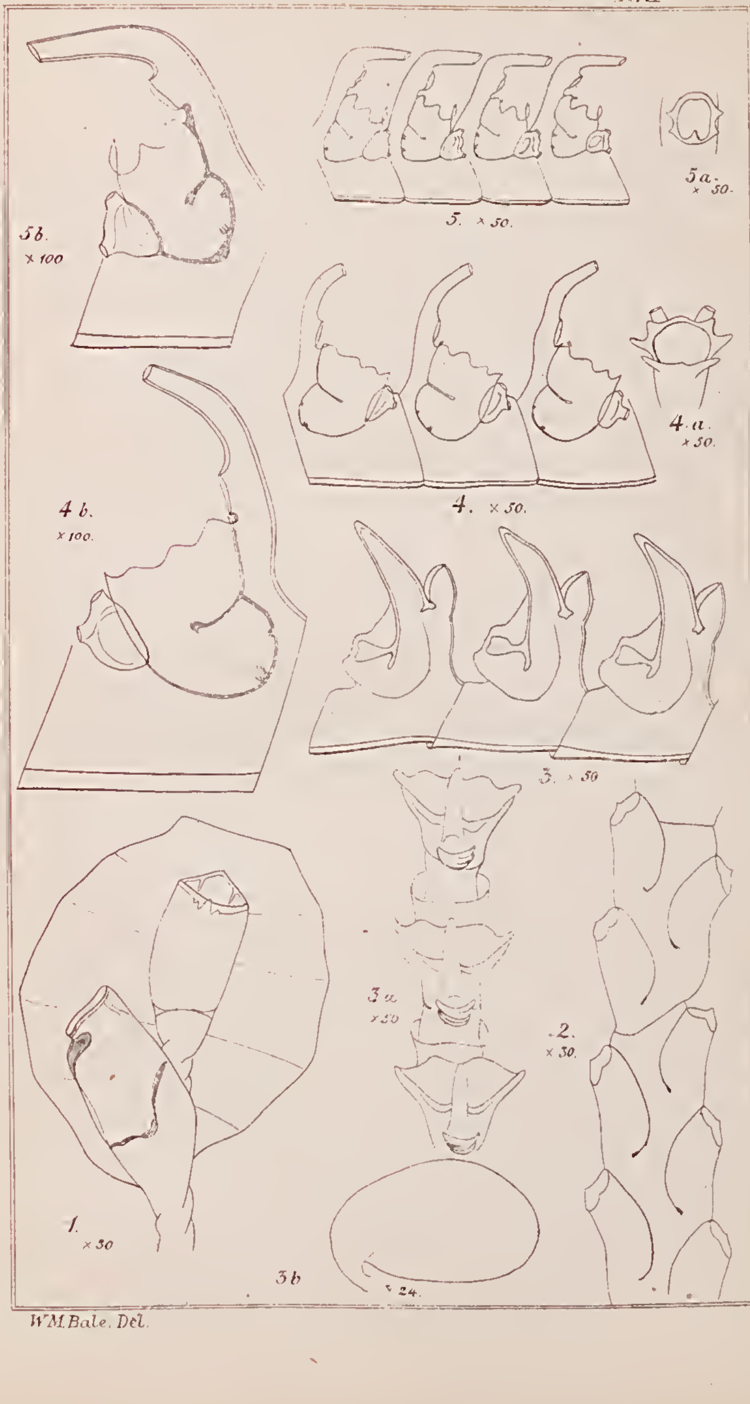

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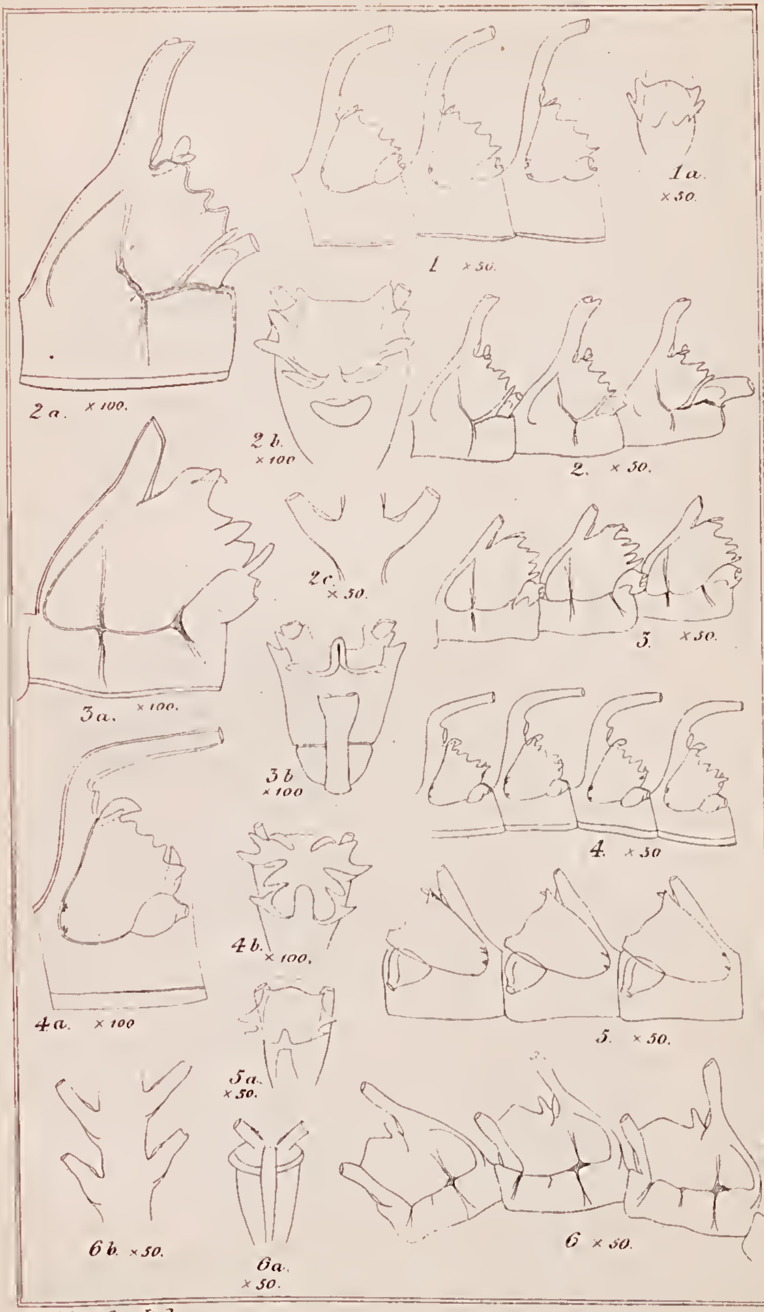
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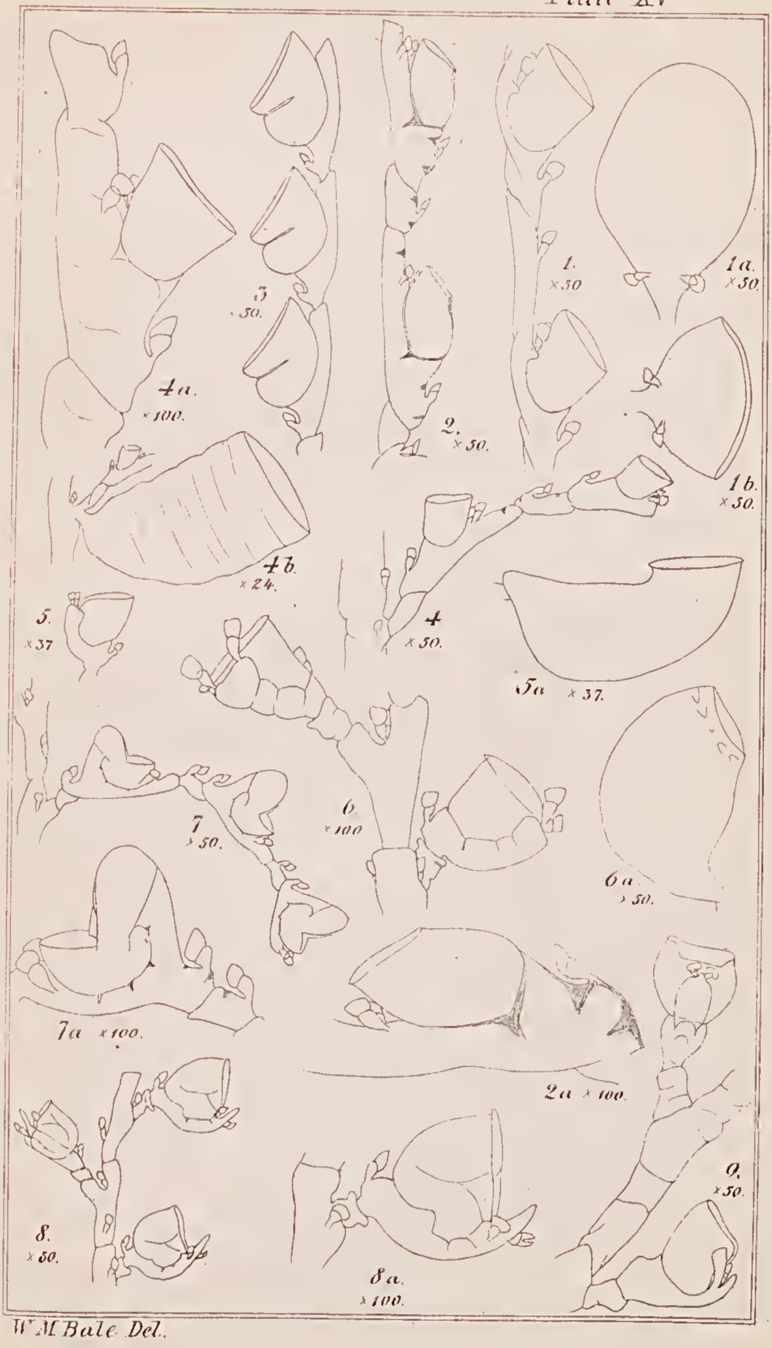
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